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What ***is*** the difference between Ecstasy and MDMA?

ALEXANDRA TURNER

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Abstract

Faculty of Science and Technology
Department of Life Sciences

Doctor of Philosophy

Alexandra Turner

In society there is a discrepancy that has developed in what the public understands about what Ecstasy is, in relation to the term 'MDMA'. MDMA, the abbreviation for 3, 4-methylenedioxymethamphetamine, is the chemical constituent that has most commonly been associated with the street drug known as Ecstasy. Though the use of Ecstasy was reportedly on the decrease, a new product has emerged known as crystal or MDMA powder. This is alongside new competing compounds entering the market, most notably Mephedrone.

The research examined explores the changing perception around what the terms Ecstasy and MDMA represent, comparing their popularity and prevalence with that of Mephedrone. This was investigated using an interdisciplinary approach, utilizing methods drawn from social sciences and analytical chemistry. Two online social research surveys were employed to establish what the public knew and understood about the terms, Ecstasy and MDMA and the drug Mephedrone. The surveys included both quantitative questions regarding specific drug knowledge and qualitative questions which asked participants about their reasons behind selecting to use a substance. The surveys provided a social context and highlighted specific perceptions that were held about these drugs. The results from the surveys were compared to seizure data collected from the Cambridgeshire Constabulary, which provided a timeline of the emergence and prevalence of the types of Ecstasy/MDMA and Mephedrone being seized. The perceptions were also compared to a qualitative chemical analysis of seized samples using Gas Chromatography – Mass Spectrometry (GC-MS).

In the findings from this research there is a definite gap between what the public know and perceive about the terms Ecstasy, MDMA and Mephedrone. A key finding from this research is what is reportedly known about Ecstasy has not translated into what is known about MDMA. There is an observed disassociation between these two terms. Mephedrone, on the other hand appears to have fallen into obscurity post its media high of 2010. The responses to the social surveys indicate a clear preference for MDMA over 'Ecstasy' or Mephedrone, as the former is seen as being of better '*quality*'. The user preference was supported by the findings from the seizers recorded in Cambridge, with the new crystal form being the most dominant type seized post 2012 and Mephedrone seizures declining after its control in 2010. In reporting the purity of street samples, the public perception was again supported as the crystal materials contained a higher percentage of the chemical MDMA. This is the first reported study of the relative purity of the alternate forms of MDMA.

Key Words: Ecstasy, MDMA, Mephedrone, Social Perception, Drug Analysis, Trend Analysis

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List of Abbreviations

2CB	2,5-Dimethoxy-4-bromophenethylamine
4-MEC	4-Methylethcathinone
4-MMC	4-Methymethcathinone
5-HT	5-hydroxytryptophan (Serotonin)
6-APB	1-Benzofuran-6-ylpropan-2-amine (Benzo Fury)
ACMD	Advisory Council on the Misuse of Drugs
APPGDPR	The All Party Parliamentary Group for Drug Policy Reform
ATS	Amphetamine Type Stimulants
BMK	Benzyl Methyl Ketone
BZP	Benzylpiperazine
CAPI	Computer Assisted Personal Interviewing
CSEW	Crime Survey for England and Wales
DA	3,4-dihydroxyphenethylamine (Dopamine)
DEA	Drugs Enforcement Agency
EI	Election Ionization
EIC	Extracted Ion Chromatogram
EMCDDA	European Monitoring Council for Drugs and Drug Abuse
EU	European Union
FSCRG	Forensic Science and Chemistry Research Group
FSS	Forensic Science Service
GC-MS	Gas Chromatography – Mass Spectrometry
GDS	Global Drug Survey
IS	Internal Standard
IUPAC	International Union for Pure and Applied Chemistry
LSD	Lysergic acid diethylamide
MAO	Monoamine Oxidase
MAPS	Multidisciplinary Association for Psychedelic Drugs
MCAT	Methcathinone
MDA	3,4-Methylenedioxyamphetamine
MDAI	5,6-Methylenedioxy-2-aminoindane
MDEA	3,4-Methylenedioxyethylamphetamine
MDMA	3,4-Methylenedioxymethamphetamine

MDxx	Substituted Methylenedioxy phenethylamine
MoDA 1971	Misuse of Drugs Act 1971
$NaBH_4$	Sodium Borohydride
$NaCNBH_3$	Sodium Cyanoborohydride
NPS	New Psychoactive Substances
ONS	Office of National Statistics
PAR	Peak Area Ratio
PIHKAL	Phenethylamines I Have Known and Loved (book)
PMA	para-Methoxyamphetamine
PMMA	para-Methoxymethamphetamine
PMK	Piperonal Methyl Ketone
PSHE	Personal, Social, Health and Economic Education
PTSD	Post-Traumatic Stress Disorder
PWITS	Possession with Intent to Supply
SPSS	Statistical Package for the Social Sciences
TFMPP	3-Trifluoromethylphenylpiperazine
TIHKAL	Tryptamines I Have Known and Loved (book)
UK	United Kingdom
UNODC	United Nations Office on Drugs and Crime
χ^2	Chi Squared test

List of Appendices

Copyright Declaration

Chapter 1 Introduction

The research outlined in this thesis incorporates an interdisciplinary approach, adopting methods from both social research and analytical chemistry to answer the question –

How have the perceptions around what is considered Ecstasy changed in the past decade?

1.1 Background to Research

The drug Ecstasy is not a new product. Since it first emerged onto the recreational drug scene in the late 1980s there has been a substantial body of research that has examined this product from a range of different disciplines, the background of which is discussed in depth in Chapter 2. However what has yet to be established is what Ecstasy means in a modern context, with the advent of new forms and competing products such as Mephedrone, entering the recreational drug market. In 2009, there were reports of a new form of MDMA, the chemical most commonly associated with 'Ecstasy' being used (Smith, Moore and Measham, 2009). There has subsequently been very little published on the emergence and prevalence of this new form known as MDMA powder or what impact it has had on the use and perception of 'Ecstasy'.

1.2 The Research Project

The aim of the research project was to examine the drug Ecstasy, how the public's perceptions and the use of this drug has changed in the last decade. The perceptions were investigated in relation to the emergence of the new crystal form of the drug and the introduction of competitor products, such as Mephedrone entering into the recreational drug market. The research was framed into three main projects. The first project was the implementation of social research surveys, the second was the collection of seizure data from collaborators and the third was a chemical analysis of seized products.

Social Surveys

The social survey project was divided into two independent surveys. The first survey asked what the participant knew about drugs, how informed they felt and the information sources they trusted to give them accurate drugs information. The second survey examined personal drug use, asking about preference and compared specific drug choices as set out in the survey.

Seizure Data

The seizure data was collected to give a real time perspective of the drugs seized in Cambridge, comparing the data to governmental and international statistics. There has been little published work on the emergence of the new form of Ecstasy, known as MDMA powder (Smith, Moore and Measham, 2009). Although often mentioned it is still unknown when and if MDMA powder has come to prevalence. Also examined is the impact that the New Psychoactive Substances (NPS) has had on the levels of Ecstasy seized in Cambridge.

Chemical Analysis

The chemical analysis project examined seized materials provided by Cambridge Police, analysing them using Gas Chromatography – Mass Spectrometry (GC-MS), and utilizing a method validated by the United Nations Office on Drugs and Crime (UNODC, 2006a). This was done to establish if what people believe they are taking is actually what they are taking and whether there is a difference in the purity between the forms seized in Cambridge. To date there has been no published data on the comparable purity of Ecstasy tablets compared to MDMA powder, or to the NPS Mephedrone that is reportedly replacing them.

1.3 Overview of Thesis Chapters

In Chapter 2 a thorough literature review of the historical and social context in which this project was based has been compiled. As 'Ecstasy' is not a new product there is a substantial body of work, from a range of disciplines that has been summarised. The chapter opens with the history of the chemical and the mechanisms of synthesis. It also covers the biological, the social and legal aspects that have impacted the use of this drug. The emergence of competitor compounds and the profile of who uses this substance is also examined. The chapter provides the background context for the three projects within this research and ends with a summary of the research questions.

Chapter 3 focuses on the application of social research surveys as a means of examining the social perception of what Ecstasy is considered to be. It provides a critical analysis of contemporary research surveys in this field; the Crime Survey for England and Wales (ONS, 2012) and the Global Drug Survey (Mixmag, 2012). It outlines the methodology and approach adopted to answer the first research question reported at the end of chapter 2.

Chapter 4 is split into two data analysis sections. The first section discusses the results for Survey A, which asked about the knowledge and perception around the two terms used to describe Ecstasy. The second part discusses the results of the second survey, Survey B on the popularity and preference of substances.

Chapters 5 and 6 describe the method and results from the examination of the seizures of Ecstasy. Chapter 5 critically assesses the size of Ecstasy markets as estimated by international organisations such as the UNODC and the European Monitoring Centre for Drugs and Drug Abuse (EMCDDA). It also outlines the method of data collection employed in this research. In Chapter 6 the results of the seizure data of selected controlled substances as collected in Cambridge between 2003 and 2013 is discussed.

Chapters 7 and 8 examine the chemical element of the research, discussing the method chosen for this research and the results of the chemical analysis of the seized samples. The method described utilizes the technique of GC-MS, making use of a well-established and validated method published by the UNODC (2006). The samples that have been analysed provide quantitative data on the levels of MDMA discovered in the different types assessed. There is also a comparison between the purity of MDMA and of Mephedrone.

Chapter 9 is divided into three mini monographs, drawing together the findings from the three projects to answer the questions set out in Chapter 2. The first section examines how the terms Ecstasy and MDMA have come to represent different products in relation to the two forms that are now found. The second section deals with the questions around the perceptions, the prevalence and the purity of MDMA by comparing whether the users perceptions collected in the second social survey correlates with the findings from the chemical analysis of the street samples. The final section evaluates the impact of Mephedrone on the perception and use of Ecstasy, answering the question of whether NPS can/have replaced the more established traditional drugs. Chapter 10 outlines the major conclusions, limitations and recommendations found over the course of this research.

Chapter 2 Context

'Not-so-new' Kid on the Block' an Introduction to the Historical and Social Context of the drug Ecstasy

2.1 The Origins of a 'Wonder' Drug

2.1.1 It began with a discovery

Before it became the 'drug du jour' of a generation (Rushkoff, 2001 p.353), the discovery of 3, 4-methylenedioxymethamphetamine (MDMA), the main component in the street drug known as 'Ecstasy', can be traced back to a German laboratory at the turn of the 20th century. First discovered by the chemist Anton Kollisch, a patent for MDMA was granted to the German chemical company E. Merck of Darmstadt on the 24th of December 1912 (Freudenmann, Öxler and Bernshreider-Reif, 2007).

There is an apocryphal story concerning the original use for this chemical that has often been cited, that MDMA was developed as an appetite suppressant (Gimeno *et al.,* 2002, Palhol *et al.,* 2004). However after an extensive review of the Merck archives no evidence was found that this was the case (Freudenmann, Öxler and Bernshreider-Reif, 2007). The origin of this story actually relates to tests run by Smith, Kline and French in the late 1940's and early 50's on the drug 3, 4-methylendioxyamphetamine (MDA) a chemical analogue of MDMA (Iversen, 2008). This is but one example of the misinformation surrounding MDMA that has proliferated throughout the literature and information sources on this compound. Misinformation is a central theme that will be explored throughout the thesis.

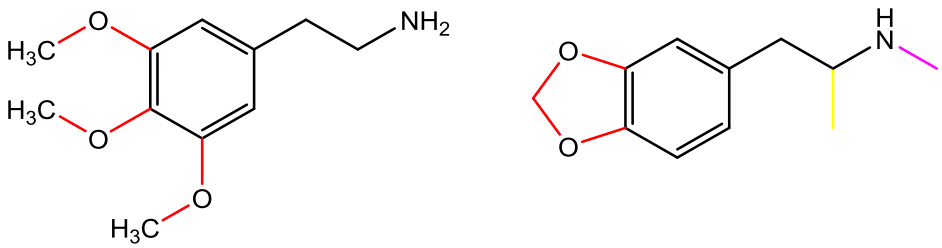
The actual use for which MDMA was developed was as an intermediate chemical in the production of a haemostatic compound in a bid to circumvent a patent on a competitor's successful patent (Karch, 2011). At the time there was very little interest in the action of MDMA as a compound in its own right. It was first documented under the name 'Methylsafrylamine', yet it would go on to be known by a multitude of names, including its most infamous moniker 'Ecstasy' (Freudenmann, Öxler and Bernshreider-Reif, 2007).

The first record of a pharmacological test of MDMA was in 1927, performed by Dr Oberlin who was investigating the effects of adrenaline and ephedrine type products (Freudenmann, Öxler and Bernshreider-Reif, 2007). There is very little information available regarding the results of Oberlin's testing, the reason for this being that much of the data was lost as a result of the Second World War (Freudenmann, Öxler and Bernshreider-Reif, 2007). Oberlin is credited with the oldest recorded structure for MDMA, recorded under the name 'Safryl-methyl-amin'.

A further mention of MDMA was found in the Merck archives in 1952 under the chemical name 1-(2-methylaminopropyl)-3, 4-methylenedioxybenzol (Freudenmann, Öxler and Bernshreider-Reif, 2007). Yet it was not synthesised again until 1959 by Dr Wolfgang Fruhstorfer, who was interested in the production of stimulants. Again the results of this trial appear to have been lost, and it is unknown whether Fruhstorfer performed human trials with this substance (*ibid.*).

Since it was patented under the name Methylsafrylamine, MDMA has had a number of different names as chemical naming conventions have changed. The most commonly used chemical name is 3, 4-methylenedioxymethamphetamine, which is abbreviated to MDMA. Although the official IUPAC reference is 1-(1, 3-benzodioxol-5-yl)-N-methyl-2-propanamine, for the purpose of this thesis MDMA will be used throughout.

The first organization to take an interest in MDMA's potential was the US military in 1953 (Shulgin, 1990). Under the code name 'Edgewood Arsenal' the project worked in collaboration with the University of Michigan and documented animal trials of hallucinogenic drugs conducted on small mammals (Karch, 2011). The documents around these trials were declassified in 1969 and published in 1973. This series of experiments examined the use of eight compounds that were derived from structural variations of the compound Mescaline involving ring substitutions and variation in chain length. MDMA was the only N-methyl compound examined (Shulgin, 1990). Mescaline is derived naturally from peyote cactuses, its chemical structure and MDMA structure are shown in Figure 2.1, with the variation in the structure colour coded.



Mescaline MDMA

Figure 2.1: The chemical structures of Mescaline and MDMA (red indicates the ring-substitution, yellow indicates variation in chain length and pink indicates the N-Methyl variation)

The study examined the reactions of five species of animal, evaluating not only the toxicity of the compounds but the behavioural effects as well. It is the first known conclusive study into the animal toxicity of these substances (Holland, 2001; Karch, 2011, Shulgin, 1990). The results of this and subsequent studies has found that MDMA is either equally toxic or moderately less toxic than its analogue MDA (Davis, Hatoum, and Waters, 1987). The toxicity of MDMA limited its ability to be weaponised and the military lost interest (Karch, 2011).

2.1.2 The Godfather of Ecstasy

One crucial figure when discussing the history of MDMA who is always mentioned is Dr Alexander Shulgin, known as the Godfather of Ecstasy. He was a driving force in the development of psychedelic substances and is recognised as the creator of over 200 psychoactive compounds, all of which he personally experienced, writing and publishing extensive notes on the subjective experience felt with each new compound (Shulgin, 2013). These experiences were collated into two semi biographical books, *Phenethylamines I have known and loved* (PIHKAL) and its sequel *Tryptamines I have known and loved* (TIHKAL) (Shulgin and Shulgin, 1991, 1997). These books provide not only his subjective experience of a host of substances but also provide an instructional guide for the manufacture of each structure. The impact of Shulgin's work is still being seen today in the emerging market of novel psychoactive compounds. The current trend of creating new substances to circumvent existing drug laws has been influenced by the work of Shulgin and his wife (UNODC, 2013, p.60). As Shulgin adapted molecules by single functional groups to assess the change in affect, so now do the clandestine chemists to negotiate loopholes in legislation.

2.1.3 An Overview of the Chemical Synthesis of MDMA

There are three main routes of synthesis that can be used to manufacture the compound MDMA. These are; the safrole bromination method, the reductive amination method and the Leuckart method. The mechanisms of these methods are detailed in a paper on the manufacture of the homologue MDA (Dal Cason 1990). Due to the similarity in structure of the two homologues MDA (Figure 2.2) and MDMA, with the difference being a single methyl group on the amine, the synthesis routes can be used interchangeably to clandestinely manufacture both compounds depending on the precursor reagents used (Dal Cason, 1990).

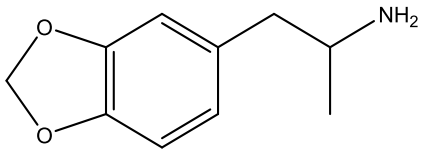


Figure 2.2: Chemical Structure of the drug MDA

Safrole Bromination Method

Safrole bromination is the method that was first patented in 1912 by Merck of Darmstadt (Freudenmann, Öxler and Bernshreider-Reif, 2007). The method requires the use of safrole as the starting product for the reaction. Safrole is an essential oil that occurs naturally and can be extracted from over 360 different tree species found in South-East Asia (UNODC, 2008). Safrole is extracted and purified to produce fragrant oil, which has historically been used in the manufacture of perfumes (CosIngs, 2011d). However due to the status of safrole changing to that of a controlled chemical, owing to the fact it is used in the illicit production of MDMA, it is no longer used for commercial purposes (CosIngs, 2011d). In 2008 the UNODC cracked down on the production of safrole in Cambodia in an attempt to disrupt the production and supply of MDMA (UNODC, 2008).

There is copious literature on the different routes that can be used in the synthesis of MDMA (Biniecki and Krajewski, 1960; Cason, 1990; Elks and Hey, 1943; Gimeno *et al.,* 2005; Renton, Cowie and Oon, 1993; Swist *et al.*, 2005 and Verweij, 1990) as well as the detailed guides provided by Shulgin in PIHKAL (Shulgin and Shulgin, 1991). However not all that has been published comes from academic sources, others are generated specifically as guides for the illicit preparation of recreational compounds with much clandestine literature easily

accessible on the internet. One such example of clandestine literature that is readily available is from the author known only as 'Uncle Fester'. The author has self-published a variety of tomes on a range of illicit subjects (Fester, 2002). His book '*Secrets of Methamphetamine Manufacture*' sets out the precise methods to synthesise not only methamphetamine but has an accurately detailed description of the safrole bromination method (*Ibid.,* pp.69-7*1)*. This method can be used to not only to produce MDMA but also its homologue MDA by the substitution of the reaction chemical methylamine for ammonia. The method described in '*Secrets of Methamphetamine Manufacture*' requires very little specialist equipment to achieve the desired result. Figure 2.3 shows the variety of routes and materials that can be used to synthesis MDMA, route 1 indicates the reaction for safrole bromination.

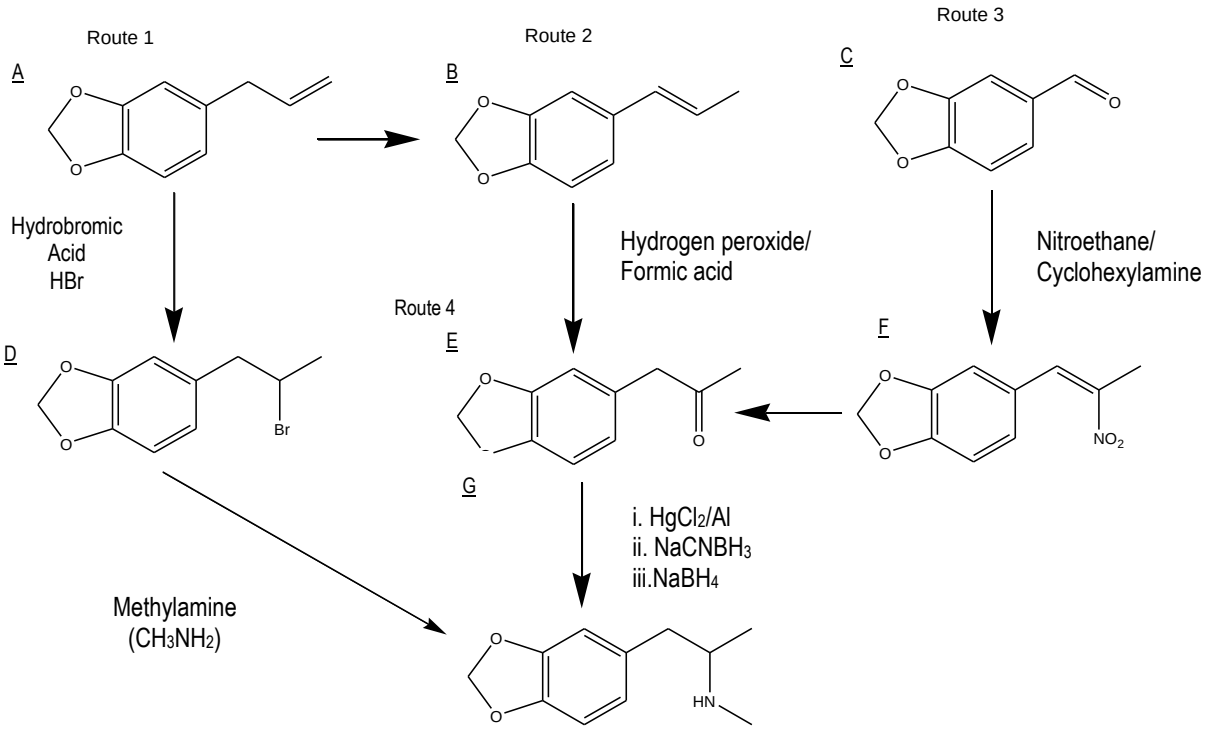


Figure 2.3: Routes of synthesis for MDMA using safrole bromination and reductive amination

(A – Safrole, B – Isosafrole, C – Piperonal, D – Bromosafrole, E – Piperonal Methyl Ketone, F – 3,4-Methylenedioxyphenyl-2-nitropropene, G – MDMA)

The Reductive Amination method

The second route of synthesis displayed in Figure 2.3 is the method described by Shulgin (1991). The method uses the precursor compound piperonal methyl ketone (PMK), which can be derived from safrole, isosafrole and also from the compound piperonal. In his book Shulgin

describes methods of generating PMK from all three starting compounds, illustrated in Figure 2.3, following routes 2 and 3 with compound E indicating the chemical structure for PMK. The need to generate PMK clandestinely, as opposed to using a laboratory supply is due to the fact that it is a controlled substance with no legitimate reason for its production (European Parliamentary Commission, 2004). Safrole and piperonal however have had legitimate uses as perfume ingredients (CosIngs, 2011d and 2011e) and so were comparatively easier to divert into the clandestine manufacturing process pre-2008 and the UNODC crackdown.

From PMK, Shulgin describes the process of reductive amination using aluminium foil and mercuric chloride ($HgCl_2$/Al) as the reducing agents, identified in Figure 2.3, route 4i. He gives exact quantities and observations about what happens at each step. However this is just one method of reductive amination. Other methods include those described by Swist *et al.* (2005) that use sodium borohydride ($NaBH_4$) or sodium cyanoborohydride ($NaCNBH_3$) as alternative reducing agents (routes 4ii and 4iii). In all cases the reductive amination is an exothermic reaction and so requires strict temperature control, with Shulgin (1991) stating that the reaction must be kept below 60˚C.

The Leuckart Method

The final method is most commonly associated with the production of the compound amphetamine, via the precursor material benzyl methyl ketone (BMK). It can be used with substitution to produce methamphetamine, MDA and MDMA (Renton, Cowie and Oon, 1993). This method works on the chemical principal of reflux, which heats the chemicals to between 150˚c and 170˚c and then cools them, repeating the cycle for 7 hours. Figure 2.4 illustrates the process of the Leuckart reaction through the intermediate N-formylMDMA.

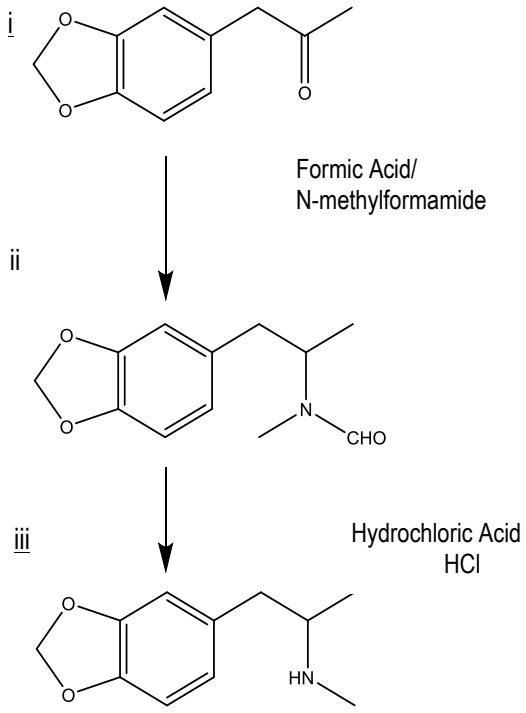


Figure 2.4: Leuckart Synthesis route to produce MDMA (i= PMK, ii= N-FormylMDMA, iii = MDMA)

All of these methods have been recorded in academic literature as ways to produce MDMA, however after the aforementioned crackdown on the precursor safrole, there have been reports that production has shifted to a new uncontrolled precursor known as Methyl 3-[3,4-(methylenedioxy)phenyl]-2-methyl glycidate (MMDMG) or PMK-glycidate that was first detected in 2004 (UNODC, 2013). Little research has been published into the prevalence of use of this new material over the more established materials. Collins *et al.* (2007) reported its discovery in a suspected shipment of MDMA in Australia, with a further two international papers discussing its appearance into the market in Switzerland (Bovens and Schläpfer, 2011) and in the Netherlands (Vijlbrief, 2012), Figure 2.5 displays the proposed structure for PMK – glycidate.

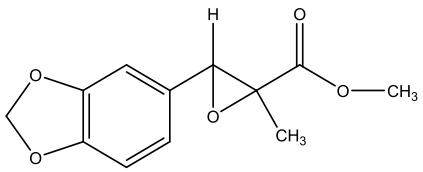


Figure 2.5: proposed structure for PMK-glycidate (Collins *et al.,* 2007)

With guides on how to produce MDMA readily available on the internet anyone with an understanding of the basic principles of organic chemistry could attempt to synthesis it. Although the starting materials are tightly regulated and controlled at a global level, production persists because there is a demand and a market for illicitly produced compounds.

2.2 The Biology of MDMA

2.2.1 The Biological Mechanisms of an Entactogen

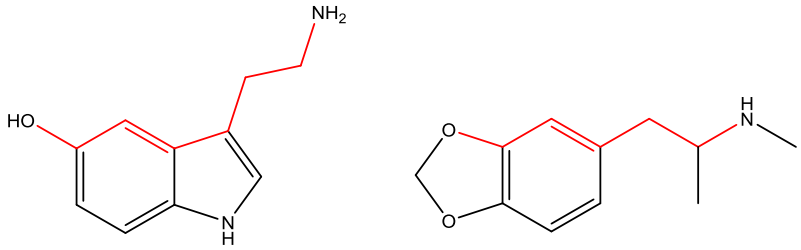
This research examines the social and chemical analysis of Ecstasy, yet to understand why it became popular the biological mechanisms must be considered. The following section briefly summarises how MDMA works, starting with its interaction with the brain.

MDMA is known to trigger the release of two important neurotransmitters in the brain; serotonin and dopamine (Liechti and Vollenweider, 2001). Serotonin or 5-hydroxytryptamine (5-HT), is found in neural cells of the brain. It is an important neurotransmitter chemical responsible for the regulation of a number of biological functions including, mood regulation, heart rate, sleep, appetite and pain (Malberg and Bonson, 2001). It is the chemical that makes human beings 'happy' and its release is responsible for the primary subjective effects felt under the influence of MDMA (Cole and Sumnall, 2003; Malberg and Bonson, 2001). Serotonin producing cells can be found throughout the brain, hence its vast impact on a range of different biological functions depending on where it is being released and the responding cell (Malberg and Bonson, 2001*).*

Dopamine (DA) is the second neurotransmitter released by MDMA. It is responsible for the energised feeling and rewarding effects attributed to the use of stimulant drugs (Laurelle *et al.*, 1995; Liechti and Vollenweider, 2001). Studies have proven that MDMA exhibits weak dopaminergic effects compared to serotonergic effects (Liechti and Vollenweider, 2002; Malberg and Bonson, 2001; Oberlender and Nichols, 1988; Schechter, 1989).

Stages of MDMA stimulated Serotonin release

When MDMA enters the body it excites the neural cells into releasing high levels of serotonin into the synaptic region (Liechti and Vollenweider, 2001; Malberg and Bonson, 2001). This increases the likelihood of binding to a corresponding receptor on a neighbouring cell. The high levels of MDMA cause the receptors to become saturated (Malberg and Bonson, 2001). MDMA also then binds with the serotonin reuptake receptors (*Ibid.)*, due to its chemical structure being similar to that of serotonin as shown in Figure 2.6.



Serotonin MDMA

Figure 2.6: Structures of Serotonin and MDMA (Corresponding structural similarities shown in red)

Once bound to the reuptake receptors the MDMA effectively blocks the system so that the serotonin cannot be reabsorbed, prolonging the exposure and the resulting effects of the serotonin release (Malberg and Bonson, 2001). Once the MDMA has been removed from the reuptake receptors the serotonin makes its way back into the cell. If there is any residual MDMA, this will cause the vesicle to redistribute it back out into the synaptic region (*Ibid.)*. Thus the MDMA depletes the body's store of serotonin, resulting in a lack of readily available serotonin, which can cause feelings of depression that may last days after the original ingestion (Curran and Travill, 1997; Liechti and Vollenweider, 2002; Malberg and Bonson, 2001; Parrot and Laskey, 1998). It is the release of serotonin that is responsible for the many favourable effects engendered by the use of MDMA.

2.2.2 The Effects of MDMA

One of the most important areas when understanding the historical and social context of MDMA and how it came to become a recreational drug are the effects. It is the effects of this compound that brought it to prevalence in the recreational drug market.

The first paper published that investigated what the effects of ingesting a dose of MDMA had on a human participant found that:

> *'MDMA has a higher threshold than does MDA, but otherwise it is very similar in potency… there are few physical indicators of intoxication and psychological sequelae are virtually non-existent… It can be compared to the effects of marijuana, to psilocybin devoid of the hallucinatory component or to low levels of MDA'*
>
> (Shulgin and Nicholls, 1968 p.77)

Since the publication of that first paper there has been considerable investigation into the reported effects of MDMA with sources of this information ranging from academic study (Curran and Travill, 1997; Downing, 1986; Freese, Miotto and Reback, 2002; Greer and Tolbert, 1986; Harris *et al.*, 2002, Kirkpatrick *et al.*, 2015; Peroutka *et al., 1988;* Sumnall, Cole and Jerome, 2006; Vollenweider *et al.,* 1998) to subjective reports from the users documenting their experiences on web forums such as Bluelight.org, Urban75 and drugs-forum.com.

The reported average onset time stated for the effects of MDMA ranges from 20 to 90 minutes, with the peak effects lasting between 1 to 2 hours (De la Torre *et al.,* 2000). An active dose of pure MDMA is stated as being between 75 – 150mg (EMCDDA, 2015). A dose can be defined as either the weight of the drug or the weight of the drugs as a proportion of the body weight of the subject (Cole, Sumnall and Wagstaff, 2002). It is important to note what the recognised dose is when comparing the quantities and relative purities found in the street samples. Does what is found on the street contain an active dose? In this research a dose is stated as being 75mg, in line with the EMCDDAs use of the term dose.

From the literature both academic and the 'grey' literature, the effects of MDMA that have been reported can be divided into two main categories; the physiological and the psychological (Harris *et al., 2002*; Erowid, 2011; Dancesafe, n.d.; TalktoFrank, n.d.). Table 2.1 lists the physiological effects, rating them as either negative, neutral or positive based on the users perspective. The distinction of which category each effect falls into is based on the report by the online database EROWID (2011), which was derived from the paper by Harris *et al.* (2002).

Table 2.1: The reported physiological effects of MDMA

Negative Effects	Neutral Effects	Positive Effects
Mild to extreme jaw clenching (trisma), tongue and cheek chewing, and teeth grinding (bruxia)	Moderately increased heart rate and blood pressure (dose dependant)	Increase in energy (stimulation)
Short periods of swooning	Analgesic, antinociception, decreased pain perception	Increased awareness of sense
Muscle tension	Decreased appetite	Increased tactile sensation
Insomnia	Visual distortion	Rushes of exhilaration
Erectile dysfunction	Rapid involuntary eye jiggling (nystagmus)	
Increased body temperature, hyperthermia, dehydration	Mild visual hallucinations (uncommon)	
Hyponatremia	Bright and intense sensations	
	Restlessness, nervousness and shivering	

Table 2.2 lists the effects that relate to the psychological impact that MDMA has on the user. Again distinguished between positive, negative and neutral, there is a distinct difference in the number of positive psychological effects compared to the physiological reported in Table 2.1.

Table 2.2: The reported psychological effects of MDMA

Negative Effects	Neutral Effects	Positive Effects
Tendency to say things you might feel uncomfortable about later	Ego softening	Mood Elevation
Inappropriate and/or unintended emotional bonding	Highly controllable experience	Euphoria
Agitation	Increased willingness to communicate	Decreased fear, anxiety and insecurities
Short term memory scramble, loss or confusion	Upwelling of unexpected emotion, emotional lability	Feelings of comfort belonging and closeness
Short term- anxiety, panic attacks, confusion, paranoia and psychosis	Increased awareness and appreciation of music	A sense of inner peace and acceptance
Difficulty concentrating and problems with activities requiring linear focus		Feelings of love and empathy
Strong desire to do or want to do more when coming down		Forgiveness of self and others

It is the positive effects of MDMA that place it into the category of empathogenic or entactogen chemicals (Harris *et al.,* 2002). One criticism of studies into the effects is the difficulty in measuring a subjective experience (Sumnall, Cole and Jerome, 2006) as not all users will experience all symptoms described in the tables. There is also the point that each users experience is subjective not only to their own unique biochemistry but to the settings in which they are using this substance and so what may be thought of as an undesirable or negative 'side' effect in one person may be neutral or even positive in another.

One effect most identified with MDMA is the feelings of acceptance of self and a feeling of connectedness that Shulgin coined 'The Open Window Effect' (1991). It is this effect that interested the psychotherapeutic movement of the seventies into the possibilities of using this compound therapeutically (Stolaroff, 2004).

However, despite all the positive effects reported that have made MDMA and by extension Ecstasy so popular there are a number of adverse effects that have also been identified. The negative effects, often called side effects, have an adverse response compared to the ones that are originally sought or can occur alongside the more pleasurable events. The negative effects associated with MDMA fall predominately in the physiological category with very few reports of negative psychological effects such as paranoia or anxiety being linked to MDMA use (Harris *et al.*, 2002). When anxiety is reported, it is often a result of combining MDMA with other substances, whether knowingly or unknowingly by consuming contaminated or adulterated products (Mohamed *et al*., 2011).

Some of the physiological effects can have serious health implications, one being the risk of increased heart rate and blood pressure, which if unanticipated can cause unnecessary anxiety for a first time user (Parrott, 2011).This effect has subsequently been found to be dose dependant (Harris *et al., 2002*). Another possible fatal effect that can arise from the use of MDMA is a loss in body temperature control. In a review on the thermal effect MDMA had on the human body it was found that MDMA is '*clearly a thermal stressor' (*Parrott, 2011, p.7). Despite the fact that that negative effects of this compound have been thoroughly researched and publicised, it remains one of the most prevalent substances on the recreational drug market (Karch, 2011). One aspect this research has sought to examine is how the perception and use of certain substances changes based on experience, which is explored in section 4.2.

2.2.3 MDMA and the Mind

The popularity of MDMA did not begin with its recreational use. Another section of society were interested in its unique properties before it made it to the social scene. In the semibiographical work PIHKAL, Alexander Shulgin recounts the story of how he introduced this chemical to the world of psychotherapy and to the influential psychologist Leo Zeff (Shulgin and Shulgin, 1991, p.74). Zeff had made use of other psychoactive substances such as Lysergic acid Diethylamide (LSD) and MDA, to help untangle the psychological knots encountered in the course of therapy. It was Shulgin who first introduced Zeff to the properties of MDMA believing he would be able to appreciate the unique effect it had over MDA. The result was that Zeff abandoned his plans for a quiet retirement and set up a network of over 4000 psychiatrists and psychologists who introduced this magical new chemical to their patients (Stolaroff, 2004).

Zeff was just one of many American psychologists of the late 1970s and early 80s who appreciated and made use of the psychological effects of MDMA. The psychologists saw it as the answer to dealing with a number of difficult psychological ailments with one anonymous psychologist stating that

> *'MDMA is like Penicillin for the soul, and you don't give up penicillin, once you've seen what it can do'*
>
> (Shulgin and Shulgin, 1991 p. 74)

When the Drug Enforcement Agency (DEA) and the American policy makers decided to evaluate MDMA for scheduling after learning of the emerging trend in its misuse on the recreational drug scene, the psychologists who had been using MDMA appealed (Holland, 2001). The first attempt to schedule MDMA in the United States was in 1986, deeming it to have no medical benefit and categorising it as Schedule 1 (Pilcher, 2008). The appeal was led by Dr Grinspoon, stating that the full medical benefits had yet to be investigated. The appeal was successful in un-scheduling MDMA, in what has since become known as the Grinspoon window (Pilcher, 2008). However the use of MDMA continued to spread across the United States, with the DEA needing to react. In 1988 the DEA was finally successful in scheduling MDMA with no subsequent appeals (Holland, 2001). The concept of control and the legislation behind drug policies is examined in the next section with an evaluation of the British system in which MDMA was controlled much earlier.

The control of MDMA caused the investigations into the medial applications of this drug to cease and research into its properties were stalled. (Pilcher, 2008). Modern study of psychoactive chemicals is still impacted by the laws created over four decades ago under the United Convention on Psychotropic Substances (United Nations, 1971), when MDMA was placed in Schedule 1, which states that it has no known therapeutic value. With the control of these chemicals as stringent as ever, very little research has been done into the possible medical benefits of a number of psychoactive drugs. This has recently been stated by Professor David Nutt who claims that our current drugs laws are '*hindering research'* (Gallagher, 2013). Professor Nutt has been a vocal advocate of drug legislation reform, most notably publishing a relative scale of drug harm (Nutt, King, Saulsbury and Blakemore, 2007), which is discussed further in section 2.3.3.

Though research into the therapeutic use of MDMA has been limited in the UK, there is one organisation dedicated to studying these chemicals that are trying to provide scientific evidence for the basis of therapeutic and medial use, and so potentially challenging the restrictions on these drugs. MAPS, the Multidisciplinary Association for Psychedelic Study, was established to examine the use of novel psychoactive compounds (MAPS, n.d.). Founded in 1986, they have been a driving force in setting up and carrying out studies into the benefits of using MDMA assisted therapy (MAPS, n.d.). In 2000 they were able to convince the DEA to allow for a pilot study to go ahead in the United States; looking at how MDMA assisted therapy can help sufferers of post-traumatic stress disorder (PTSD) (*Ibid.)*. It is believed that MDMA can assist in a therapeutic setting due to its empathogenic properties, which Shulgin coined the 'open window' effect (Shulgin and Shulgin, 1991). MDMA enables the users to examine internal conflicts safely, with the added serotonin release resulting in a more enjoyable experience. The organisation has completed a number of trials in the US and has subsequently taken their mission internationally with trials completed in both Spain and Switzerland, and others just beginning in Australia and Canada. The research into the possible benefits of MDMA are still on-going (MAPS, n.d.). Yet despite evidence that MDMA does have therapeutic use it remains strictly controlled.

2.3 The Legal Perspective

2.3.1 The Misuse of Drugs Act 1971

The legislation that dictates current drug policy in the United Kingdom is the Misuse of Drugs Act 1971 (MoDA c.38, 1971); the main function of the act was to identify and control the substances that posed a risk to society. Since its inception the MoDA 1971 has undergone numerous amendments to keep current with the changing trends of drug use in Britain. The concept of changing trends is another theme in this thesis, and will be explored further in later chapters.

When the MoDA 1971 was originally transcribed it did not include the 'novel' synthetic psychoactive compounds, such as the ones mentioned in PIHKAL (Shulgin and Shulgin, 1991), as they were not readily available in the British market at the time of its creation. It was not until an amendment in 1977 that the ring-substituted phenethylamines were officially controlled (MoDA 1971, amendment 1977). The paragraph that covers all the ring substituted phenethylamines categorised them all as Class A which is a classification above its more established homologue amphetamine. There is however no direct reference to the term 3, 4-methylenedioxmethamphetamine or MDMA in the Act and all ring substituted phenethylamines have subsequently become known as the 'Ecstasy' group due to the popular street name used for MDMA. MDMA was originally categorised as Class A due to perceived hallucinogenic properties, believed at the time to be similar in effect to another Class A drug - LSD. Hallucinogenic properties are now considered an uncommon side effect (Green et al., 2003).

The decision on how to classify the substances and any subsequent new compounds that emerge in Britain is completed in accordance with the Advisory Council on the Misuse of Drugs (ACMD). The ACMD was set up to determine the state of society, the impact that drug use and abuse may have on it and the ways of limiting this impact (Home Office, n.d.). The Advisory Council review and give opinions based on scientific evidence to help the government deal with the problems associated with drug use. In 2009 the ACMD published its review of MDMA.

2.3.2 MDMA ('Ecstasy') A Review of its Harms and Classification under the Misuse of Drugs Act 1971

In 2008 the ACMD was asked to reassess the impact of MDMA in Britain as it had been over a decade since the previous report and a greater body of scientific information had become available *(*ACMD, 2009*).* The report was led by the then chairman of the ACMD Professor David Nutt, who was subsequently dismissed after government criticisms of a number of controversial articles he wrote on the relative harm of drugs, including Ecstasy, comparing them to everyday activities. He has most often been quoted for the statement that 'Ecstasy is less dangerous than horse riding' (BBC, 2009; Nutt, 2009). Professor Nutt has subsequently become an outspoken voice in the field demanding a more evidence based drugs policy.

The ACMD review focused on the compound MDMA, as opposed to the whole group of ring substituted phenethylamines. This was due to its recorded prevalence over the other compounds in that class, all of which were considered under the title of Ecstasy (ACMD, 2009). It considered the impact MDMA had on society and the individual users in four mains categories of concern; the physical harms, the acute psychological effects, the mental health effects and the societal harms.

The first few points considered in the review looked at the physical and psychological harms associated with MDMA use, which have been discussed in the previous section. On the topic of dependence it is stated that there is little evidence of long term physical dependence on MDMA, compared to analogous recreational drugs like cocaine or amphetamine (ACMD, 2009 p.24; Iversen, 2008; Nestler, 2005). It is the unique pharmacology of MDMA that is believed to be responsible for the '*relative lack of dependence liability',* as MDMA has more effect on serotonin than dopamine (ACMD, 2009 p.24)

The second consideration examined the societal harms caused by MDMA. As a drug, the use of MDMA is considered to be purely recreational, as opposed to one that is daily or dependant like other drugs found in Class A, for example heroin (ACMD, 2009). There is also a low association between the use of MDMA with acquisitive crime or other negative impacts on society (*Ibid.*, p 27). There is also a contrast discussed between the use of MDMA, alcohol and other stimulants and public order offences, with few offences being related solely to MDMA use (Association of Chief Police Officers, 2008). The findings in the report are supportive of those published by Professor Nutt and colleagues on the relative scales of harm,

which placed ‘Ecstasy’ at the lower end of the scale (Nutt, King, Saulsbury and Blakemore, 2007).

One aspect this research examines is the societal awareness of MDMA and the change in usage over time, which was also a focus of the 2009 review. The report makes use of data collected by the British crime survey to examine the drug use trends for MDMA. The data suggested that since 1996 the use of MDMA had been ‘relatively stable’ (ACMD, 2009 p.9). In 2006/07 the number of participants 16-59 years old reporting to have used ‘Ecstasy’ in the last year was 1.8% (ONS, 2007). This then fell to 1.3% for the year 2012/13 (ONS, 2013), suggesting that Ecstasy use was on the decline. However, there are a number of reasons why this data should be considered circumspectly; firstly the method by which the data is collected, secondly the sampling methodology and lastly what the data shows in comparison to other surveys on drug use. These considerations are critically examined in section 3.3, which compares the methodologies used to estimate drug use when developing a survey.

The second aspect of the report that impacted this research was recommendation 5, which stated that further research needed to be completed in the type and form of MDMA that is being taken recreationally (AMCD, 2009 p.30). This relates to an apparent emergence of a new form of MDMA known as MDMA Crystal/powder (Smith, Moore and Measham, 2009), which is a key focus in this research. In 2014 a paper was published exploring the changing use of language used to describe Ecstasy, finding that there had been a shift away from using Ecstasy towards the use of the term MDMA (Turner *et al.*, 2014, located in Appendix I). It is how this change in the use of these terms relates to the form being consumed and the perception around this substance that will be examined throughout this thesis

One final point made in the report was recommendation 6, that the ACMD advised the MDMA should be reclassified as a Class B. This recommendation was not accepted by the government at the time, nor by the subsequent government. However in the last few years there has seen a sea change with the call for reformation of drug policy becoming a dominant topic.

2.3.3 Call to Review Current Policy

The call to reform the current system of criminalisation of drugs has been a battle between prohibitionist and pro-drug groups. A turning point in the debate came in 2009, when the then head of the advisory council Professor David Nutt published a paper in which he compared the dangers of Ecstasy to that of horse riding (Nutt, 2009). After the publication of this paper, and other statements criticising the government's stance he was asked to resign by the then Home Secretary Alan Johnson, who it is reported expressed;

> *'surprise and disappointment over Professor Nutt's comments which damage efforts to give the public clear messages about the dangers of drugs'*
>
> (Tran, 2009)

This coincided with the governments' rejection of the ACMD's findings on the reclassification of cannabis, with the subsequent move back to a Class B (MoDA 1971, amendment 3130, 2008). Professor Nutt went on to start the Independent Scientific Committee on Drugs in 2010. He was the first of a number of prominent governmental officials to promote the concept of an evidence based policy, focused on harm reduction as opposed to criminalisation. Having first published the development of a rationale scale of drug harm (Nutt, King, Saulsbury and Blakemore, 2007), Professor Nutt and colleagues published a second paper, using multi-criteria decision analysis to review the comparative harms of a range of drugs in the UK (Nutt, King and Philips, 2010). Of the 20 substances examined Ecstasy was shown to be comparatively low on the developed harm scale, coming in at 16th behind anabolic steroids and above LSD (*ibid.)*. Ecstasy has frequently been used as an example of a relatively safe drug.

In 2013 a report was published by the All-Party Parliamentary Group for Drug Policy Reform (APPGDPR). The inquiry report titled *'Towards a Safer Drug Policy: Challenges and Opportunities arising from 'legal highs''* was published in response to the newly emerging substances that had entered the market. In the report it is suggested that there should be a shift away from blanket criminalisation, finding that banning drugs did not decrease the demand or use of drugs but was detrimental to employment, increased levels of homelessness and was a drain on the tax payer (APPGDPR, 2013)

In an interview discussing the report on the Today Programme on BBC Radio 4 Baroness Meacher is quoted as saying that;

'There are drugs a great deal safer than alcohol and tobacco, and one can use the example of Ecstasy'

(Baroness Meacher, 2013 speaking on BBCRadio4 Today Programme)

One month after the release of this report, MP Caroline Lucas launched an online e-petition requesting that the Home Office investigate into the impact of the MoDA 1971 and whether it was still '*fit for purpose'*. Only petitions that receive over 10,000 signatures are eligible to be debated in the House of Commons. Ms Lucas's petition received a total of 134,758 signatures (HM Government, 2013). The success of the petition may be due in part to celebrity endorsement, most notably from the comedian Russell Brand who is an outspoken supporter of a harm reduction and health-based approach to drug policy.

In May of 2013, the Home Office sent Liberal Democrat MP Jeremy Browne on a fact finding mission to examine the policies of other nations who have chosen different approaches to the criminalisation of drugs (Wilson, 2013, Travis, 2013). The findings from this expedition were published in a report on the 30th of October 2014 (Home Office, 2014), which coincided with the date of when Ms Lucas's e-petition was to be debated before the House of Commons. The debate was attended by only 21 members of parliament out of a possible 650, a low level of attendance (Palmer, 2014).

When the report was released it caused some controversy between the parties of the coalition Government in power. This is due to one of the key findings from the report that found that there was '*no obvious link between tough laws and the levels of drug use'* (BBC News, 2013). The Deputy Prime Minister accused the conservative colleagues of trying to 'block the report' (*Ibid.)*, the Conservatives in turn accused Mr Clegg of sending *'an incredibly dangerous message'* also stating that *'drug use in the UK was "plummeting" because of existing policy'* (*Ibid.)*. The statement about the level of drug use plummeting is misleading, as discussed in section 2.3.2 the issues surrounding the methodology by which this data is collected is critically examined in section 3.3. Although the current government's rhetoric states that drug use is in decline it is still evident in society.

2.3.4 Theories of control

There are many theories that have been applied to the study of illicit drug use (Becker, 1963; Cornish and Clarke, 1985; Hirshi, 1969; Young, 1971). The following section examines a selection of these theories, applying them to the context of this research and specifically to the use of the drug Ecstasy. As Ecstasy is generally considered to be a purely recreational drug and therefore non-addictive (Peroutka, 1990), the focus in this section as with the rest of the thesis only examines recreational users.

Social Control Theory

Unlike other criminological theories, which focus on why individuals commit deviant and criminal acts, social control theory instead investigated the factors which stopped people from committing them. First established by Hirshi (1969, p.31), who proposed that it was not necessary to explain motivation behind the acts as '*we are all animals and thus all naturally capable of committing criminal acts'*. From this he proposed a comprehensive theory as to why many are able to desist from crime, based on four key tenets: attachment, commitment, involvement and belief. Often held to be the most influential factor, attachment is the aspect believed to be responsible for the internalisation of values and norms. Thus under this theory it is believed that when an individual has positive and non-deviant connections they are less likely to engage in criminal activities. This is further compounded by the second element, commitment described as *'stake in conformity'* (Vold, Bernard and Snipes, 2002 p.184). The third element, involvement, identifies the importance of conventional activities while the final tenet requires the belief in following a non-deviant life. Social control theory states that if the individual has strong connections to their society they are less likely to deviate from that societies norms. This can be applied to the use of illicit drug use, in that the majority of society reportedly does not engage in the use of controlled substances (ONS, 2013). The fact that the majority does not use the substances may reflect the criminal nature of their use and so would be in contravention of commitment to society which is regulated by the law. However conversely the tenets can be applied to use of drugs if an individual's attachments are involved in a culture of drug use, which is explored further in section 2.4.3.

Containment Theory

Similar to social control theory is containment theory, which provides an explanation not only for deviant behaviours but also conforming ones. Set out by Walter Reckless (1961), containment theory explores the middle ground between pathological deviance (biological or psychological) and where deviance is expected and part of the norm, such as with certain communities and within organised crime (*Ibid.* p. 284). Containment theory assumes that strong inner control and reinforcing outer containment would insulate an individual from normative deviancy. The aspect of inner control included concepts such as: self-control, good self-concept, ego strength, frustration tolerance, resistance to diversion, sense of responsibility and positive goal orientations (*Ibid.)*. Whereas outer control related to the social buffer that holds the individual within the boundaries of society, similar to Hirshi's attachment. There a number of ways in which containment theory can be applied to the use of drugs, and specifically to MDMA.

Outer control factors in this case can be divided between the desires to abide by the law; the aspect of outer control represented by the implementation of the MoDA 1971, and the opposing outer control aspect would be an individual's conformity within user groups. Whereas inner control could be reflected by the individuals desire to experience the substance or not. For example if an individual's inner control, the desire to use the substance, outweighs the containing aspect of the outer controls, the fear of recriminations by law enforcement, then drug use would occur. Conversely there will also be individuals with no inner desire to experience substances no matter the out controls and so drug use would never occur. There is a spectrum between the two extremes, of those who will use no matter what and those who would not. But the reasons behind the inner choice can be further explained using the rational choice model.

Rational Choice Theory

The final theory explored in this section relates to the classical school of criminology, originally a component of the work of Beccaria (1764), rational choice theory assumes that deviant behaviour is a result of an internal cost-benefit analysis by the individual. The perspective largely assumes that offenders are largely rational in their decision making process, and that the crime is purposeful with the intention to benefit the offender (Cornish and Clarke, 1985; Vold, Bernard and Snipes, 2002). This theory is therefore applicable to drug use, which is seen largely as a victimless crime when focused solely on the impact on the end user (Hunt and Joe-Laidler, 2015; Measham and Shiner, 2009).

When someone decides to use a recreational drug, like MDMA they are making a rational choice based on the analysis of the information that is available to them. It is based on this principle that this thesis is examined, that all participants are making a rational choice to use the selected substances. What will also be examined is the perceptions and information on the drugs and how public perception of the terms Ecstasy and MDMA has affected usage and whether the perception about these terms is reflected by the analysis of seized samples.

2.4 The Social phenomenon

2.4.1 Introduction of MDMA to the Recreational market – a Time line

There have been many books written on the emergence of 'Ecstasy' as a recreational drug, tracking it as it became popular around the world (Collin, 2009; Crictcher, 2000; Holland, 2001; Kavanaugh and Anderson, 2008; Pilcher, 2008 and Saunders, 1993). A summarized timeline of the events leading up to its eventual emergence in the British recreational drug scene is shown in Table 2.3.

Table 2.3: Timeline of the emergence of MDMA (Holland, 2001; Pilcher, 2008; Kavanaugh and Anderson, 2008)

1960s	Before MDMA was introduced its chemical analogue MDA was finding popularity as a recreational drug, known as the 'love drug'.
1971	UN convention on Psychotropic Substances and MoDA 1971 enacted in the UK
1972	MDMA was first forensically identified in a street sample in Chicago.
1977	MDMA controlled under the 1977 amendment to the MoDA 1971 in the UK
1980s	MDMA use became popular across the United States on the back of emerging music scenes of 'House' 'Techno' and 'Dance'
1983/84	Proto-rave with Balearic music started to emerge on the Spanish island of Ibiza, the beginnings of a new youth movement was founded
1984-86	MDMA use grew popular in Spain
1985	Ecstasy is brought to the attention of the British public by Peter Naysmiths article in 'The Face'
1987	Ecstasy use increased in discos on Ibiza, along with the new music sound was then exported back to the UK
1988	British 'Summer of Love' marked by increased Ecstasy consumption
1989	Large outdoor dance parties become popular in Britain
1990s	The rave scene continues to grow in popularity in Britain
1991	First large American rave is recorded in San Francisco
1993	Dance safer campaign established in the UK to reduce rave-associated injury
1995	The schoolgirl Leah Betts dies after consuming an Ecstasy pill
1997	5.3% of participants in the British Crime Survey reportedly had taken Ecstasy 'ever' in their lifetime, with 1.8% taking it within the last year.
2000's	Shift in venue from outdoor 'Raves' to indoor licensed nightclub venues saw the spread of Ecstasy from underground rave movement into mainstream youth culture

The above timeline depicts how Ecstasy became a part of the recreational drug scene in the early 1980's, spreading quickly across the United States to the Balearic Islands and eventually the UK. The key events listed impacted the use and perception of this drug throughout its long history. From obtaining its infamous moniker to the culture of consumption that developed, the following sections examine in more detail the culture of Ecstasy use and the changes that have been observed within the last decade.

2.4.2 Ecstasy – a Brand name

So far the terms Ecstasy and MDMA have been used synonymously to describe this recreational drug. As with many recreational drugs MDMA acquired a street name fairly early on in its emergence. It is reported to have got its name from an anonymous American dealer in the early 1980's who is quoted as saying;

> *'Ecstasy was chosen for obvious reasons, because it would sell better than calling it Empathy. Empathy would be more appropriate but how many people know what that means?'*
> (Pilcher, 2008 p.24)

Subsequently the terms have been used interchangeably, in both the media and academic literature where one term has become synonymous for the other. Yet with Ecstasy tablets frequently being found to contain substances other than MDMA (Erowid, 1996; Saner, 2013), it would be more accurate to say that - '*All MDMA is Ecstasy, not all Ecstasy is MDMA'.*

It has been found that there is a strong correlation between prevalence and the emergence of drugs and them gaining a street name. As was found with the compound 6-(2-aminopropyl) benzofuran (6-APB), which became more popular once it was branded as 'Benzo Fury' (Power, 2013). The idea of branding drugs to make them more recognisable is a key concept when understanding the prevalence and persistent popularity of the drug Ecstasy. As stated there are two names that are being used interchangeably to describe the same compound; Ecstasy and MDMA. The changing use of these two terms has been examined and published as part of this research (Turner *et al.*, 2014). What has yet to be explored is whether the two terms are understood by the public, does MDMA still equal Ecstasy?

2.4.3 The Culture of Ecstasy consumption

As much has been written on the history and use of Ecstasy, so too has there been much investigation into the cultures and subcultures that have surrounded drug use, from Becker's (1963) work '*Outsiders*' on cannabis subculture to the current theory of '*Normalisation*', which is discussed below. One influential piece of writing to this thesis was Jock Young's *'The Drug Takers'* (1971). Young argued that drug use has to be considered within the context of the subculture in which it takes place, challenging the view that drug use '*was a disease at the edge of society' (*Hunt and Joe-Laidler, 2015. p470). Sumner (1994) remarked that Young's analysis saw drug use as an individual solution to the problems of modernity (*Ibid.)*.

Young also argued that society's reaction to drug use was not based on the substances themselves but rather was based on the reasons behind that use (Hunt and Joe-Laidler, 2015: Measham and Shiner, 2009). This can be linked with the use of Ecstasy, as the emergence of MDMA in the British recreational drug scene occurred simultaneously with the subcultural phenomenon known as raves (Holland, 2001), which were massive social gatherings where people would come together in an enclosed environment to listen and dance to music.

> '*The object of a rave was to experience a reality that went beyond itself*.'
>
> (Rushkoff, 2001 p.353)

Raves were most commonly associated with the new synthesised music, which had 120 beats a minute, the same as a foetal heartbeat (Rushkoff, 2001). The enclosed spaces would produce a womb-like environment that fostered the feelings of inclusion and togetherness. This feed into the experiences felt while intoxicated by MDMA (Rushkoff, 2001). So MDMA, known as Ecstasy, became the drug of choice at these social gatherings. With the empathogenic effects acting as '*social lubricant'*, and the amphetamine-like side effects enabling the users to dance for longer, the use of Ecstasy pervaded this scene *(*Rushkoff, 2001).

> *'The 'E' kicked in and I was off! Big smiles all round. Somehow we all got split up and I found myself alone, wandering aimlessly looking for my mates. Everyone I saw was my best friend, until I got close to them and realised I didn't know them'*
>
> (Pilcher, 2008 p.58)

The use of Ecstasy quickly spread from the subversive underground culture of raves, proliferating into the mainstream consciousness as the '*drug du jour'* for the party and dance scene (Rushkoff, 2001). A legacy of *'normalisation'* had begun, whereby drug taking was no longer seen as a strict taboo, but an experience and *'part of the broader search for pleasure, excitement and enjoyment framed within consumption-oriented leisure lifestyles'* (Measham, and Shiner, 2009, p. 502). The thesis of normalisation remains one of the most important developments in the understanding of the drug use as a part of society (Parker, Aldridge and Measham, 1998), whereas previous study attributed use to individual or social pathology, normalisation saw use as a '*Unremarkable feature of young people's lives' (*Measham and Shiner, 2009 p. 502). In the late 1990's Ecstasy had made its way into use by the general public, no longer restricted to being taken in fields or warehouses it was being consumed on a weekly basis in nightclubs and dance clubs up and down the country (Measham, and Shiner, 2009). By the mid-1990's it had become to be seen as the *'cultural signifier of a generation'* (Shapiro, 1999, p.23). *As Young (1971, p. 222*) insisted all those years ago*,* we must *'learn to live with psychotropic drug use' because 'it is only by treating citizens as responsible human beings that any sane and long-lasting control can be achieved' (*Measham and Shiner, 2009 p.507). A sentiment that is conducive to the rational approach taken in this research.

Yet as the use of Ecstasy proliferated there were a number of high profile fatalities that were attributed to its consumption, including the widely publicised case of Leah Betts (Harris *et al.*, 2002). One question which was examined was why use continued despite an apparent risk. This can be contextualised using the conceptual framework of the social amplification of risk (Kasperson *et al.,* 1988). Kasperson *et al*. (1988) defined risk in two ways; firstly based on the consequence of the harm, either low or high and secondly on the probability of the harm occurring. They concluded that society viewed low consequence/high probability risk and high consequence/low probability risk as being of equal value (p.177). The risk analysis an individual makes regarding whether or not to take a substance can be described by three levels. The first level or micro-level examines the risk in the context to the use, what is the probability of harm to the user. The second level examines the harm outside the user but at a local level; harm within their peer group or within the family, the final or macro level would be impact to society as a whole. Studies have found that most people have a comprehensive conception of risk, while public perceptions were seen as a product of intuitive biases, economic interests and therefore reflect more general cultural values (*ibid.* p.178). One issue highlighted that is reflective of the issues around the risk perception of drugs was that:

'*As risk analysis incorporates a variety of methods to identify and evaluate risks, various groups present competing evidence based upon their own perceptions and social agenda'*

(Kasperson *et al.* 1988 p.178*)*

The debate that can arise from conflicting perceptions of risk has clearly been seen in the debate around drug use. As discussed in previous sections there has been much debate around the individual harms of these drugs, with a former government adviser losing his position as a result. The multi-criteria analysis published by Nutt *et al.* (2010) took a radical view of the relative harms of 20 drugs. Debate and controversy between experts has been seen to erode confidence in risk analysis (Kasperson *et al*. 1988). This also includes the analysis reported within the drug using community, whose risk analysis of substances would be different to a non-user as the information on which they make their analysis is based on subjective knowledge. The difference between subjective and objective and the importance of information sources are examined in the social research surveys of this thesis.

When examining the historical context, the dominance of Ecstasy as the king of party drugs at the start of the millennium was at risk, with issues around the purity and quality of the product. These factors combined led to a decline of trust of the product on the street (Measham, 2004), which in turn caused an apparent decline in use, evidenced by reports from the British Crime Survey/Crime Survey for England and Wales (Office of National Statistics, 1996-2014). However, this apparent decline in the use of Ecstasy focused predominately on the use and perceptions around the tableted form, and did not take into consideration other forms of MDMA such as powders and crystals. There is little to no published literature on the emergence of alternate forms, their prevalence in usage in modern British society or what they actually contain.

2.5 The Decline of MDMA in Pills

2.5.1 The Decline in the Purity of Ecstasy Tablets

The growing popularity of the Ecstasy pills in the late 1980s and early 1990s was aided by the clear branding imprinted on them in the form of recognisable insignias of luxury brands such as Mitsubishi and Nike (Pilcher, 2008). Users would identify tablets they had taken before and assume that subsequent purchases would be of a similar quality. However purity issues arose in the mid-1990s when demand of MDMA began to outstrip supply and the drug content of the pills started to decline (Parrott, 2013). As the tablets contained less and less of the active component, the consumers then needed to purchase more and more of the tablets to maintain the same level of intoxication. When pills first emerged they sold for as much as £25 a pill (DrugScope, 2015) yet as the quality went down so too did the price with some tablets now being sold for as little as £3 (Binney, 2013). There were a number of factors that influenced the reported decline in the usage of this drug; one being the user's perception of the drug, the other being the actual composition of the products being sold.

2.5.2 Perception and Experience Studies

Since Ecstasy first emerged into the recreational drug markets at the end of the 1970s in the US and towards the mid-1980s for the UK, the quality and purity of the products available have fluctuated. The following section examines the studies covered in Parrott's (2004) paper, critically evaluating the reported perceptions on purity.

The first study referenced by Parrott was by Peroutka *et al.* (1988), which claims to be the first study that examined the subjective experience of Ecstasy users. The sample of 100 self-identified Ecstasy users asked users about their experiences of Ecstasy. Parrott (2004, p.236) summarises that there were no subjective reports of issues with purity reported by the users within this study, however purity or the perception around the quality of the MDMA is not reported to have been discussed by Peroutka *et al.* (1988).

The next study published that focused on the subjective experience of users investigated Ecstasy use in Australia, (Solowij *et al.,* 1992). The sample for this study was also comprised 100 participants. The participants were asked about their experience of using Ecstasy comparing their experience to their use of other amphetamine and hallucinogenic compounds.

The authors note that analysis of street samples would have provided a '*useful corollary',* but it was not possible at that time (*Solowij et al., 1992* p.1162*).* It is reported by the authors that at the time of the study evidence from police seizures indicated a high level of purity in the tablets being examined. Yet of the participants who reported a decrease in the effectiveness of MDMA (49%), 24% attributed this to a decline in purity (*Ibid.*). It was also reported that 70% of participants noticed variations in the effects felt over time, attributing the variations to fluctuations in quality and purity of what was available.

Of the studies conducted in the UK, Hammersley *et al.* (1999) examined patterns of Ecstasy use in 229 participants. Though this paper does scrutinise how Ecstasy was used and in what context there is no discussion on the perception of whether there are any purity issues with the product. Parrott (2004, p.236) claims in his review that there were no subjective reports of purity problems in this study, yet purity is not discussed by Hammersley *et al.* One paper that does touch on the subject of perception was produced by Handy, Pates and Barrowcliff (1998). In their study of drug use in Wales they examined the patterns of use, identified perceived risks and assessed potential gender differences. The sample size comprised 389 participants, with a gender ratio stated as 2:1 male to female, the impact of gender differences in drug surveys is further explored in this research in section 2.7.2. On the question of perceived risk, 50.5% of the participants considered taking Ecstasy as 'risky business' (Handy, Pates and Barrowcliff, 1998, p86). The main reasons given were: mental health, physical health, adulterants and legalities. What is not reported is which of these reasons was the most dominant or prevalent reason given or whether it impacted a change in the use of this substances. Though in these early studies only one truly identified a perception of a decline in quality, there has been a pervading opinion that the quality of tablets was on the decline (Parrott, 2004).

One survey that has consistently reported on the user's perception of MDMA and Ecstasy is the work by Dr Adam Winstock, in collaboration with the dance magazine Mixmag. Winstock *et al.* (2001) published a study of 1151 participants on the use and perception of Ecstasy. When asked to compare how the participants perceived the quality of pills compared to the previous year, 43% thought they had improved, 28% thought they were the same and 29% thought they had got worse (Winstock *et al*., 2001, p.13). When these figures are tested using a one way chi square test the values returned are χ^2 value of 4.16 and a P value of 0.125, which is not significant at the critical significance level of 0.05. This suggests that perception

around the quality of Ecstasy at the turn of the millennium was mutable, with no significant difference between those who thought it was better, the same or worse. Since that first study at the turn of the millennium the magazine Mixmag has published an annual report on drug preference and prevalence in the dance scene. In the 2010 edition it reported that 76% of respondents thought that the quality of pills had gone down and increase of 47% from the first study a decade earlier (Mixmag, 2010). In 2011, the survey distinguished between two forms powder and tablets for the first time. This is one of the first studies that acknowledged the use of the alternate form, with 55% of participants reporting to prefer powder (Mixmag, 2011). The survey also asked questions on the perception of the different types, with 13% of the participants reporting that they thought the quality of pills had increased and 68% that there had been a decrease in quality. The perception surrounding the powder form was more divided: 14% reported an increase, 31% claimed it was the same, 31% stated a decrease and 23% did not know (Mixmag, 2011). In the 2012 survey, 13% of participants reported an increase in the quality of pills compared to 45% who reported a decrease, and 18% though that powders had increased, however 22% thought they had decreased (Mixmag, 2012).

As the studies are looking at subjective experience there are issues with quantifying personal experience, especially in relation to purity when considering factors such as tolerance levels. Another issue is relying on the fact that the participants are discussing what they believe they have taken without categorically knowing what the substance actually is. One way perception can be assessed is in the comparison to the analysis of seized samples, however as highlighted by Solowij *et al.* (1992), it is difficult to correlate exactly what people take with the evidence from the analysis of seized samples. However analytical analysis can provide an insight into the changing trends in what is available.

2.5.3 Chemical Analysis of Ecstasy Pills

The users' perception of the varying quality of Ecstasy tablets has been confirmed by studies into the chemical composition of seized samples. Studies in this area can be separated into those that examine number of samples containing MDMA and studies that examine content of MDMA in samples. Table 2.4 summarises findings from studies published over a period of two decades that reported the number of samples of Ecstasy that contained MDMA, its analogues as well as other unrelated compounds.

Table 2.4: Summary of studies examining content of Ecstasy samples from 1986-2006. Data expressed as a percentage of total samples tested (as reported by the authors)

Study	Sample size	MDMA (% samples)	MDMA + Other (% samples)	MDA (% samples)	MDEA (% samples)	Other[h] (% samples)	Uncontrolled (% samples)	Unidentified (% samples)
Renfroe USA (1986)	101 Tablets	58	24	14	-	-	-	2
Spruit The Netherlands (2001)	373[b] 1053[c] 1745[d] 2102[e] 2653[f]	47.7 49.4 53.1 60.6 44.1	8.1 8.9 11.2 15 13.7	4.6 4.4 2.7 2.5 1.7	20.4 11.5 16.7 12.6 6.8	19.4 25.8 20.2 9.3 33.7	-	-
Milroy, Clark and Forrest UK (1996)	13 Tablets	-	23	15	23	23	-	-
Sherlock *et al.* UK (1999)	25 Tablets	32	16	-	16	16	16	4
Baggott *et al.* USA[a] (2000)	107 Tablets	63[g]				29		8
Ramsey et *al.* UK (2001)	156 Tablets 90 Powders	29 6	-	-	2 0	8 59	28 23	33 12
Tanner-Smith – USA[a] (2006)	1214 Tablets	39	15	5	<1	29	-	11

[a] samples analysed by Dancesafe, [b] for 1993, [c] for 1994, [d] for 1995, [e] for 1996, [f] for 1997, [g] samples recorded as containing either MDMA, MDEA or MDA and any combination thereof
[h] samples containing any other psychoactives i.e. cocaine

Table 2.4 can be used to demonstrate that the content of tablets considered to 'Ecstasy' has varied over the years, with earlier studies reporting greater observance of other methylenedioxy (MDxx) compounds such as MDA and MDEA. It also shows the occurrence of other substances being included not only in combination with MDMA but also in place of it. Two papers, Baggott *et al.* (2000) and Tanner-Smith (2006) assessed data provided by the organization Dancesafe, which runs a harm reduction campaign in collaboration with Enlighten harm reduction (Pillreports.com, n.d.). The website continues to posts analysis of submitted samples from the US as a harm reduction tool (*ibid.*). What these papers examined was the percentage of samples that contained MDXX compounds but not the amount of compound each sample contained.

One paper that has assessed the longitudinal changes in the content of MDMA in Ecstasy pills is by Cole *et al.* (2002). The authors examined findings collected by the Forensic Science Service (FSS) on the decline in levels of MDMA being found in seized Ecstasy tablets between 1991 and 2001. The data provided by the FSS gave an average content of the Ecstasy tablets examined year on year. The maximum average content that was presented was 103mg per tablet in 1993, with the minimum being 73mg recorded in 2001. A summary of the data is presented in Figure 2.7.

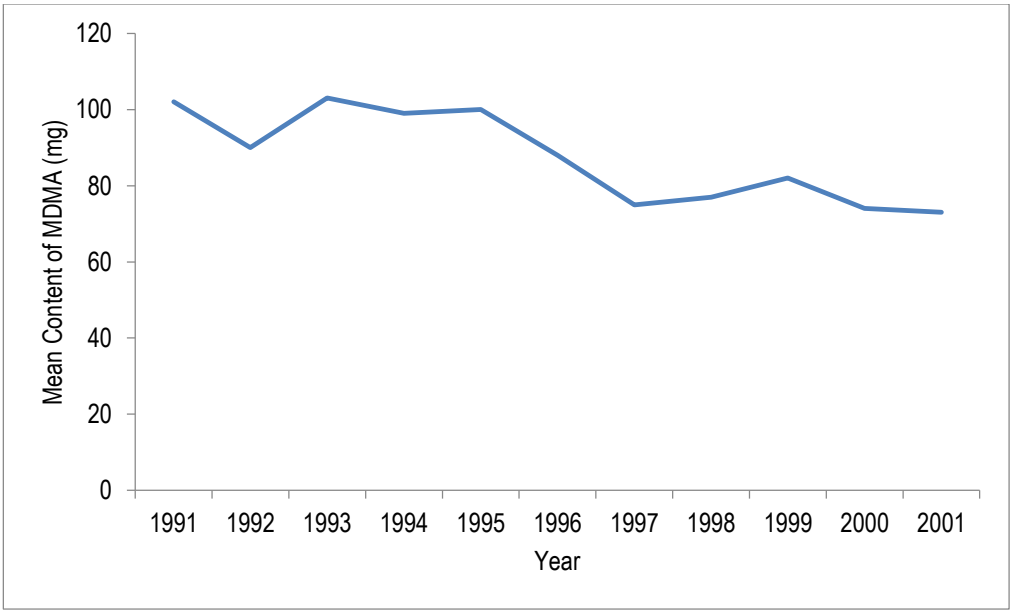


Figure 2.7: The mean MDMA content of Ecstasy tablets year on year, as analysed by the Forensic Science Service in the United Kingdom between 1991 and 2001 (Cole *et al.*, 2002)

To assess whether the decline in content was significant a Spearman's correlation co-efficient was applied to the data by the authors. A significant negative correlation was observed between the average content and the year of the seizures (Cole *et al.*, 2002). This supports the perception that the quality of tablets was on the decline leading into the early noughties. There has not subsequently been the same content analysis published that gives a clear overview of the trend since. The reason for this can be clearly observed with the closure of the Forensic Science Service in 2010 (House of Commons Science and Technology Committee, 2011). As the field of forensic science has been privatised, the analysis of seized material is shared between a number of different organizations. The closure of not just the FSS but also the Drugs Intelligence Unit has resulted in a void in quantitative data available on national drug seizures as work is done in isolated local laboratories.

One organisation that does publish information on the purity of street drugs is the EMCDDA. They collect and publish the data provided by the host nations within Europe that are involved. In 2011, the EMCDDA reported that the mean level of MDMA found in retail tablets from the UK was just 71mg, with a range of 17mg to 116mg (EMCDDA, 2011). As the active dose for MDMA ranges from 75mg to 150mg, this suggests that the declining trend observed by Cole *et al.* (2002*)* continued a decade later with Ecstasy tablets still being of a low content, thus supporting the perception reported by the Mixmag survey (2011) that the quality of pills had gone down. The issue with the EMCDDA findings are that they are based on a sample of only 10 Ecstasy tablets, and ignore the other forms of MDMA (EMCDDA, 2011).

The latest data suggests that this trend may have changed. In 2014 the average MDMA content of Ecstasy tablets in the UK, as reported by the EMCDDA, was 102mg from a sample of 108 tablets (EMCDDA, 2014). This is within the range considered an active dose. Yet when the other descriptive statistics are considered there is greater variability observed. The range given for the tablets was between 3mg and 208mg, with a median of 113mg and a mode of 96mg being reported. This data can be used to support the theory of the transient nature of the Ecstasy market, with such a vast range in the content of MDMA being found in the street samples, it is understandable why the users may be sceptical of the quality of pill they may receive.

There has also been the additional issue of pills sold as 'Ecstasy' containing para-Methamphetamine (PMA) (Figure 2.8), a toxic analogue of MDMA (Byard *et al*., 2002;

Caldicott *et al*., 2003; Dams *et al*., 2003; Kraner *et al.* 2001; Martin, 2001 and Refstadt, 2003). In the summer of 2013 a number of deaths were attributed to the distribution of Ecstasy pills contaminated with PMA (Holden, 2013).

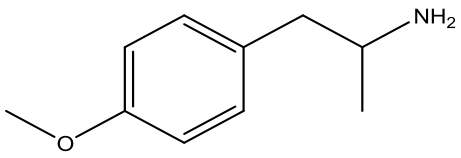


Figure 2.8: The chemical structure of PMA

As has been alluded to in previous sections MDMA is not just found as 'Ecstasy' tablets. A new form has emerged, which is known as MDMA powder. There has been very little data published on the purity of the other forms of MDMA or a comparison between the two available types. The only published data, to date, on the purity of alternate forms of MDMA is in a footnote on the EMCDDAs website (EMCDDA, 2014). The EMCDDA report that of the 487 samples examined, which was over four times as many as tablets reported for that year, the average content of MDMA found in the crystal form was 81.1%. The median is given as 88% and the mode is 92%. This data is not comparable to what is recorded for the tablets as they are not reported consistently. Tablets are reported as milligram weight whereas powders as a relative percentage. This research will provide a comparison between the two types of MDMA seized, to see whether there is a significant difference in the relative purities between Ecstasy tablets and powder MDMA.

A further issue that has impacted the content of MDMA relates to a UN embargo on the production of safrole. In late 2007 over 50 tons of the precursor, safrole oil, was seized in Thailand smuggled from Cambodia (UNODC, 2008). As stated in section 2.1.3, safrole is a key starting material in the synthesis of MDMA. This was the largest crackdown in safrole production and subsequently led to a marked decrease in the availability of MDMA around the globe (UNODC, 2011 p.151). The post crackdown deficit of MDMA coincided with a shift in the recreational market and the emergence of new and unknown compounds (UNODC, 2013).

2.6 Introduction of the New Psychoactive Substances (NPS)

2.6.1 Global Overview of World Drug Markets

The last few years has seen an increase in attention on the newly emerging psychoactive substances, with both the UNODC and the ECMDDA releasing reports addressing the global and continental trends emerging from the misuse of these relatively unknown compounds (UNODC, 2013b; EMCDDA, 2011a). The numbers of new chemicals being reported is increasing year on year with currently over 280 new substances being documented on the ECMDDA's early detection radar (ECMDDA and Europol, 2013). The analysis of drug trends and the data generated on seizure levels for the UK is one focus of this thesis, which is explored in Chapter 5.

2.6.2 A Change in Terminology

Over the years there has been a shift in the terminology used to describe the newly emerging drugs into the recreational drug market. Beginning in the 1980s the newly emerging synthetic drugs were coined '*designer drugs'*, with Ecstasy being one of the substances included in this new group (UNODC, 2013a, p.60). The phrase '*designer*' refers to the fact that these compounds where being chemically designed to circumvent strict phrasing in the already established drug laws by adjusting the structure by as little as a single functional group (UNODC, 2013a, p.60). The title also has a secondary association, in that when Ecstasy first emerged into the recreational drug scene it was popular with the '*Glitterati elite*' (Pilcher, 2008 p.30). Thus giving Ecstasy a status symbol comparable to the ones of the elite fashion designers, whose insignias were often plagiarised and imprinted onto the tablets.

However, the term was soon deemed inappropriate as the substances it related to were already controlled in the UK, and so the term '*club drugs'* replaced it (UNODC, 2013, p.61). This term is still used to refer to those substances often taken in the specific social setting of nightclubs/ raves; and encompasses not only controlled substances like cocaine and Ecstasy but also un-controlled substances like amyl nitrate (*Ibid.)*. The terminology changed again at the ends of the 1990s and into the start of the new millennium, with the phrase '*Research Chemicals'* becoming popular. The producers of these new substances tried circumventing legislation by disguising their intent, marketing the chemicals for '*so-called scientific research*' and being labelled as '*Not for human consumption'* (UNODC, 2013*,* p.*61)*.

In the mid-2000s there was a massive revolution in the terminology, with recreational drugs going mainstream under the title of '*Legal Highs'* (*UNODC, 2013, p.61*). These were substances that were marketed as legal alternatives to popular controlled substances, like Ecstasy. The term caused a media storm and the substances themselves being deemed a new moral panic (Power, 2013). These included the newly emerging piperazine compounds, the synthetic cannabinoids and the synthetic cathinones. Despite the fact that the majority of the substances considered to be legal highs have subsequently been controlled under the MoDA 1971, the term persists in the British media reporting on these substances. Like with the '*Research Chemicals'* some of the suppliers of '*Legal Highs'* used misdirection in their selling to disguise their intent; most notably that of the drug Mephedrone, which was sold under the moniker of plant food, and with other synthetic cathinones being sold as '*Bath Salts'* (UNODC, 2013 p.59).

Consequently the UNODC, following the lead of the EMCDDA has begun using a new term to describe newly emerging substances. As using the term '*Legal Highs'* suggests that the substances are in some way legitimate. The new term was introduced by the Commission on Narcotic Drugs in its resolution 55/1 (UNODC, 2013 p.62). The terminology brought in was '*New Psychoactive Substances'* (NPS), and relates to any substances that newly emerges into the recreational drug market. This means that some drugs that are already established can fall under this umbrella term if they emerge into a new market, as the term is being adopted internationally (UNODC, 2013 p.62). It was first legally defined by the European Union and has been adopted by both the EMCDDA and the UNODC (*Ibid.*).

According to the ECMDDA, the new groups of substances that have been identified as falling under the purview of this new terminology are phenethylamines, tryptamines, piperazines, synthetic cathinones and synthetic cannabinoids (EMCDDA, 2011 p.94). The UNODC would also include other substances such as ketamine, the plant-based psychoactives, i.e. Khat, and Aminoindanes (UNODC, 2013a, pp.65-67). Technically the synthetic cathinones could fall under the category of phenethylamines based on their chemical structure. As such, the group of phenethylamines could subsequently be divided into two sub groups of the synthetic cathinones and new amphetamine type substances. There has been many changes to the terminology used, both in a legal context and by what is used on the street to describe controlled substances, how well the terms are recognised by the public is assessed in Chapter 4 the results from the social surveys.

2.6.3 A focus on Mephedrone

Over the last few years a number of NPS products have emerged into the British market, as alternatives or replacements to the controlled Ecstasy group (EMCDDA, 2013). As mentioned above they were originally introduced under the guise of '*Legal Highs'.* One such product is the drug Mephedrone that is part of the focus of this research. Mephedrone has had the most media presence of the NPS, as well as often being cited as the replacement for MDMA, with a BBC documentary on drug use stating that;

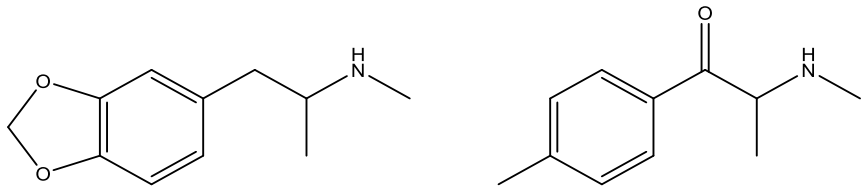
'Cocaine and Ecstasy are out and Mephedrone and Ketamine are in'

(BBC, 2013)

This statement, which was used as the tag line for the BBC documentary, makes an assertion about the drug trends within the UK. As part of the research conducted in this thesis the four substances mentioned in the above statement were assessed in the social research surveys to ascertain to what level this statement is true.

What is Mephedrone?

Mephedrone is the brand name given to the compound identified as 4-methylmethcatinone (4-MMC). It is part of the substituted and synthetic cathinone class of drugs that emerged in the late 2000's in the British recreational drug market (Measham *et al.,* 2010). These new synthetic compounds are derived from the naturally occurring compound cathinone that is found in the Khat plant (*Catha Edulis*) (Coppola and Mondola, 2012). Mephedrone was one of many substances in this class that emerged as an alternative product to MDMA, at a time when the global availability of MDMA was reported to be low (UNODC, 2013). Mephedrone is often sold as a white crystalline powder, either loose or in capsules (Measham *et al.,* 2010, Wood and Dargan, 2012). Taken by insufflation (snorting) or through oral ingestion, either by a method known as 'dabbing' or by 'bombing' (Measham *et al.,* 2010).



a) MDMA b) Mephedrone

Figure 2.9: Chemical structures of MDMA and Mephedrone (4-MMC)

The structure of Mephedrone is similar to that of MDMA in that it has the same central structure of a phenethylamine, as shown in Figure 2.9. However where MDMA has the methylenedioxy- functional group attached to the 3rd and 4th carbon atoms of the benzene ring, Mephedrone has a single methyl group attached at the 4th carbon only. In addition to the difference found on the benzene structure Mephedrone also has a ketone group attached at the Rβ carbon.

What does it do?

The ingestion of synthetic cathinones is reported to cause an increase in the release of the catecholamines; dopamine, serotonin and norepinephrine into the synaptic region, this is in a similar manner to what is experienced with the amphetamine type stimulants and by extension MDMA (Coppola and Mondola, 2012). It is this similarity that generates the effects that led to Mephedrone being touted as an alternative to MDMA. The reported effects of Mephedrone include both mental and physical stimulation, euphoria and feelings of empathy and openness that are most commonly associated with the use of MDMA (Measham *et al.,* 2010; Winstock, 2011a).

The popularity of Mephedrone and the impact of Media

Much is unknown about the emergence of Mephedrone before it came to prominence in the British Media in 2009/10. The first reference that could be found by this author that referred to the substance as Mephedrone in an academic context is by Archer (2009) who noted the emergence of these substances online in the wake of the control of piperazine compounds in 2009. The media's impact on promoting the awareness of this substance and the modern '*moral panic*' that ensued has been examined in a paper by Alexandrescu (2014). The popularity of the drug Mephedrone appeared to go hand in hand with the ever increasing presence of news stories relating to its use by the youth of the United Kingdom, with the highest frequency of these stories reported to be in March and April of 2010 (*ibid.*).

The popularity and use of this substance in the United Kingdom has been tracked by two surveys; the Global Drug Survey (GDS), formerly the Mixmag survey, and the Crime survey for England and Wales (CSEW). The GDS first included Mephedrone in the publication of the 2010 survey, and the CSEW included it into their 2010/11 publication, the reported use is recorded in Table 2.5.

Table 2.5: Percentage of Participants reporting to have taken Mephedrone in the UK

CSEW	2009/10	2010/11	2011/2012	2012/2013	2013/2014
Mephedrone Use in Last Year	n/a	1.3%	1.0%	0.5%	0.6%
GDS	2010	2011	2012	2013	2014
Mephedrone use in last 12 months	33.6%	51%	30%	13.8%	7.9%

As year of publication refers to use in the previous year it is clear from both surveys that the use of Mephedrone peaked in 2010, as shown in the reports published in 2011. What is noted thereafter is a decline in the reported usage in the following years, which correlates to when legislation was introduced to control Mephedrone and its chemical analogues. Though introduced on the back of the '*Legal Highs'* trend, the synthetic cathinones including Mephedrone were controlled in April of 2010 as a Class B Substance (MoDA 1971, Amendment 1207, 2010). Though there was much publication in the media of the emergence and impact of Mephedrone use, whether the prevalence has been significant and sustained has yet to be assessed, and the possible reasons for this apparent decline in the use of Mephedrone is discussed throughout this thesis.

2.7 Profile of a Drug user

This chapter has so far discussed the historical and cultural context of the drug Ecstasy; reviewing the literature from chemical, biological and sociological disciplines. The next section will examine the studies on who uses this substance.

2.7.1 Typologies of drug use

The World Health Organisation (WHO) categorises drug use into five broad types: 1) experimental use, 2) functional use, 3) dysfunctional use, 4) harmful use, 5) dependant use (Sumnall *et al.,* 2006 p.6). The last three categories represent what is known as 'problematic' drug use, and it is often the problem drug users and addiction that is the focus of the debate around drug use and policy concerns.

One criticism of the above typologies would be in how the terminology can be interpreted. The terms are vague and there is opportunity for significant overlap between categories (Rehm *et al.,* 2005, p390). If someone is managing their addiction they may not want or seek help, likewise the interpretation of the terms by the users themselves and self-categorisation may mean that users don't identify their use as being 'problematic'. Yet perhaps the majority of use is not problematic? One estimate states that up to 90% of consumption of illicit substances could be unproblematic (Seiffert, 2013). There is also evidence that:

"'*Escalation' to harder drugs, long term continuation of use and development of dependency is confined to the minority "*

(Measham and South, 2012, pp.690-691)

As with the emergence of designer drugs in the late 1980's, '*research chemicals'* in the 1990's and the more recent *'legal highs'* there are subcategories of use that can be applied and are often self-identified by the recreational user. Werse and Morgenstern (2012 p.228) have identified a further five typologies of the 'legal' highs users; 1) experimental users, 2) substitutors, 3) potheads 2.0, 4) specialist psychonaughts and 5) omnivores. Though the definitions are applied specifically to legal high users responding to surveys in Germany the terms can be applied to broader recreational drug using communities.

An experimental user, much like the description by the WHO, may try a substance or range of substances on few occasions. The substitutors try a substance and then when it is unavailable or as in the case of *'legal highs'* are controlled, will switch to a secondary substance (Werse and Morgenstern, 2012, p.228). This is reportedly what occurred when MDMA became unavailable in 2009/10 and Mephedrone emerged (Brunt *et al.,* 2011). The typology of 'potheads 2.0' relates to users interested in the use of cannabis and cannabis related products, such as 'Spice' (Werse and Morgenstern, 2012 p.228). The specialist psychonaughts and omnivores are differentiated only by the purpose of their use. Werse and Morgenstern (2012 p.228) suggest that omnivores are likely to use '*virtually all kinds of drugs*' basing use on availability, mood and setting. Psychonaughts on the other hand are reported to be selective of the substances and experiences that they seek, with the expansion their drug experience given as their main motivation (*ibid.).*

There is also a sixth group not mentioned in any of the above typologies, which is the group of people who refrain from using controlled psychoactive substances. That is not to say that they refrain from the use of alcohol or uncontrolled substances but in the context of this research non-users are considered to be anyone who reports to have never used any substance that has ever been controlled under the MoDA 1971.

2.7.2 Who uses Ecstasy?

Within the fields that study drugs there is a dominant focus on the 'problematic' drug use and the harms it causes to the individuals and to society. The use of 'Ecstasy' however is not included under the umbrella of 'problematic drug use'. As defined by the EMCDDA problematic drug use is;

> '*Injecting drug use or long duration or regular use of opioids, cocaine and/or amphetamines'. This definition specifically includes regular or long-term use of prescribed opioids such as methadone but does not include their rare or irregular use nor the use of ecstasy or cannabis*.'
>
> (EMCDDA, 2012)

Ecstasy, and by extension MDMA are considered 'social' drugs, as reported in the ACMD report in 2009 there is little evidence of dependence or negative social impacts arising from its use (ACMD, 2009 p.28). The use of this substance will therefore be considered solely in regards to the social user without examining concepts of abuse or addiction. To derive a 'profile' of the Ecstasy user a review of selected representative studies published on Ecstasy use, including those mentioned in section 2.5.2 was compiled examining the gender ratio and mean age as reported in the studies, shown in Table 2.6.

Table 2.6: Summary of the demographic variables reported in studies on Ecstasy use shown as a percentage of respondents (Age variable is stated as described in each study)

Study	Year	Male (%)	Female (%)	Age	Sample size
Solowij *et al.* (1992)	1992	61	39	Range:16 to 48 Mean: 27.13	100
Webb *et al.* (1996)	1996	52	47	Mean:20.9	3075
Handy, Pates and Barrowcliff (1998)	1994-1995	66.7	33.3	Mean: 22.6	389
Hammersley *et al.* (1999)	1993-1995	56	44	Range: 14 to 44 Mode: Male – 21 Female – 20	229
Sherlock and Conner (1999)	1996	63.7	36.3	Range: 15 to 51 Mode 21 Mean 22	4042
Gross *et al.* (2002)	2002	61.2	38.8	Range: 16 to 32 Mean: 21.4	210
McCambridge *et al.* (2005)	1999	60.9	39.1	Mean: 23.9	1151
	2000	62	38	23.9	795
	2001	62.3	37.6	24.1	787
	2002	52.1	47.9	24.5	335
	2003	64.1	35.9	24.2	805
Ogeil, Rajaratnam and Broadbear (2013)	2013	54.1	45.9	Mean: Male – 24.66 Female – 25.91	268

One key observation of the studies chosen is the gender ratio, where the proportion of male participants has consistently outweighed the proportion of females, this is reflective of what is often reported in drug use studies. It is also true for the Global Drug Survey, in the 2012 survey the gender ratio reported was 69.7% male to 30.3% female (Global Drug Survey, 2012). The ratio of 2:1 male to female is usually cited to describe the gender of drug users (Measham and South, 2012 p.692), however this figure may not accurately reflect actual levels of drug use as there are a number issues that can affect survey responses. The majority of the surveys above relied on a referral sampling method. The issues impacting drug use surveys are discussed in detail in Chapter 3. The age of the Ecstasy user is also relatively consistent within the studies with most citing mean values in the early to mid-20s. There appears to be little variation in who is self-reporting to have taken Ecstasy in the previous two decades with the studies finding that majority of Ecstasy users responding to these surveys are young adults and male.

2.8 Research Questions

Through the course of the literature review there were four areas where a gap in knowledge was identified from which the research questions addressed in this thesis were derived. The first question was developed to address the gap in knowledge on the changing use of terminology and the inconsistency in the use of the terms 'Ecstasy' and 'MDMA'.

Question 1: Has there been a change in what is meant by the terms 'Ecstasy' and MDMA, and how are they being used in relation to the recreational drug in modern UK society?

The terms 'Ecstasy' and 'MDMA' have been used synonymously since the epithet was first assigned to the newly emerging party drug in the 1980s. Although MDMA is the most common compound reported to be found in the recreational drug sold as Ecstasy (ACMD, 2009), the legal definition includes any of the ring-substituted phenethylamines (MoDA 1971, c.38). During the course of the literature search it became apparent that there had been a change in how the term Ecstasy was being used, with an increase in the use of the alternative term MDMA being found (Turner *et al*., 2014). What is addressed by this research is whether the terms still have the same connotations or if they have come to mean different things, at both an academic level and to the general public. Additionally, whether the general public are aware that Ecstasy and MDMA are the same thing or if MDMA is now considered a product in its own right is addressed. The awareness of this change in terminology was explored through the use of an online social survey into the social perception of drugs. The results from the survey provide an understanding of whether one or the other names is more commonly recognised, and whether there is a direct association between the two terms.

The second question addresses a comparison between what is found in street seizures relative to stated user preferences.

Question 2: What are the differences in the types of Ecstasy being seized on the streets of Cambridge, and how does this relate to user preference?

The second question was developed to study whether the change in the terminology and the naming of recreational drugs, as examined by the first question, reflects a change in the form in which Ecstasy is being found. There has been a lack of acknowledgement in the literature

of the alternative powdered form and its relative prevalence compared to the traditional tableted form. The current awareness of an alternative form can be found in its inclusion in the Global Drug Survey (Mixmag, 2013) and in the recommendation in the Advisory Council on the Misuse of Drugs 2009 report on MDMA, which states better data is needed on identifying alternate forms of this drug (ACMD, 2009). Question two is addressed in the findings from the data that has been collected in collaboration with the police at Cambridgeshire constabulary, through the examination the seizure records and is compared to the findings from the second social research survey. A related question was then developed:-

Question 3: Does the user perception around the difference types of MDMA reflect what is found chemically?

The third question answers the question around the purity of the different forms with the analysis of the street level drugs by the analytical technique of GC-MS. There is little to no data published on the relative purity of MDMA in the powdered form, and the reported quality of Ecstasy tablets has a reportedly wide range (EMCDDA, 2013). The last question looks to address what is found chemically in these drugs, and at what purity and whether this correlates to the users perceptions around these drugs.

Finally, the impact of the growth and decline in Mephedrone use is also considered.

Question 4: What impact has the emergence of Mephedrone had on the popularity and prevalence of Ecstasy and MDMA?

The final question compares the relative popularity of the drugs in question, in comparison to the seizure data. The seizure data provides a picture only of what has been found, yet from user based surveys it is apparent that there are people who take controlled substances without ever getting caught (Mixmag, 2013; Homeoffice, 2013). The second survey was developed to study whether there was a definitive difference in user perception and preference of the drugs, looking specifically at Ecstasy, MDMA and Mephedrone. The data collected is then compared to the other user based surveys, as well as to the seizure data collected and can be used to identify whether what is being seized accurately reflects what people report to be taking and like taking.

Chapter 3 Social Research Surveys on Drugs

3.1 Introduction

The first element of the research focused on the sociological aspects of the drug Ecstasy, exploring its changing position within the social consciousness and its popularity as a party drug. This was achieved through the use of two online surveys; Survey A that was focused on discovering the general public's knowledge of recreational drugs and Survey B that looked at which drugs people report to haven taken.

Survey A: Knowledge and Awareness

Survey A was broken down into 3 sections; the first was used to gain an understanding of the participant's baseline knowledge of recreational drugs; the second investigated the participants' trust in information sources and the third section sought to understand participant's perceptions about the importance of drug awareness.

Survey B: Popularity and Prevalence

Survey B asked the participants to recount their own experiences with selected substances. It was separated into 4 sections on; drug use, experience, preference and a discussion around drug use. Survey B was designed to explore which substances people have taken and their reasons behind those choices. A thorough breakdown of the questions for both surveys can be found in section 3.5.3.

The survey data provides a sociological context that will then be compared to the analytical and trend data of the other two elements in this research. This was done to see if there was an association between what people report they like taking and what is actually being seized on the streets of Cambridge.

3.2 Context of the social surveys

The research questions that are explored in this part of the project examine; (1) how the use of the terms Ecstasy and MDMA have changed and (2) the impact the emergence of the new psychoactive substances (NPS) has had on the reported level of use of MDMA. As has already been stated the terms Ecstasy and MDMA have been used interchangeably, yet can relate to different products (Smith, Moore and Measham, 2009; Turner *et al.* 2014). The sociological research method of surveys was chosen to investigate the general public's understanding of the two terms and to identify whether the information the public knows accurately represents the academic understanding of the terms. Is there a consistency in the public's knowledge surrounding Ecstasy?

The second aim of the research questions was to investigate the level of drug usage and reasons behind preference, and so the second survey was developed. Two major national surveys influenced this work, primarily the 'Crime Survey for England and Wales' (CSEW) (ONS, 2013) and the 'Global Drug Survey' (GDS) run in collaboration with the magazine MIXMAG (2013), both of which are critically analysed in section 3.3. Survey B was developed for this project to qualitatively explore the personal experience of the participant.

3.3 Critical analysis of research method

3.3.1 Survey Theory

A survey is a system that can be used for the collection of information, to detect patterns of relationships between variables from a number of case studies (Bryman, 2012; Sue and Ritter, 2012). They can use quantitative methods, qualitative methods or a mixture of both, and the data can be collected in the form of either self-completion questionnaires or as structured interviews (De Vaus, 2001). For the purpose of this chapter the focus is given to self-completion questionnaires and the use of mixed method questions, as this was the method that was chosen.

Self-completion questionnaires can be implemented as either paper-based or online. The model chosen for this research was the use of internet based surveys. The benefits of using an online model over the conventional paper-based are that online surveys are comparatively cheaper and are not as resource intensive, meaning that they are more environmentally friendly and sustainable (Sue and Ritter, 2012). Another benefit of the online model is that

they are faster and more efficient in delivering the questionnaire, making the data collection and data entry easier. By being produced on the internet, online questionnaires become available to a broad spectrum of possible respondents (*ibid.)*.

There are disadvantages to using the online model one of which is the reliance on software, errors in the programming and loss of data can occurs. However when using an online model this issue can be mitigated by thoroughly backing up all data (Sue and Ritter, 2012). A second disadvantage with the online model is the validity of the user responses. How does the researcher know that the participant is who they claim to be? In a study into the comparisons of the responses between paper-based and computer based surveys specific to the topics of alcohol; tobacco and drugs, it was found that the computerised method yielded similar outcomes to the traditional methods and is therefore a justified method of collecting this sort of data (Hallfors *et al.,* 2000).

There are two main limitations that can be used to criticize the application of surveys in investigating sensitive topics, such as the topic of drugs and drugs use: the stigmatisation associated with certain social behaviours and the lack of accessibility to the target sample (Caetano, 2001).The first limitation is based on the principle of social desirability bias, with the participants being reluctant to admit to stigmatizing behaviours, such as taking drugs or drinking alcohol (Caetano, 2001). Marquis, Marquis and Polich (1986, p.386), investigated the response bias and reliability of six sensitive research areas; including the topics of alcohol consumption, drug use and embarrassing medical conditions and concluded that as whole across all topics considered the respondents *'did not withhold or underreport sensitive personal information'*. It was also found that the results were similar to those found for non-sensitive topics, and that variation in the reliability of data may have been due to the survey design (*ibid.)*. The impact of social desirability bias in relation to its application to this study is discussed further in section 3.4.

The second limitation, the lack of accessibility, depends on sampling method and participant choice. For example, with general population surveys such as the Crime Survey for England and Wales (ONS, 2013), the focus is on a cross section of society as opposed to focusing on the specific group of drug users. However this sampling methodology employed may not reflect an accurate picture of the drug using community, a factor that is critically assessed in the following section.

3.3.2 Critical Analysis of Comparative National Drug Surveys

This section evaluates the contributions and methodologies of two of the most prevalent and consistent social drug surveys in the UK, which were used in the development of this project. The survey methodologies are critically examined in regards to the implications they make on the estimation of the size of the drug using community. The two surveys are used as point of comparison throughout the analysis of second research survey.

An overview of the Crime Survey for England and Wales (CSEW)

Formerly known as the British Crime Survey (BCS), the CSEW is an interview based victimisation survey, covering the public's perception of a number of crimes (ONS, 2013). First conducted in 1982, the methodology and crime types included within this survey have remained comparably consistent over the years (ONS, 2013). Initially it was run every two years until 2001 when it changed to an annual collection. From 2012, its name changed from the BCS to the CSEW when it ceased to include data for Scotland (ONS, 2013). The Scottish Government had commissioned a tailor made victimisation survey the Scottish Crime and Victimisation Survey (SCVS) in 2004 (The Scottish Government, 2013).

The main aim of the CSEW is to provide trends analyses for the crime types and the population it covers; this includes but is not limited to drug usage (ONS, 2013). It does not claim to provide an absolute level of crime occurring in England and Wales, what it does provide is an estimate of the national levels of the crimes covered in the survey (ONS, 2013). One benefit of data provided by the CSEW report is that it reflects crimes that are not reported to or by the police. The data is also unaffected by changes in reporting practices of the police or by the levels of police reporting (ONS, 2013). In the case of drug use this can be compared to the recorded seizure levels. The size of the drug market is also estimated by the UNODC and the EMCDDA and relies on the official reported seizure levels (UNODC, 2013; EMCDDA, 2013), which are discussed in Chapter 5.

An overview of the Global Drugs Survey (GDS)

The Global Drug Survey (GDS) is an independently run survey assessing drug preferences. It claims to provide '*qualitative and quantitative, non-judgmental, informative and confidential drug surveys*' (GDS, 2013). It began as a feature in the dance magazine Mixmag in 1999, which was run annually and founded by Dr Adam Winstock. The Mixmag drug survey was originally limited to responses from subscribers and readers of the magazine, who had a vested interest in the research subject (Mixmag, 2011).

In 2012 a secondary media partner joined the GDS, in the form of The Guardian newspaper (Global Drug Survey, 2013). The survey was rebranded as the Global Drug Survey. With the rebranding also came the globalisation, the survey was now being hosted online and more readily accessible to the world. However in disseminating their findings they separate by country, with the United Kingdom and the United States being the largest contributors to the 2013 survey (Global Drug Survey, 2013). It is the responses to the 2013 survey that will be used to compare to data collected for this research.

Comparison of the methodologies employed by the CSEW and the GDS

The following comparison of the CSEW and the GDS is founded on their question formats, the method of survey delivery and the sampling procedures. Though there have been a number of studies that have investigated the use of Ecstasy (Gross *et al.,* 2002; Hammersley *et al.,* 1999; Handy, Pates and Barrowcliff, 1998; McCambridge *et al.* 2005; Ogeil, Rajaratnam and Broadbear, 2013; Sherlock and Conner, 1999; Solowij *et al.,* 1992), the CSEW and the GDS are two of the most consistent surveys that study the changing trends in drug usage in England and Wales, and Britain respectively. However each survey uses a different methodology to collect the data; the CSEW uses the face-to-face interview method (ONS, 2013), whereas the GDS uses structured self-complete questionnaires (Global Drug Survey, 2013).

The CSEW is reviewed annually to reflect emerging issues, yet the wording of the questions has remained constant. The process employed is reliant on a core sample representative of the population households in England and Wales. In 2013 this related to 35,000 households being identified as possible candidates (ONS, 2013). Households are identified by the use of the Postcode Address File (PAF) method (ONS, 2013). The interviewers then determine if the

chosen households are eligible, properties deemed ineligible include uninhabited houses or second homes. Also ineligible are group residences such as halls of residences. The ramifications of this are considered in the section on limitations of drug survey research.

Once the households are chosen an adult resident is chosen at random to participate in the survey (ONS, 2013). The data is generated in face-to-face interviews that employs the use of computer assisted personal interviewing (CAPI), where responses are recorded by the interviewer using digital tablet (ONS, 2013). Self-completion modules were introduced in 1996 and are used for topic areas deemed sensitive or likely to make the participant uncomfortable, such as the questions on drug use (ONS, 2013). For these modules the participants would be required to complete the questions on the interviewer's tablet. The limitation of this methodology is the risk of introducing social desirability bias as the participant is answering questions in the presence of the interviewer. Although bias has been detected in the use of all modes of survey (Glynn and Park, 1997), it has been shown to be more pronounced in interviewer led ones (Ipsos Mori, 2012).

The GDS by comparison conducts its survey anonymously online. It employs the use of initial drug use screening questions before tailoring subsequent questions based on the participants recent self-reported drug use. As with the CSEW, the GDS is reviewed annually to reflect changes, yet it states that 65% of the questions are re-used to permit the monitoring of the changes in the drug trends over time (Global Drug Survey, 2013).

The GDS relies on the self-nomination of participants, unlike the CSEW that uses direct recruitment and participant selection (Global Drug Survey, 2013). To recruit participants the GDS has employed a number of measures that were also adopted for this research. As stated in the previous section the GDS has a number of media partners, including Mixmag and the Guardian newspaper (*ibid.)*. The GDS also relies increasingly on promotion through social media to attract a more diverse sample group that were also utilized to promote the surveys for this research.

3.3.3 Limitations of Surveys on Drug use

The first limitation identified for both surveys relates to the sampling methodologies. This can be analysed when comparing the nature of each of the methods to the general population. Figure 3.1 displays a visual representation of the general population of Britain, signified by the blue circle. Within the population there is a subsection, the drug using population, signified here as the red circle.

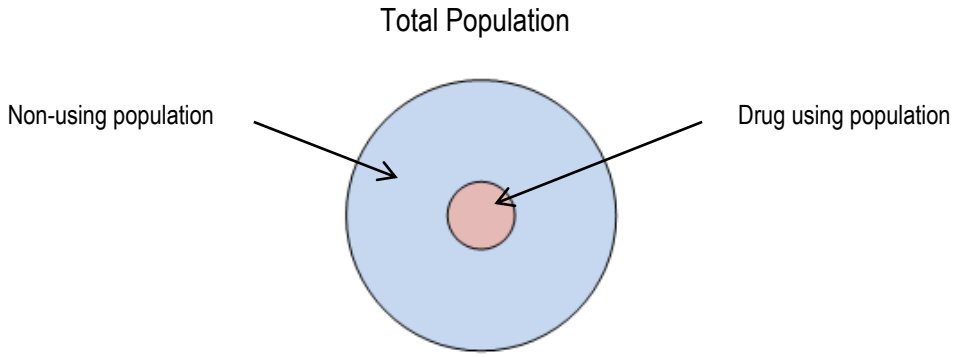


Figure 3.1: Visual representation of general population and drug using population

Although the total population of the UK is known, with the estimate for the population of England and Wales in mid-2013 being 57 million people (ONS, 2014) what is unknown is the exact size of the red circle, the drug using population. Both surveys use different methods to try an estimate the size of this group. The CSEW method of participant selection and recruitment seeks to *'reflect the profile of the general population'* (ONS, 2013, p.8). This is represent by Figure 3.2, whereby the survey seeks a cross-section of the general population, including participants from both the non-drug using and drug using sections of society.

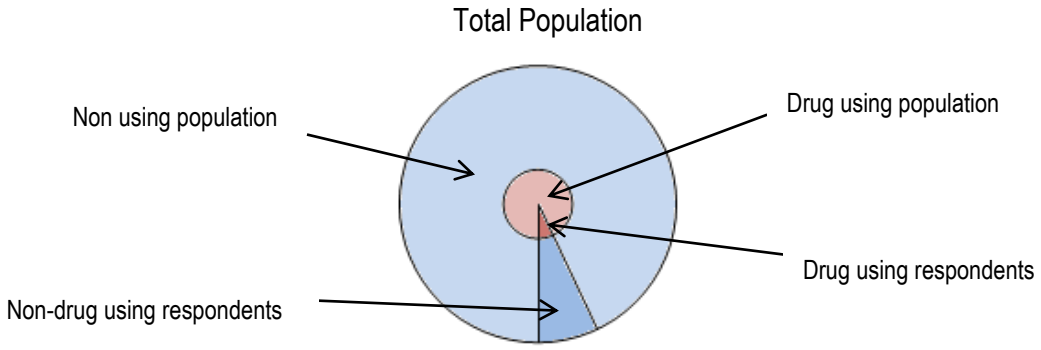


Figure 3.2: Visual representation of the CSEW sampling methodology

The limitation of this method is an assumption of homogeneity of the drug using population, that the random sampling used by the CSEW will garner a representational selection from the drug using community. However there is also the issue that this method does not include responses from halls of residence (i.e. students), young adults living in shared accommodation or from the homeless community. Therefore in not acknowledging or representing these groups in the CSEW could have a negative impact the proportional levels being reported from the drug using population and reflect an under reporting of drug use. The demographic analysis of the CSEW is assessed further in comparison to findings from this survey in section 4.2.1.

The method for the CSEW can be compared to the participant selection method of the GDS, which claims to be a cross-sectional survey (Global Drug Survey, 2013). As the GDS is self-nominating and employs screening procedures to eliminate any non-drug using respondents, the sample represents only from within the drug using population, as represented in Figure 3.3.

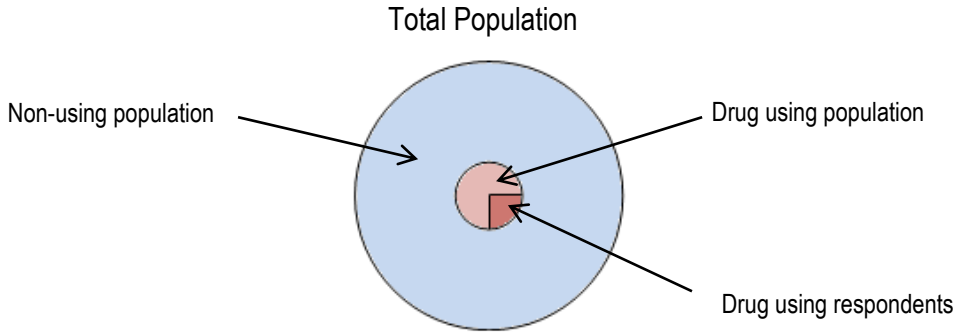


Figure 3.3: Visual representation of the GDS sampling methdology

The limitation of the GDS methodology is that fails to consider the relative size of the drug using population in relation to the non-using population. One question is how big a proportion of the drug using population does the GDS represent? The restriction of using the different approaches to estimate the relative size of the drug using population can be examined by comparing the findings. For example the number of people reporting to have taken Ecstasy in the last year for the CSEW in 2013 was 1.3% (Home Office, 2013), which works out at 278 people, when using the unweighted base (*n* = 21359). These results can then be compared to the GDS that found that 67% of respondents claimed to have taken Ecstasy, which works out to 5159 of its participants (*n* = 7700).

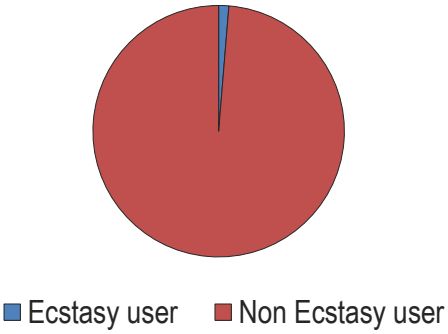


Figure 3.4: Estimated levels of Ecstasy use as reported in the CSEW for 2013 (Home Office, 2013)

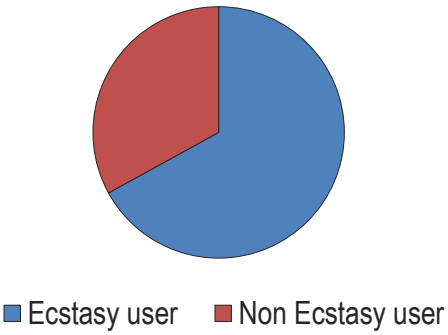


Figure 3.5: Estimated levels of Ecstasy use as reported in the GDS (2013)

Figures 3.4 and 3.5 show the proportion of respondents who report to have taken Ecstasy compared to the unweighted base of participants. Both figures reflect the representations of sample selection as shown in figures 3.2 and 3.3, but also highlight the disparity in the levels of drug use being recorded. On the one hand Ecstasy use is relative low, with less 2% of the total population reporting to have ever taken it. Yet when the sample is focused on the drug using population it increases to 67%. The population of England and Wales estimated mid-2013 was 57 million people (ONS, 2014). If the data is extrapolated from the two surveys discussed the population of Ecstasy user's ranges from 741,000 users based on the reports from the CSEW up to 3,819,000 for the GDS. However the authors of GDS do take into consideration that their data is representative of only the sample group (Global Drug Survey, 2013) and that their findings should not be extrapolated to general populations.

The CSEW is however held as the standard for assessing drug use in England and Wales, with the Prime Minister David Cameron recently using these statistics to support the claim that drug use is on the decrease (Wintour, 2014). The reliability of the data to support this claim is debatable, as the issue of introducing respondent bias needs to be considered.

There are two possible forms of bias that can impact the data collected in both methodologies. The first is social desirability bias, when the participant provides the answers they believe the researcher wants to have (Bryman, 2012). The GDS attempts to address bias through the use of an online format, where no contact is required between the participant and the researcher (Global Drug Survey, 2013), which is an added benefit as the participant may be embarrassed or uncomfortable discussing the topic of drug use when confronted by a stranger in a face-to face interview.

However as the CSEW uses a face-to face interview, the researchers behind the CSEW acknowledge the risk of bias and have tried to mitigate it by including the self-report modules method, described in section 3.3.2 (ONS, 2013). Yet there would still be the social pressure of completing the survey in front of the interviewer (Glynn and Park, 1997; Ipsos Mori, 2012), with the added pressure that the interviewer is reporting on behalf of a governmental organisation. Social desirability bias may come in to effect when examining the CSEW method of collection as the topic that is being examined is not only potentially seen as a social taboo but is also a criminal act, which the participant is effectively admitting to a government official.

The second form of bias that may be present is recall bias, where participants have forgotten not only when they have taken a substances but also what substances they may have taken (Hassan, 2006). This can be observed in the types of questions asked. Both the CSEW and the GDS uses fixed response questions (ONS, 2013; Global Drug Survey, 2013), which does not give as much scope to assess the reasons and decision making processes behind which drugs the participants choose to take or why. There are criticism about how and when the data is collected. Both surveys ask about historic drug use over set periods, asking participants about substances they have ever taken, substances taken in the last year and within the last month. The issue with asking these questions is the risk of introducing recall bias, if a participant cannot pinpoint exactly when they last took a particular substance. This would lead to inconsistent reporting, however this can be caught with asking about any historic drug use in the *'ever taken'* question. Yet as the GDS does not recorded who responds year to year and the CSEW randomly chooses households it is impossible to state categorically that yearly trends are truly comparable.

The final issue is that drug use especially that of recreational drugs such as Ecstasy and MDMA powder, is not a static state. There is evidence to suggest use of these substances is transient and subject to specific usage trajectories as shown in the work by Smirnov *et al. (2013),* which examined the usages trends of young adult populations in Australia. The authors found that the self-reporting of high level MDMA use peaked at six months after initial use had started, with a sharp decline in use between the six and twelve month period in young adults.

3.4 Counteracting Social Desirability Bias in Social Surveys

Due to the nature of the research area it is important to address the possibility of encountering social desirability bias when dealing with sensitive subject matter (Bryman, 2012; Glynn and Park, 1997; Krumpal, 2011; Marquis, Marquis and Polich; 1986, Wheeler, 2013) where the topic being investigated may have negative social connotations. This is compounded with the study of drugs, as the behaviour being investigated is also illegal. Though it is not illegal to have taken controlled substances, it is illegal to have possession of them (MoDA c.38, 1971).

One way that this research tried to mitigate the impact of social desirability bias was to host the survey completely on the internet with no interaction between the researcher and the participant, aside from the initial recruitment to complete the survey. The use of self-administered questionnaires, such as the web based method, has proven to yield better accuracy when reporting on sensitive subjects. Tourangaeu and Yan (2007, p.864) report in a review of studies on sensitive topics:

'A higher proportion of respondents reported illicit drug use when the questions were self-administered than when they were administered by an interviewer.'

The complete anonymity that web based method provides promotes a greater sense of honesty from the participant when completing the surveys. Yet there are disadvantages to this method in that all information provided was taken as verbatim, all information provided was taken to accurately represent the views of the participant at the time of completion with no follow up with participants after. The surveys also included qualitative questions that allowed the participants to further explain their reasoning behind certain answers.

3.5 Survey Development (Methodology)

3.5.1 Ethical Approval

Prior to the development of the surveys ethical approval was sought from Anglia Ruskin University and was granted in October 2012.

Consent

To ensure that the highest ethical standards were met the participants were asked for their consent for both surveys. A clear explanation of how the consent process worked with these surveys was included before the start of each surveys. As all data was collected through a third party (Google™), no information on the participants was given to the researcher aside from that provided within the survey. It also meant that once submitted participants could not request to withdraw their responses. This was explained at the beginning and end of both surveys, a copy of the consent information is included in Appendix III.

3.5.2 Survey Variables

Demographics of other surveys

The demographic variables for this survey were chosen in consideration of what had been used in previous surveys mentioned. The CSEW uses a number of demographic variables to evaluate its participants, the first set of variables is based the geographical location, where the participants are based. The second set of variables is on the household structure, family structure and income of the participant. The final set of variables is specific to the individual; age, gender, ethnicity, marital status, employment status; occupation, alcohol consumption, nightclub visits and pub/ bar visits. The survey has a total of 11 variables by which the data is grouped and analysed (ONS, 2013). The GDS also uses a number of demographic variables to differentiate their data sets. The variables used by the GDS are; gender, age, income, geographical location (limited to country), sexual orientation, musical preference and other recreational activities (Global Drug Survey, 2013). After considering the approaches of the two different surveys, it was decided that due to the anticipated sample size for surveys A and B, the number of variables would be limited. The two variables that were chosen were gender and age, which could also be compared to historic studies on Ecstasy use as discussed in section 2.7.2.

Gender

Gender was chosen as it is the most fundamental difference in the population; it easily separates the data set into two comparable groups. An initial aim was to gain equal weighting of both male and female participants as the distribution of the UK population in 2013 was 1.03 females to males (ONS, 2014b). The CSEW achieve a ratio of 45% males to 55% females, compared to the GDS who managed a 69.7% to 30.3%, male to female ratio. The initial aim was to recruit an equal amount of each gender to represent the distribution of the UK Population, yet analysis of previous self-nominating studies (Section 2.7.2) suggested that males were more likely to respond.

Age

The age grouping was more difficult to define, specifically at which age the cut off points should be. Due to ethical restrictions of using research with children, the lower age limit was set to 18 years of age. However due to the anonymity of the data collection method, the age of the participants is taken as stated. No upper age limit was set however the final age band was set at 60+. The age ranges were as follows;

Band 1: 18-21
Band 2: 22-29
Band 3: 30-39
Band 4: 40-49
Band 5: 50-59
Band 6: 60+

The 1st and 2nd bands used in this research are the groups most likely to be experiencing the current changes in the recreational drug market, and as indicated most likely to be taking Ecstasy now (Gross *et al.,* 2002; Hammersley *et al.,* 1999; Handy, Pates and Barrowcliff, 1998; McCambridge *et al.* 2005; Ogeil, Rajaratnam and Broadbear, 2013; Sherlock and Conner, 1999; Solowij *et al.,* 1992). The 3rd and 4th bands represent the participants who would have experienced the original popularity of Ecstasy and the rave movement of the late 1980s and 90s. The final two bands represented the generations who experienced the initial introduction of the drug laws of the 1970s. The CSEW uses participants between the ages of 16 to 59, whereas the GDS also spans 18 to 60+.

3.5.3 The Questions

Once the variables had been decided, the survey questions were developed to address the research questions.

Questions for Survey A: Knowledge and Awareness

The questions for Survey A are divided into the following sections;

Section 1: Knowledge of Street Drugs (Questions 1 to 4)

The questions in section 1 were devised to gather the base line knowledge of the participants, with a focus on the substances of interest to this project but also the most common substances in Britain. It was included to not only identify what people know but also if there are any gaps in the public's knowledge that need to be addressed, specifically concerning the terms Ecstasy and MDMA.

Section 2: Information sources (Questions 5 to 8)

The second section sought to establish who the trusted information sources are, who the public trust to gain information and how the data collected from this survey influence the dissemination of new drug information.

Section 3: Drug Awareness (Questions 9 to 12)

The last section addresses the concept of awareness of drugs in society. Do the participants feel that it is an important issue? Section 3 allowed for the participants to explain their own views on this topic.

A complete rationale for each of the questions included in Survey A can be found in Table 3.1

Table 3.1: Questions for Survey A: Knowledge and Awareness

	Question	Type	Answers	Rationale
1	Which of the following drugs have you heard of?	Multiple Choice	Amphetamine, Cannabis, Cocaine, Crack, Ecstasy, Heroin, Ketamine, LSD, MDMA powder, Mephedrone, Piperazines, 2CB, None	The first question established a basic level of knowledge of recreational drugs that are controlled in Britain. It lists 12 controlled drugs, including ones that are well established as well as the newer synthetic drugs such as Mephedrone and Piperazines (UNODC, 2013 p.62). The drugs were chosen based on their inclusion in the other social surveys mentioned earlier, as well as drugs that are of specific interest to this project, i.e. Ecstasy and the alternate term MDMA. The drugs will be ranked by the number of people who had heard of them, with the drugs of interest being compared as to how often they are identified. This question will set the foundation of whether MDMA as a term is as well-known as Ecstasy in the public consciousness.
2	Which Class do you think each drug belongs to?	Single Choice	Same drugs as above Class A, Class B, Class C and Do not know	This question tested whether the general public understands the classification system and can accurately place the selected substances into the correct class; it goes towards proving the level of knowledge about drugs in British society, based on the MoDA 1971. It will be analysed in two ways; firstly by how many people get the classification right for each drug, and secondly by what the majority of people classify each drug as.

	Question	Type	Answers	Rationale
3	Which of the following names do you associated with; Cannabis, Ketamine, Ecstasy and Mephedrone?	Multiple Choice	Cannabis: Bubble, Charlie, Dope, Grass, Green, Hash, Mandy, Pot, Skunk, Weed, Not heard of and other Ketamine: Bubble, Charlie, Dust, Green, K, Mandy, Skunk, Special K, Not heard and other Ecstasy: Adam, Bubble, Charlie, Crystal, E, Green, Mandy, MDMA, Skunk, XTC, Not heard and Other Mephedrone: 4-MMC, Bubble, Charlie, Green, Mandy, Meow-Meow, Skunk, White Magic, Not Heard and Other	This question looked at the recognition and association of names and colloquial terms used to describe four chosen drugs. The drugs chosen represent the two that are of interest to the rest of the study, Ecstasy and Mephedrone. The other two were used to deflect attention so as to not introduce bias by introducing to much focus on Ecstasy. Cannabis was chosen due to the fact that it is the most widely abused drug not only in Britain, but globally (UNODC, 2013) and Ketamine due to its media presence at the time. For each drug a number of known terms was included as well as a set list of terms that were used in each question. The set list included terms that describe the other drugs in the question and one for an unrelated drug. The terms that were chosen were taken from TalktoFrank (2013), a national government website that lists the known colloquial terms associated with each drug.

	Question	Type	Answers	Rationale
4a	How prevalent do you think drugs are in modern British society?	Likert Scale	1 (Low) to 5 (High)	This question asked about perception; how the participant gaged the level of prevalence of drugs in society. The answers provided by the people who rank it lower can then be compared to those who rank it higher. Did the people who rank it higher feel more or less informed on the drugs in question than those who would rank it as low? This can be tested by comparing the answers from the rest of question 4.
4b	How informed do you feel about the health risks caused by drugs?	Likert Scale	1 (Low) to 5 (High)	What this question examined was the general perception of the health risks around drugs. Did the participants feel informed on this topic? Part of this project was identifying what the participants know, but also where there is a lack of knowledge. A lack of knowledge or the misunderstanding concerning drugs is a main issue this research hopes to address. Health risks are a key factor; if the general public feel uninformed about possible risks it could endanger the users.
4c-g	How informed do you feel about the effects of; Cannabis, Ketamine, Ecstasy, MDMA Powder and Mephedrone	Likert Scale	1 (Low) to 5 (High)	Questions 4c to 4g examined the specific awareness of five of the drugs discussed in earlier questions. For this question Ecstasy and MDMA were separated and represent individual products, so they could be compared. The point of these questions was the comparison, though their individual values may give insight about each of the specific drugs. For example due to its prevalence it is anticipated that cannabis would score highly in the awareness/informed factor whereas Mephedrone being a new drug would score low. It again builds on the findings from the earlier questions on how well MDMA has infiltrated the public consciousness.

	Question	Type	Answers	Rationale
5	Have you ever received any education in regards to drugs and drug abuse?	Single Choice	Yes or No	A yes or no answer, it can be used to separate the participants who have had education and those who haven't and then compare to their answers for question 4.
6	Where would you go if you were looking for information about drugs? a) For yourself b) For someone else	Multiple Choice	Teacher/School Friends Family GP/Doc Internet Drugs Forum Local drug service Drugs Helpline Government website Television Other Media (Newspapers)	This question was divided into two sections, to compare whether people would use different information sources for themselves versus if looking for someone else. For example someone might look at a drugs forum if they wanted to find out what the effects of a drug are and contact a helpline if they suspect that a friend has a drug issue. It will also provide the most popular sources of information from these 11 options. The results can be then compared to the results from question 7, which asked participants to rank the information sources on how trustworthy they are.

		Type	Answers	Rationale
7	Who do you trust for your information?	Likert Scale	1 (Do Not Trust) to 5 (Most)	Divided into 6 parts, the participant is asked to rank each option on a scale with 1 being '*Do not trust'* and 5 being '*most trustworthy.* The information sources chosen represent different perspectives in the field of drugs information: 1) Government - they represent the law makers and stakeholders in the dissuasion of public drug use. They have a very clear agenda when it comes to drugs as set out in the MoDA 1971. 2) Independent Scientist - to differentiate them from those who may be included as governmental sources; the example of Professor David Nutt is included as he is the most identifiable figure in this category. 3) The Media - most vocal on this topic but how much do the public trust the information they report? 4) Known User – a person who has experience but not an legitimate information source 5) Doctor/GP – medical professionals whose primary concern is the health of the patient 6) Internet – most easily accessible anonymous endless resource of information It can also be compared to question 6, is the most popular source also the most trusted, and if it's not why is it the most popular?

	Question	Type	Answers	Rationale
8	If you were considering taking a substance for the first time, or had recently taken a substance, who would you feel most comfortable discussing this with?	Single Choice	Teacher/School Friends Family GP/Doc Internet Local drug service Drugs Helpline Talk to FRANK A Known user Other	With this question the idea of use was introduced, up to this point personal drug use had not been asked. This question hypothetically asks who the participant would be comfortable discussing drug use with. As it is still a sensitive subject this would give insight into how drugs education can develop, for example if people are only happy to talk to friends, how can open and honest dialogue about personal drug use be established? It is also a review of the services available, if people aren't comfortable or don't trust them what can be advised to change this. It was a single choice option, which meant the participants could choose only one option however the other option was included so as to not limit the responses.
9	Do you think it is important to be aware of drugs?	Single Choice	Yes or No	A simple yes or no question that was elaborated on with the responses to questions 10 and 11. It emphasised whether the participant believes it is important to be aware of drugs. Again the participants were limited to the options of either yes or no to get a decisive opinion, the participant may not have ever considered this question before taking part in the survey and so the question primes them for the response for the next question.

	Question	Type	Answers	Rationale
10	If you responded yes to question 9, what are you reasons?	Paragraph Text	Open Answer	These questions were set as a paragraph answer so that the participants could write as much or as little on the subject as they liked. Based on the previous questions that will have made them think about what drugs in society mean to them these questions allows them to articulate their own feelings on the subject, if they so wished. It was a voluntary question, unlike the previous 9, which required an answer to complete the survey these were left optional. These questions are likely to contain the most content and so will not be quantitatively analysed but qualitatively. Key words and phrases will be looked for and the will be visualised using info graphic software, such as Wordles or Word bubbles. This software finds the most commonly occurring words in a set of text and makes an image to represent the prevalence of each word allowing for thematic analysis.
11	If you responded no to question 9, what are you reasons?			
12	Do you think more should be done to educate people about drugs	Single Choice	Yes or No	The last question was also yes or no, which required the participant to choose only one option. It established whether the participants believe enough is being done to educate on the topic of drugs. If they do not think there is enough what recommendations can this research make to improve this and impact policy?

Questions for Survey B: Popularity and Prevalence

The questions for Survey B are divided into the following sections;

Section 1: Drug Use (Questions 1 to 3) – sets out to establish the level of drug use of the participants over a set period. These questions are comparable to the questions found in both the CSEW and the GDS, and will give an indication of current drug use trends.

Section 2: Experience (Questions 4 to10) – compares the drugs against each other. These questions look at the subjective experiences of the users to give an indication of what influences the participant's decisions when choosing to use the selected substances.

Section 3: Preference (Questions 11 to 17) – elaborates on the previous section, the 3rd section seeks to establish if there is a definable preference when selecting recreational drugs, and whether the internet is a source of supply.

Section 4: Discussing Drug Use (Question 18 to 26) – these questions were developed to assess the openness and honesty of the participants, when it came to discussing their own drug use. These questions attempt to measure the impact of social desirability bias, and to see if there is a difference in discussing drug use between the age groups.

A complete rationale for each of the questions included in Survey B can be found in Table 3.2.

Table 3.2: Questions for Survey B: Popularity and Prevalence Survey

	Question	Type	Answers	Rationale
1 -3	From the following list please check any substances that you have; 1) Ever taken 2) Taken in the last year 3) Taken in the last month	Multiple Choice	Amphetamine, Cannabis, Cocaine, Crack, Ecstasy, Heroin, Ketamine, LSD, MDMA powder, Mephedrone, Piperazines, 2CB, Alcohol, Tobacco, BZP, Methamphetamine, Magic Mushrooms, Methylone, Naphryone, Other	These questions are in the check box format, allowing the participant to choose multiple substances as and when they are applicable for each of the three questions. For example a participant may have tried cannabis in their lifetime but not within the last month or the last year. This question was based on the findings of the CSEW, the GDS and also from findings on the EMCDDA website for drug prevalence (Home Office 2013, Mixmag, 2013, EMCCDA 2013). The answer choices available included are; the 12 drugs included in the first survey plus 7 new substances and the option for the participant to list their own. Alcohol and tobacco were included to give perspective on general acceptable drug use, which is examined further in question 24. BZP is the most prevalent form of piperazine and may give an indication of awareness of specific piperazine type drugs as opposed to using the blanket term. Methamphetamine and magic mushrooms were included because they are found in the other comparable surveys on drug use, and methylone and naphryone were included because there was a focus on their usage by the Home office at the time of question development (Home Office, 2013). The analysis of these questions will be looking at the significance of the number of reported usage for each substance, which can then be compared to each time frame.

	Question	Type	Answers	Rationale
4	How would you rate your physical experience on the following substances?	Single choice	Substances; Cocaine, Ecstasy pills, MDMA powder, Mephedrone, Ketamine, Piperazine Options; Negative, Indistinct, Positive, Not Taken	This question asked the participants to describe their physical experience felt on the selected drugs. The drugs chosen for this and the subsequent questions are; cocaine, Ecstasy pills, MDMA Powder, Mephedrone, ketamine and piperazine. The descriptive options used for each drug was in four categories; positive, indistinct, negative and not taken. This question provides an insight into the user's perspective on these chemicals, but also allows for comparison between substances. The significance of each of the answers for each drug can be compared, and then cross compared between each substance, for example is the physical experience for cocaine significantly more negative than that reported for Ecstasy. The substances can also be ranked by the number of positive experiences and again by negative experiences
5	How would you rate your emotional experience on the following substances?	Single choice	Substances; Cocaine, Ecstasy pills, MDMA powder, Mephedrone, Ketamine, Piperazine Options; Negative, Indistinct, Positive, Not Taken	This question was laid out exactly the same as the previous question, however this time it was the emotional response that was examined. Due to the fact that MDMA has empathogenic properties this question compares the perspectives of the users have around pills and powders but also with Mephedrone and piperazine. Do these compounds also have a positive emotional response? As with Question 4 the significance of the responses can be compared for each drug individually and they in comparison to the other substances.

	Question	Type	Answers	Rationale
6	Have you or do you know someone who has ever had a bad experience on any of the following substances?	Single Choice	Substances; Cocaine, Ecstasy pills, MDMA powder, Mephedrone, Ketamine, Piperazine Options; Yes- Myself, Yes- Someone else, No	This question used the same drugs as questions 4 and 5, with the responses changed to; Yes-myself, Yes- Someone else and No. For this particular question the participant could only pick one response for each of the substances. It is inclusive for those people who may not have ever tried the substances themselves but know people who have. It establishes which of the substances has the highest level of bad/negative experiences associated with it. This question is a tally that can then be compared to the more qualitative questions that follow.
7	Has your personal experience changed your drug use of the following?	Single Choice	Substances; Cocaine, Ecstasy pills, MDMA powder, Mephedrone, Ketamine, Piperazine Options; Yes, No, Not Taken	This is a statement question, where the participant can state whether their personal experience has changed their own drug usage. The options again use the same compounds as the previous three questions with the responses now changed to; Yes, No and Not Taken. The question is an open one about usage, as the participants usage may have gone up after a positive personal experience of down after a negative one. This question is asking for the evaluation of the change. It is in the subsequent question that the participant is asked to quantify that change. The significance of the responses can be compared for each drug individually and then in comparison to the other substances.

	Question	Type	Answers	Rationale
8	Has your knowledge of another person's bad experience changed your drug use of the following?	Single Choice	Substances; Cocaine, Ecstasy pills, MDMA powder, Mephedrone, Ketamine, Piperazine Options; Yes, No, Not Taken	In the same format as the previous section, this time it is the bad experiences that are being evaluated, to see the impact of external factors cause a changes in behaviour. Again the significance of the responses can be compared for each drug individually and they in comparison to the other substances.
9	If you answered Yes to either question 7 or 8, How has your usage changed?	Paragraph Text	Open	Both of these questions were open answer, which allowed the participant to write as much or as little as they choose. The purpose was for them to quantify the changes stated in their answers to either question 7 or 8, on whether their experiences had changed their behaviour. This question was an optional one as opposed to compulsory and so participants could continue the survey without needing to respond. Similar to the questions at the end of the first survey these questions will give an insight into the participant's opinions on this topic and will be analysed in the same way. Through thematic analysis and the identification of the most commonly occurring words and phrases to give an indication as to whether there is a positive or negative change.
10	If you answered No to either question 7 or 8, Why didn't your usage change?			

	Question	Type	Answers	Rationale
11a	If given the choice between Ecstasy Pills and MDMA powder which would you choose?	Single Choice	Ecstasy Pill, MDMA Powder or Neither	Questions 11a to 14a asked the participant to choose between two compounds, to establish whether there was a preference. This is a main focus for this research, to observe whether the NPS compounds are more popular than MDMA. It also examines whether powders are more popular than pills with regards to Ecstasy, as suggested in the GDS (Global Drug Survey, 2013). Each of the question formats was in the multiple choice form with an option for each of the compounds as well as a neither option, this allowed for the answers to be ranked against each other.
12a	If given the choice between MDMA powder and Mephedrone which would you choose?		MDMA Powder, Mephedrone or Neither	
13a	If given the choice between MDMA powder and Piperazines which would you choose?		MDMA Powder, Piperazine or Neither	
14a	If given the choice between MDMA powder and Ketamine which would you choose? *		MDMA Powder, Ketamine or Neither	
11b - 14b	What are your reasons for your choice?	Paragraph Text	Open	Each of the above questions was followed by a text answer question where they are asked to explain their choice, as with the other open answer options this was a voluntary response where the participant could write as much or as little as they choose. They were analysed by the same method as described for previous open response questions.

	Question	Type	Answers	Rationale
15	Please Rank the following substances in order of your personal preference	Scale	Substances; Cocaine, Ecstasy pills, MDMA powder, Mephedrone, Ketamine, Piperazine Options; 1- least to 5 most	This question asks the participants to directly compare the same compounds as used in the above questions. The participants were asked to rank the compounds on a scale of 1 to 5, with 1 being the least and 5 being the most preferable. The results were assessed by comparing the results of the participants who reported to have taken the substances and those who had not.
16	Have you ever bought a substance over the internet?	Single choice	Yes or No	There have been reports that more users are buying their product over the internet (Martin, 2014). This question evaluated to what extent that was true and was related back to the other questions in this section.
17	Have you ever tried a substance without knowing exactly what you were taking?	Single choice	Yes or No	This was a yes or no question, and examined the trust drug users have in what they are taking. This question will also add to the profile generated. For example who are more likely to try a substance men or women?
18	What do you believe it was?	Multiple Choice	Cocaine, MDMA Powder, Mephedrone, Ketamine, Piperazine and Other	This question is only relevant to the participants who responded yes to the previous question**,** and the responses for each drug can be tallied and then compared. The options for this question were; cocaine, MDMA powder, Mephedrone, ketamine, piperazine and Other. The last option is to allow for substances not considered in this project.

	Question	Type	Answers	Rationale
19	Do you ever talk about your own drug use?	Single choice	Yes, No or N/A	This question assessed the participants' honesty when responding to the questionnaire, whether drug use is something that is talked about? There was also the option to put N/A or not applicable due to the fact that some participants may have never taken any of the substances mentioned and therefore would not be able to talk about their own experiences.
20	Have you ever discussed your drug use with any of the following?	Multiple choice	Friends, Family, Online, Drugs Councillor, Drugs Helpline, Frank or Other research group	Building on the previous question, this question asked who the participants did talk to about their own drug use with. The options ranged from friends, family, professionals to other research groups. Who did the participants feel comfortable to talk to about their drug use with? This can then be compared to the responses from Survey A to see if there is a correlation.
21	Who do you feel you can be honest about your drug use with?	Text	Open	An open answer text response allowed the participants to elaborate on the previous question, if a previous answer was not included it also assessed whether people were confident to talk about their own drug use or whether it is still a closed subject.

	Question	Type	Answers	Rationale
22	Do you think some drugs are more acceptable than others?	Single choice	Yes or No	A yes or no question, it examined the participants own perception of the acceptability of drugs. This was then expanded in questions 23 and 24, which asked for an example for both an acceptable but also an unacceptable drug. These responses can be correlated back to earlier ones, for example are the participants more likely to view drugs as acceptable if they have tried them?
23	Can you give an example of a drug you think is acceptable	Text	Open	These open answer questions asked the participant to give an example of which drugs they believed were acceptable if any and which are seen as unacceptable. It can be assessed to see if there was difference in who believed which substances are acceptable.
24	Can you give an example of a drug you think is unacceptable			
25	If given a choice between something you have taken before and something completely new which would you choose?	Single choice	Something Taken Before or Something New	The last questions sought to study the phenomenon of NPS, assessing the likelihood that someone would be willing to 'try something new'. Can the factors that would lead to this be found in the responses given in question 26?
26	What is your reason for your answer to question 26?	Text	Open	The participant were able to provide a reasons for their choice to the previous question, again this question was voluntary but may provide an insight into how NPS infiltrate the established recreational drug market.

3.5.4 Survey Development

The software

For the purpose of this research the software that was chosen to host the social surveys is produced by Google, the reasons for which are discussed below.

Google documents are an add-on of the Google+ package that is freely available with a Google email address (Google, n.d.). The package provides online hosted software similar to Microsoft's Office, including the function to develop online surveys. The surveys can be managed and stored through the email address associated with the G+ account (Google, n.d.). The features available include straight forward set up and manipulation of a range of question types. The major benefit of this program is that it inputs the response to the survey directly into an excel type spread sheet that can then be exported in to a range of formats for data analysis. It also runs its own simple visualisation of the data as the survey is being run, thus giving early indication of the likely outcomes from each question. Other software packages were available, including SurveyMonkey. However it was the features mentioned above, as well as its usability, which led to the choice of using Google software to develop, run and manage the two online surveys (Google, n.d.). For this research a specific email account was set up. The benefit of the email account being that it provided an anonymous point of contact if participants required further information. A G-mail account was chosen as it enabled the use of the other Google based programmes.

The Email address used was: - AngliaRuskinDrugSurveys@Gmail.com

Making the Survey

Once the questions were finalised, they were inputted into the Google Documents form. In addition to the questions, page breaks and paragraph boxes were added as and when it was deemed appropriate, to separate questions into relevant sections and to provide additional information where necessary. It was also possible to edit each question at any point and move the order by clicking the question box and shifting it up and down depending on what was needed.

When all the questions had been set up suitably, both Survey A and Survey B were launched. A soft launch began in December 2012, with the survey sent to small selection of Anglia Ruskin University students, where the author is based, to analyse usability before being officially launched in January 2013. The survey was run 12 months, no additional funding was provided or used as an inducement for participation or survey promotion. The surveys were officially taken offline on the 2nd of January 2014.

3.5.5 Sampling

Method

A number of factors were considered when developing the methodology for participant sampling; firstly who were the target group, what would be the most effective way to reach them to ensure participation and how to guarantee anonymity of the participants due to the sensitivity of the topic. A convenience sampling method was employed (Sue and Ritter, 2012), with the only limiting factors being that of age, restricted to participants who are over the age of 18. This meant that anyone who wished to complete the surveys only had to have access to the internet and the links to the surveys. To generate interest and recruit participants a number of resources were used as detailed with the use of social media playing a vital role in the gathering of participants.

Sample Size

A number of factors were considered when deciding on a given sample size, first was the absolute size of the sample, opposed to the relative (Bryman, 2012). Although a larger sample is desirable, it cannot '*guarantee precision' (ibid.* p.198*)*, however it is more likely to increase precision, as the sample size increase the likelihood of sampling error decreases. It should be noted that though Bryman uses the term '*precision'* what is actually required is a greater level of accuracy. Where precision relates to how close the responses are together compared to how accurately they represent the true views of the participants. Conversely Fowler (1993 p.34) observed that it is not customary for survey researchers to be able to *'specify in advance a desired level of precision'*. The scope of this project is unlikely to generate the sample sizes comparable to those of either the CSEW or the GDS, as it did not have the same budget or resources namely the use of media partnership as found with the GDS. However the comparable surveys from section 2.7 had a range of participant sizes from 100 to over 4000.

Social Media Recruitment

Facebook

The most prevalent social media website used by contemporary society (Pew Research Center, 2014), it is a vast resource with numerous applications for social research. For the purpose of this research a group page was utilized, where links to the surveys are stored that were shared by the general public.

Twitter

Twitter is a micro-blog site that allows users to post 140 character statements that can be seen by their followers or by the general public with the addition of relevant hash-tags (Twitter, 2015). The hash-tag function creates a conversation type scenario, where users who are tweeting on the same topic can be found. The benefit of Twitter is that there are numerous celebrities and accounts that have over a thousand followers, which retweet if approached. This research made use of retweets and targeted online personalities to spread the research to the general public. Also due to the fact that twitter is web-based the participant was taken straight to the surveys when they clicked on the link. Over the course of the twitter campaign there were a number of significant retweets; one by Dr Christian Jessen a noted doctor, TV personality and host of 'Ecstasy trial: Live'. A second was from the team at the Global Drug Survey.

Email Lists

Within Anglia Ruskin University there are student email lists that were employed to garner interest in the research at a local level.

QR Code

A visualisation of the links was generated in the form of QR codes, which enabled anyone with a smart phone to take a photo of the code that automatically opened the survey in their phone browser. The codes were generated by a free online site (http://www.qr-code-generator.com/). They were also printed and included in documents, such as poster presentations. The QR codes are displayed in Figures 3.6.

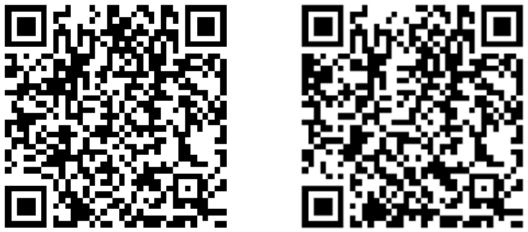


Figure 3.6: The QR codes used to distribute online Surveys A and B

3.5.6 Survey Analysis

Due to the nature of the data collection, through the use of the Google documents, all responses were automatically loaded into a spread sheet that was downloaded and put into a number of statistical software packages, including SSPS and Nvivo. Each survey was analysed separately using a variety of methods depending of the data type collected. As the surveys used a mixture of both quantitative and qualitative questions the analysis was tailored to each question. The statistical tests that have been used varied by the type and level of responses generated from the surveys, whether parametric or non-parametric tests were required. The majority of the data collected was non-parametric as the questions were nominal in nature and so the Chi squared test (χ^2) was applied throughout. The chi squared is a non-parametric inferential statistical test that can be applied to frequency data. It is used to test if the differences between the observed and the expected frequencies are due to chance or something other than sample error (Mehta and Patel, 2012).

Two forms of the χ^2 test were used throughout the analysis of the surveys, one-way and two-way chi squared. The one-way test was used when the frequencies observed are assigned to a single set of categories, for example when testing the difference in response between genders. The two-way test was used when the responses were assigned according to two categories or variables, for example when assessing the difference between the numbers of people who had taken Ecstasy compared to the number who had taken MDMA, producing a two-dimensional frequency/contingency table. The Chi squared test is only valid if each cell in the table has a minimum count of 5. When the count was below 5 a number of exact tests could be applied to test the data, the Fishers Exact or the Monte Carlo Exact to provide a valid χ^2 statistic (*Ibid.).* A worked example of the chi squared tests and other statistical tests used throughout can be found in Appendix V.

3.5.7 Critical analysis of chosen survey method

The method that is outlined in the previous sections was used to complete the recruitment and data collection for this part of the research. As assessed in section 3.3 there were a number of limitations that were identified in the existing drug use surveys. The following section critically examines the strengths and weaknesses relating specifically to this research.

The first main difference between this survey and the Global Drug Survey was the decision to not include exclusionary questions. Viewpoints were accepted from both self-reported users and non-users, this enabled a comparative ratio which is not represented in the global drug survey, which only looks at drug users. A second strength of this research method was the recruitment method utilized, which attracted participants from within the age range identified by previous studies to most likely be engaging in the behaviour that was being examined, namely the use of Ecstasy/MDMA. There were no additional exclusionary criteria set nor specific groups targeted beyond participants over the age of 18 and with access to the internet. The use of the internet as the collection medium and the anonymity obtained from using this method is also a strength, as validity studies have shown that the use of self-administered questionnaires, such as the web based method, has proven to yield better accuracy when reporting on sensitive subjects (Tourangaeu and Yan, 2007). With the anonymity that the web based methods provide a greater sense of honesty is promoted from the participant when completing the surveys. The use of the google+ software was also a benefit as although data was collected anonymously it only accepted complete survey responses and recorded time and date information which enabled internal verification of the data by the researcher to ensure validity.

There were with any survey a number of limitations that applied, one key disadvantage to this method was that all information provided must be taken verbatim, and it is assumed that the findings accurately represents the views of the participant at the time of completion often with no possibility of follow up with the participants after. There is the further issue that although voluntary self-nomination does result in access to the target group – drug users, it has been found that self-nominating participants' responses differ from non-respondents, under what is known as the volunteer effect (Friedman & Wyatt, 1997, McCambridge et al. 2005). As people responding to the survey will already have an interest in the topic, being able to extrapolate from the data is limited only to the participant group. This is not necessarily a negative as the

second survey examines specifically the users perceptive of the drugs Ecstasy and MDMA and their experience for the purposes of comparison with the other projects and so non drug users' perception would not be suitable for this. Another weakness of the chosen methodology which was also highlighted in the critical analysis of other surveys is they often do not include participants who are homeless, this was however not considered to be an issue given that the focus was on the drug Ecstasy/MDMA which is considered to be non-addictive and recreational. Therefore the lack of representation by this group in this research was considered minor.

Chapter 4 Results for Social Research Surveys

The following chapter has been divided into two sections, the first discusses the results for the first social research survey on knowledge and awareness of the drugs/terms of interest to this research. The second section discusses the results of the second research survey on use and preference.

The purpose of the first survey discussed in Section 4.1 was to explore the baseline knowledge of the two terms Ecstasy and MDMA and compare how the public identifies them. Though the two terms have been used synonymously in the past there is evidence that they are being used to describe different products (Smith, Moore and Measham, 2009; Turner *et al., 2014*). The results from this survey will establish whether the terms Ecstasy and MDMA can still be considered to be the same. There is also an evaluation of who/what are considered to be the best sources of information and what this means with regards to drugs education and clarifying drugs information.

Section 4.2 analyses the results from the second social survey where participants were asked about prior drug use and their own perceptions about selected substances. The discussion of these results focuses on the use of Ecstasy, MDMA powder and Mephedrone from the point of view of the people who have used these substances. The results will identify any preferences the users may have and their reasons behind their choice. This can then be compared to the findings from the analytical chapter to see whether perception matches the reality in regards to quality and purity of products being seized versus what users believe.

The analysis of quantitative data from both surveys made use of the statistical analysis software package SPSS (Version 20. IBM, 2011), whereas the analysis of qualitative data was aided by the software NVivo (Version 10. QRS International Pty Ltd, 2012).

4.1 Results for Survey A: Knowledge and Awareness

4.1.1 Demographic Analysis for Survey A

The first section of this results chapter evaluates the demographic break down of the participants who responded to the first social research survey. As stated in section 3.5.2 of the social research methodology chapter, the two variables examined were gender and age. The total number of valid responses received by this survey was 440.

Gender

Although the gender ratio of the UK in 2013 was 1.03 females to males (ONS, 2014b), this ratio was not achieved in this survey. The proportion of female to male participants is displayed in Figure 4.1.1.

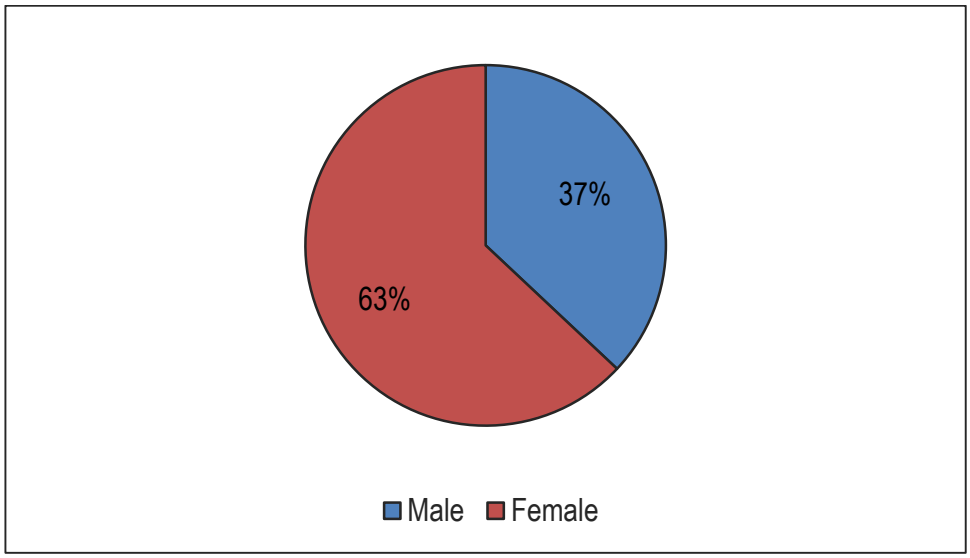


Figure 4.1.1: Proportion of female and male participants for Survey A: Knowledge and Awareness (*n* = 440)

The participants for this survey were predominantly female, with a ratio of 1.70 females to males. This is unusual when compared to the findings from section 2.7.2, which found drug use surveys have historically had more male respondents (Gross *et al.,* 2002; Hammersley *et al.,* 1999; Handy, Pates and Barrowcliff, 1998; McCambridge *et al.* 2005; Ogeil, Rajaratnam and Broadbear, 2013; Sherlock and Conner, 1999; Solowij *et al.,* 1992). The Global Drug Survey for example had an almost opposite gender response with 70% of the 2013 survey respondents reported to be male (Mixmag, 2013). One survey that does report a more

balanced proportion of females is the CSEW, which achieved 45% to 55% males to females in the 2013 survey.

With regards to the social research survey employed as part of this doctoral research there was no intentional selection or preference for gender when sampling for the survey. One explanation of the difference in the proportion of genders may be the result of the location in which the research and researcher is based. Anglia Ruskin University in Cambridge has a student ratio of 62% female population and 60.5% female staff (Anglia Ruskin University, 2013), which may have impacted on the unique outcome of a more female dominated survey.

Age

As with the variable of gender there was no preference required for the age of participants to complete this survey, with the only exception being that participants were required to be over 18 as specified in the ethical approval. Though the age requirement was stated on the participant information sheet (in Appendix III), the data was collected anonymously and age was taken as given. The percentages achieved for the age demographics is shown in Figure 4.1.2.

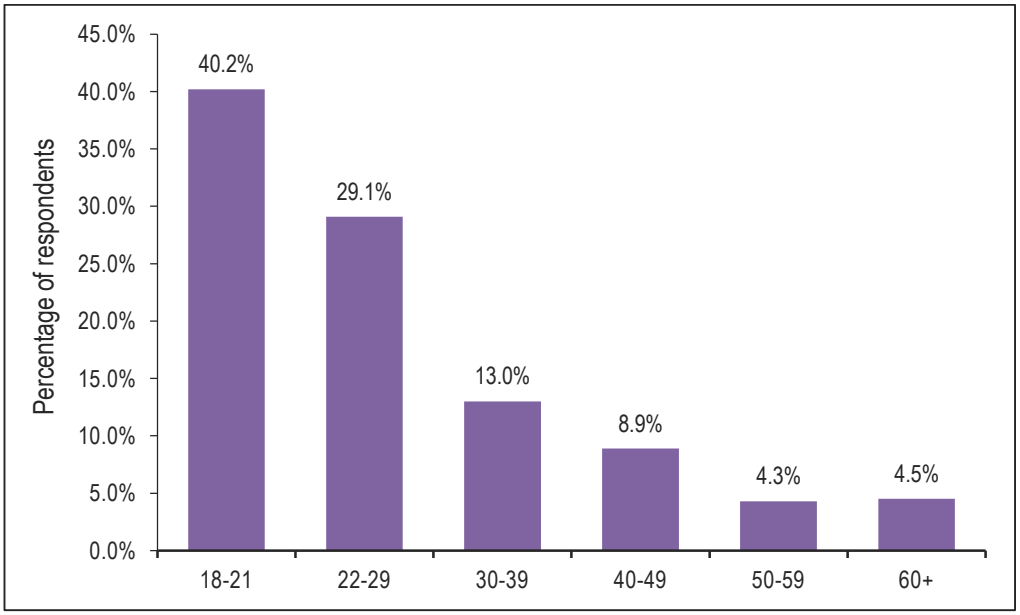


Figure 4.1.2: Proportion of participant in each age band for Survey A: Knowledge and Awareness (*n* = 440)

The responses to the question of age do not show an equal distribution, which may be due to the data collection and sampling method chosen, namely the use of an online survey and the use of social media as a recruitment tool. According to estimates by the Pew Research group (2015) 90% of 18-29 year olds used some form of social networking sites in 2013, compared to 78% for 30 – 49 year olds, 65% for 50 – 64 year olds and 46% for people over 65. As social media was the main recruitment tool the impact of this is reflected in the final outcome, with the majority of the respondents falling within the two youngest age groups. The results above are also consistent with the findings from section 2.7 on the age profile of respondents to previous drug use surveys with the majority of participants being under 30. These findings could suggest that there is more interest in discussing drugs from the younger population.

The data was also tested to see whether the gender ratios within each age band were comparable, to check that one age bad was not solely male or female. Across all the age ranges the gender divide was weighted towards female participants, but the proportion of males to females did not significantly vary band to band. The significance was tested using a two-way chi squared test that returned χ^2 value of 3.924 with a P value of 0.577, which exceeds the critical significance value of 0.05 (95% confidence level) and is therefore not significant. All further significance tests were applied at a 95% confidence level.

4.1.2 Questions 1 to 4 - Awareness of Drugs in Society

Question 1: Which of the following drugs have you heard of?

The first question asked the participants whether they had heard of a selection of 12 specific recreational drugs that are controlled in the UK. The lists included drugs that are well established such as heroin and cocaine as well as the newer synthetic drugs, the piperazines and Mephedrone. The aim of this question was to explore whether the term MDMA powder is as well-known as Ecstasy. It also highlights how well other comparable drugs; namely ketamine, Mephedrone and the piperazines are recognised by the public. Figure 4.1.3 displays the percentage of people who reported to have heard of each substance compared to the percentage who had not.

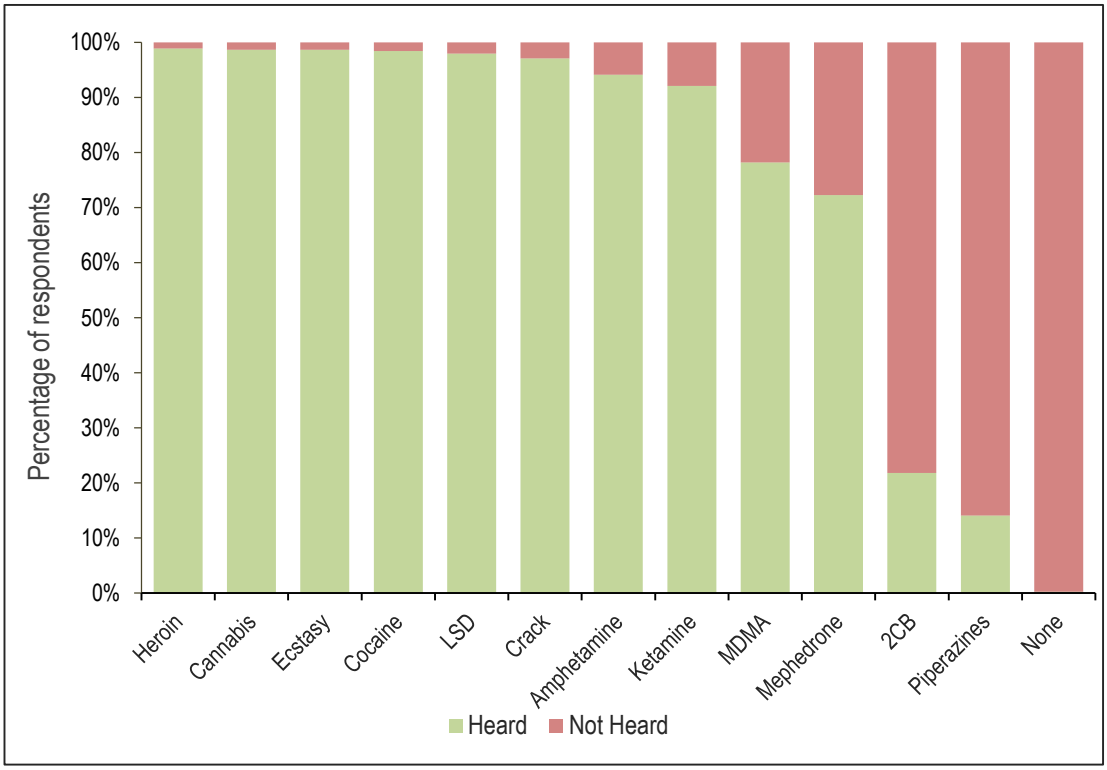


Figure 4.1.3: Percentage of the responses for each drug listed in Question 1 (shown as a percent against total responses *n* = 440)

The figure above shows that there is difference of 20.4% between the participants who reported to have heard of Ecstasy compared to MDMA. This suggests that despite the fact that the main chemical component of Ecstasy is considered to be MDMA, less people are aware of the existence of the term MDMA than that of the colloquial brand name. The

difference between the numbers of people who had head of Ecstasy versus those who had heard of MDMA was tested using a two-way chi square, which returned a χ^2 value of 89.92 and a P value of <0.001. Therefore a significant difference was observed between the number who had heard of Ecstasy and those who had heard of MDMA, with no participant reporting to have heard of MDMA but not Ecstasy.

Demographic analysis of Question 1: Which drugs have you heard of?

The first analysis examined the difference between which substances the two genders reported to have heard of. The results are shown in Figure 4.1.4.

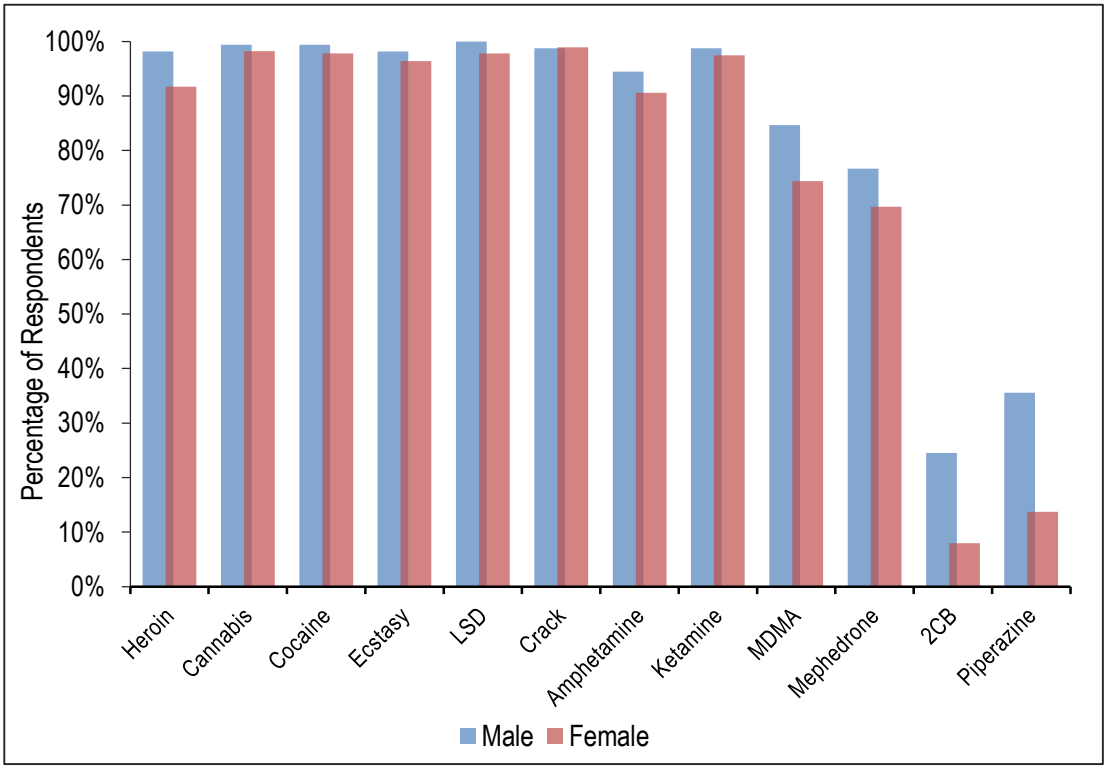


Figure 4.1.4: Percentage of participants having heard of each drug by gender (male *n = 163,* female *n = 277)*

Of the responses to this question a significant difference in reporting by gender was observed for only four of the drugs, when tested using the two way chi-squared test of significance. These were: amphetamine, MDMA, piperazines and 2CB. The table of the chi square test statistics for all 12 substances is located in Appendix IVa Table 4.1.ii. There was no significant difference observed between the genders reporting to have heard of Ecstasy, with 100% of the male participants reporting to have heard the term.

The difference between who reported to have heard of the terms Ecstasy and MDMA can be further examined by looking at the difference in the reporting between age groups, shown in Figure 4.1.5.

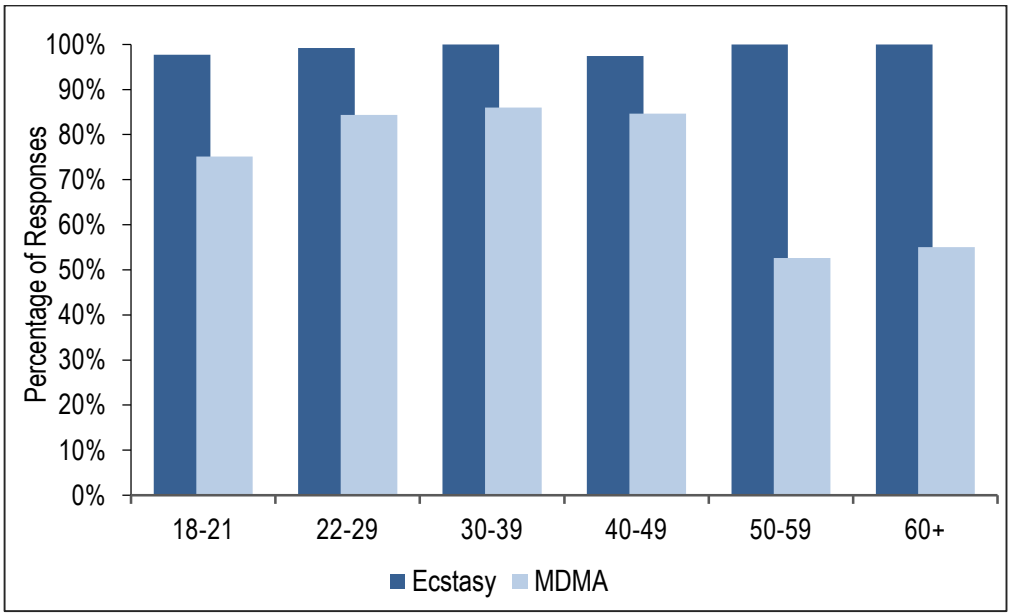


Figure 4.1.5: Percentage of participants reporting to have heard of Ecstasy and MDMA by age group (18-21 *n* = 177, 22-29 *n* = 128, 30-39 *n* = 57, 40-49 *n* = 39, 50-59 *n* = 19 and 60+ *n* = 20*)*

The graph above shows that for each age group, MDMA is the less known term. The difference between the level of reporting between the age groups for both Ecstasy and MDMA was tested using a two way chi-squared test. There was no significant difference observed between the age groups and whether they reported to have heard of the term Ecstasy (χ^2 = 3.125, P = 0.691). However for the term MDMA a significant difference was observed, with a χ^2 value of 20.380 and a P value of 0.02. The data suggests that the older population are less aware of the use of the term MDMA compared to that of Ecstasy. The above findings show that not only there is a difference between the number of people reporting to have heard of Ecstasy compared to MDMA but also a difference between who is reporting to have heard of them. Across all variables there was no significant difference in the awareness of Ecstasy. Yet there was a difference between the genders and the age groups in terms of who had heard of MDMA, with males and the participants under 50 reporting a higher level of awareness. There was also a significant difference in the number of participants reporting to have heard of Ecstasy but not MDMA. This finding is the first to support the hypothesis from the first research question, that Ecstasy and MDMA are not considered to be the same, as there is a significant difference in who has heard of each term.

Question 2: Which Class do you think each drug belongs to?

The second question in the survey asked the participants on their knowledge of the legal classification system used within the UK to control the chosen substances and whether they could accurately place the selected substances into the correct class. This question was included to see whether the participants could identify that MDMA is the same classification as 'Ecstasy'.

A brief description of the classification system was included before the question. The description stated that; the drugs considered the most harmful are Class A, the drugs considered to be of lesser harm are Class C with drugs in the middle being Class B. An option for 'Do Not Know' was also included to allow participants to indicate if they had no knowledge of the classification of a specific drug.

The results in Table 4.1.1 show the percentage of respondents who correctly classified each of the drugs alongside the results for what the majority of responses believed the classification to be. A full break down of responses for each of the 12 drugs can be found in the Appendix IVa table 4.1.iv.

Table 4.1.1: Response to Question 2 compared to the correct classifications for each substance (*Amphetamine is classified as Class B, unless prepared for injection (MoDA 1971))

Drug	Correct Classification (As of Jan 2014)	Percentage of participants who chose the correct classification	Most Frequent Response (Percentage)
Heroin	A	94.1%	Majority Correctly Identified
Cocaine	A	88.2%	Majority Correctly Identified
Crack	A	86.1%	Majority Correctly Identified
Ecstasy	A	68.4%	Majority Correctly Identified
LSD	A	61.8%	Majority Correctly Identified
Cannabis	B	57.5%	Majority Correctly Identified
MDMA	A	47.5%	Majority Correctly Identified
Amphetamine	B*	35.7%	A (40%)
Mephedrone	B	26.6%	Don't Know (39.8%)
Ketamine	C	21.4%	B (32.7%)
Piperazines	C	8.6%	Don't Know (77.5%)
2CB	A	3.2%	Don't Know (72.7%)

For seven out of the twelve drugs the majority of participants were able to correctly identify the classifications. When it came to the responses for Mephedrone, piperazines and 2CB the majority reported that they 'Did not know', this can be correlated to the findings from Question 1 where for piperazines and 2CB the majority had not heard of them. The case of Mephedrone is important as although the majority of participants report to have heard of it (72.3%) nearly 40% did not know the correct classification. This may be due to the fact that it is a relatively new recreational drug, as mentioned in section 2.6, it has only been controlled since 2010 and emerged under the banner of 'legal highs' (Alexandrescu, 2014; Measham *et al., 2010;* MoDA 1971, Amendment 1207, 2010).

A second point is the difference that occurred was with the responses for amphetamine, where the majority of participants placed it in Class A, which was considered as incorrect by this research. Amphetamine has a dual classification based on its preparation, whereby amphetamine is classified as a Class B unless it is prepared for injection in which case it is Class A (MoDA, 1971). An explanation for the response choice by the participants could be because amphetamine is an analogue of methamphetamine and other ATS drugs that are classified as Class A and so there may be a common association of these substances and level of harm. A further point of interest from these results relates to the responses for ketamine, which as of April 2014 was reclassified as a Class B (MoDA, 1971 amendment order 2014 no. 1106). This was the most frequent response by the participants, however at the time that the survey was run it was still classified as a Class C and so was counted as an incorrect identification.

The scope of the participants' knowledge of the classification system was also assessed. Out of the 440 participants who responded to this survey only 4 (0.9%) were able to correctly identify the class of all twelve substances, this increased to 27.7% participants for the seven substances that were correctly identified by the majority.

Significance of results for Question 2: Which Class do you think each drug belongs to?

The variation between the levels of responses for each classification for each drug was assessed using a one way chi squared test in Appendix IVa Table 4.1.v. The results of the chi squared tests found that for all drugs a significant difference was observed and that none of the responses for any drug were evenly distributed between the classification choices.

The one way chi squared test was also applied to test whether there is a significant difference between the levels of participants who got the classification correct and those who chose any other option (in Appendix IVa Table 4.1.vi.). For the drugs; cannabis, cocaine, crack, Ecstasy, heroin and LSD significantly more people were able correctly identify the classification of these substances. For ketamine, Mephedrone, piperazines and 2CB there were significantly more participants who were unable to identify the correct classification, which may relate to the relative obscurity of these compounds compared to the more established street drugs.

MDMA was the only substance that did not have a significant difference between the number of participants who correctly identified and those who did not. Though the majority of

participants did pick the correct classification (47.5%), when the three incorrect options were grouped together no significant difference was observed. The difference in the results between Ecstasy and MDMA for this question were also compared. As Ecstasy had a significant difference and MDMA did not this suggests that there is a difference in how the participants perceive these two terms. This was further assessed using the two demographic variables.

Demographic analysis of Question 2: Which Class do you think each drug belongs to?

In the analysis of question 2 using the two variables of gender and age, a variation of the two way chi squared test was required. A full break down of the statistical tests for all the drugs is shown in Appendix IVa Table 4.1.vii. For three of the substances: cocaine, crack and heroin, there was no significant difference observed for either the variable of gender or age. By comparison the responses for amphetamine, cannabis and MDMA has a significant difference for both variables. The other substance displayed a significant difference in the reporting of only one variable, with the responses for Ecstasy, ketamine and LSD reporting a difference by the age groups and the responses for Mephedrone, piperazines and 2CB showing a difference between the genders. These results also show the disparity in the knowledge across the range of substances examined, with the reporting on heroin and cocaine appearing to be the only consistency.

Comparison of Results for Ecstasy against MDMA

As the focus of this doctoral research is on how the terms Ecstasy and MDMA are perceived the following section compares the responses for these two results. This was achieved by cross tabulating the responses given for the two options. The cross tabulation looked at how many of the respondents answered which classification option for Ecstasy against what they chose for MDMA, the results are in Table 4.1.2.

Table 4.1.2: Cross-tabulation of the responses for Ecstasy against MDMA for Question 2

		Q2 MDMA				Total Ecstasy
		Class A	Class B	Class C	Do Not Know	
Q2 Ecstasy	Class A	186	48	10	57	301
		42.3%	*10.9%*	*2.3%*	*13.0%*	*68.4%*
	Class B	18	34	10	24	86
		4.1%	*7.7%*	*2.3%*	*5.5%*	*19.5%*
	Class C	3	6	5	10	24
		0.7%	*1.4%*	*1.1%*	*2.3%*	*5.5%*
	Do Not Know	2	1	0	26	29
		0.5%	*0.2%*	*0.0%*	*5.9%*	*6.6%*
Total MDMA		209	89	25	117	440
		47.5%	*20.2%*	*5.7%*	*26.6%*	*100.0%*

To test whether there is a difference between participants who were able to identify both terms correctly and those who were unable to identify them a one-way chi squared was applied to the above results. The test returned a χ^2 value of 78.066 and a P value <0.001, which is a significant difference between the people who identified both correctly and those who did not, with significantly more in the latter category. When the results were assessed using the demographic variables, shown in Appendix IVa Table 4.1.viii and Table 4.1.ix, there is a significant difference observed between the responses by the genders and by the age groups. Though only the 30-39 age groups had more participants who got the classification of both terms correct than incorrect.

The results from question 2 support the hypothesis that the majority of participants were not aware that Ecstasy and MDMA are classified as the same, suggesting that the participants are not associating the two terms thus supporting the idea that these two terms now have separate identities. The implications of these findings suggests that the lack of association may be impacting on the reported level of use and the education around these two terms. If a participant is asked whether they have taken 'Ecstasy' but think they have only taken MDMA this could lead to underreporting of use, something that is explored further in Survey B. The concept of separate identities for these two terms is further explored in the following question on association of drugs with colloquial names.

Question 3: Which of the following names do you associate with: - Cannabis, Ketamine, Ecstasy and Mephedrone?

Question 3 looked at the recognition and association of names and colloquial terms used to describe four chosen drugs. For each drug a selected number of known or associated terms were included, as well as names that are specifically associated with other substances. These were taken from the website TalktoFrank (2013) and are listed in Table 3.1.

Some drugs have a multitude of names associated with them, while others have fewer more specific terms. Not all terms included in this question were relevant to the drugs that were being asked about. Part of the purpose of this research was in identifying whether there is misidentification of the names. Misidentification or a lack of understanding regarding colloquial terms can have implications to the user if they are not sure what it is they are using. It can also have an effect on the reporting of use if participants do not associate the colloquial name given to the substance they are using and the terms used by researchers. Five deliberate decoy terms were also included. These are described in Table 4.1.3, which gives the decoy name and the substance it is supposedly associated with according to TalktoFrank (2013).

Table 4.1.3: List of decoy terms used in Question 3

Term	Associated Substance
Bubble	Mephedrone
Charlie	Cocaine
Green	Ketamine
Mandy	Ecstasy
Skunk	Cannabis

Although the term green is referenced by TalktoFrank as an alternative for ketamine and was intended as a decoy in the other three questions, the level of participant identification of ‘green’ as an alternative for cannabis meant that it was included in the recognised list, this is in spite of the fact that it is not a recognized alternate name for cannabis on TalktoFrank (2013), Erowid (n.d.) or Drugscope (2015). In responding to this question the participants were able to choose as many of the terms they believed were relevant to the four drugs. Table 4.1.4 shows the percentage response for each of the drugs and the relevant terms.

Table 4.1.4: Percentage of respondent identification of terms associated with specific substances in Question 3

Cannabis		Ketamine		Ecstasy		Mephedrone	
Weed	97%	K	74%	E	91%	Meow-Meow	56%
Pot	93%	Special K	59%	MDMA	44%		
Grass	90%			XTC	37%	4MMC	12%
Green	64%	Dust	4%	Mandy	21%		
Hash	86%			Crystal	6%	Bubble	9%
Dope	85%	Green	1%	Adam	5%	White Magic	8%
Skunk	80%						

The responses show that the alternative names for cannabis resulted in the highest level of recognition, with the highest being weed and the lowest green. Both ketamine and Mephedrone had low association with all but one of the key terms. In regards to the identification of the alternative names for Ecstasy, the responses were variable. The other side of this question looked at how often the terms are misidentified, whether people are using the colloquial terms consistently for the substance. Table 4.1.5 shows the percentage response for incorrect identification of the decoy terms.

Table 4.1.5: Percentage of incorrect identification by participants to Question 3

	Cannabis	Ketamine	Ecstasy	Mephedrone
Bubble	2%	3%	1%	*n/a*
Charlie	8%	1%	1%	0
Green	*n/a*	*n/a*	0	0
Mandy	7%	0	*n/a*	2%
Skunk	*n/a*	1%	1%	0

The overall misidentification was low, with cannabis having the most misidentification of terms. The use of the term green, which was originally included as decoy name related to the substance ketamine, was included in the chosen terms for cannabis as it received over 64% identification. The majority of the terms received less than 5% of the participants misidentifying these terms. Participants were also able to provide their own alternatives. The level of response for voluntary terms suggested were 42 for cannabis, 38 for ketamine, 22 for Ecstasy and 45 for Mephedrone. Of the times when the alternative option was deployed some used it to identify only knowing the name provided at the start of the question, the rest of the names provided can be found in Table 4.1.6.

Table 4.1.6: List of alternative names as provided by participants (*n = number of times mentioned independently by different participants) to Question 3

Drug	Alternatives Given
Cannabis	Blow, Blunts, Brown, Bud*3, Chang, Cheese, Draw*2, Ganja*6, Henry, Jungle, Lots of others*3, Marijuana*3, Mary Jane*6, MJ, Resin, Smoke, Sput, SweetLeaf, THC, The Devils Lettuce, The good thing, Tweeb, Wacky Baccy*2, Zoot
Ketamine	Horse Tranq, Horsey, Katy, Ket*8, Kit Kat, Regretamine, Wonk
Ecstasy	Disco Biscuits, Eccies, Fliers, Love Drug, MD*2, Molly*3, MumandDad, Pills*4, Pukka, Tabs, Speed*2, Whizzers
Mephedrone	Chine White, Dolly, Drone*2, Ember, MCat*2, Meph, Meth, MKat*4, Plant food, Speed

Cannabis had the most alternative names suggested by the participants, with 3 participants merely stating that there were lots/loads of other names. Ketamine had the least amount of alternative names and the highest number of people stating they knew no other names beside ketamine.

The use of the term Speed was used multiple times, not only as an alternative for Ecstasy but also for Mephedrone. Speed is a term reportedly associated with the drug amphetamine (TalktoFrank, 2013) however there is also evidence to suggest it is being used for methamphetamine (Erowid, 2013). This suggests that the term 'Speed' is being used as a generalised descriptor for any stimulating substance. There is also the association identified between the use of the term Ecstasy and the form in which the drug is found, i.e. tabs or pills. This finding supports the hypothesis that the term Ecstasy is connotative of the form rather than the chemical composition. With regards to the drug Mephedrone the number of alternatives can relate to any number of the Cathinone derivatives, for example MCAT or MKat is used to describe the drug methcathinone.

Variable analysis on the results for Question 3: Which of the following names do you associate with: - Cannabis, Ketamine, Ecstasy and Mephedrone?

The level of association of the drugs with their alternate names was assessed using the two demographic variables to see whether there was a difference in the names each gender and the different age ranges associated with the terms. The difference was assessed using the chi-squared test, the full table of results is located in Appendix IVa Table 4.1.x.

Of the six terms that were chosen as alternatives to Ecstasy, half returned a significant difference in the responses between the genders. A significant difference was observed for the terms; 'Mandy', 'MDMA' and 'XTC', with all three being identified more by male participants than female. This was also the case for the term 4-MMC, in relation to Mephedrone. Significantly more male participants identified 4-MMC as an alternate name than females. This is of interest as 4-MMC is the abbreviation of chemical name 4-methylmethcathinone and is similar to MDMA, which is the abbreviation of 3, 4-methylenedioxymethamphetamine the chemical associated with Ecstasy. What these results suggest is a difference in the level of knowledge and awareness between the two genders concerning these two drugs. The differences between the genders will be explored further in the second survey, when the participants were asked about their own drug use. The difference may be due to females not using or coming into contact with these substances, something that was suggested in the section 2.7, which found that the majority of previous drug use survey participants were male.

The association of the terms can also be explored by applying the variable of the different age groups. Again a chi squared test was applied, the results for this are shown in Appendix IVa Table 4.1.xi. The results of the chi-squared test against the age variable shows two of the terms for Ecstasy and Mephedrone had a significant difference in the level of responses between the different age groups. For Ecstasy the difference was observed for the terms 'Mandy' and MDMA, for Mephedrone the difference was observed for Meow-Meow and White magic. The results showed that for Mandy, Meow-Meow and White Magic the names were less likely to be identified by participants from the bands 30 to 39 and older.

The term MDMA, which is the focus of this research, showed a different trend when compared by the variable of age. When the results were analysed, the band that identified the highest level of association between the terms Ecstasy and MDMA was the 40 - 49 band with 62% association. The 18 – 21 and the 30 – 39 both reported 40% of participants associating the two terms, while 22 – 29 was slightly higher at 49%. The two oldest age groups examined in this research showed the lowest association with the 50 – 59 obtaining 26% and 60+ obtaining 30%. Overall only 44% of the participants who responded to this survey associated the term MDMA with Ecstasy, which is a significant difference when tested using one-way chi (χ^2 = 6.145, P = 0.015). These results support the argument made throughout this research, that the terms Ecstasy and MDMA are no longer synonymous. The results from this and previous

questions prove that there is a division in what the participants understand Ecstasy and MDMA to be.

Question 4 – Multipart scale questions on perception

The next set of questions examined the participant's perceptions of the substances and asked them to assess their own level of knowledge using a Likert scale. The analysis of these questions gives insight not only into the public's views on the prevalence and health risks of drugs but about how informed they feel about the selected substance, and how each drug compares to the others.

Question 4a: How prevalent do you think drugs are in modern British society?

Question 4a asked the participants to think about the prevalence of drugs in modern British society. The range of answers was based on a Likert scale from 1 to 5, whereby a response of 1 indicated that the participants thought the prevalence of drugs was low and 5 representing a high level of prevalence. Figure 4.1.6 displays a histogram showing the distribution of the responses to this question, while a summary of the descriptive statistics of mean mode and median for each of the dependant variable groups is shown in Table 4.1.7.

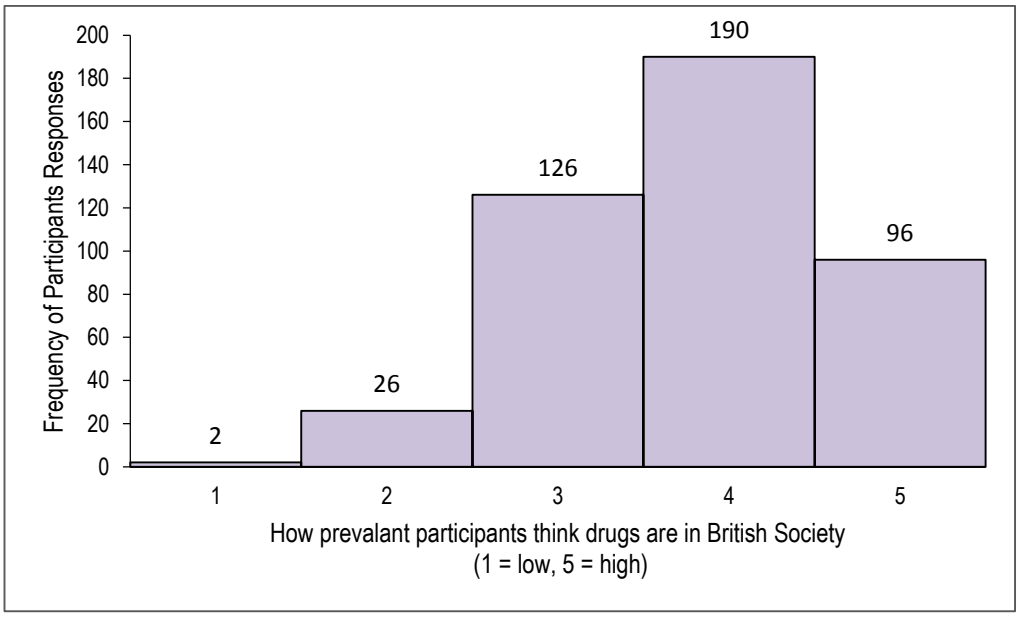


Figure 4.1.6: Frequency distribution for total responses to Q4a – the prevalence of drugs in British society

Table 4.1.7: Descriptive statistics per variable for the responses to Questions 4a – Prevalence of Drugs

	Total	Male	Female	18-21	22-29	30-39	40-49	50-59	60+
Mean	3.80	3.85	3.77	3.72	3.91	3.91	3.64	3.68	3.40
Mode	4	4	4	4	4	4	4	4	3
Median	4	4	4	4	4	4	3	4	3
n	440	163	277	177	128	57	39	19	20

The majority of respondents ranked the prevalence of drugs in society towards the higher end of the scale, with an overall mean of 3.80. The mode was 4 across all the variable groups, with the exception of the 60+ age group. This suggests that the majority of the participants thought that drugs were quite prevalent in society. The difference between the responses given for this question from the total group were assessed using a one-way chi squared. This test gave a χ^2 value of 263.091 and a P value of <0.001, which is significant at critical level of 0.05.

To test whether there was a difference between how the genders responded to this question a two-way chi squared was employed. As there were some counts that were less than five the Monte Carlo Exact was also applied and returned a χ^2value of 7.620 and a P value of 0.105. As the P value is greater than the critical level of 0.05 there was no difference in how the genders responded on the prevalence of drugs. A second two-way chi squared using the Monte Carlo Exact test was employed to test the difference between the responses from the different age groups. This returned a χ^2 value of 37.945 and a P value of 0.002, which is below the critical level and is therefore significant. The difference occurs between how the 60+ perceived the prevalence of drugs and the other age groups. Though use of the ranking of the scale could be considered quite broad and open to how each participant determines what they consider high. Yet it appears that the majority of participants did believe that drugs are prevalent in British society. The implications of this can be further explored by the analysis into the qualitative questions later in the chapter.

Question 4b: How informed do you feel about the health risks caused by drugs?

Question 4b looked at how informed the participant felt about the general of health risks associated with drug use. Figure 4.1.7 displays the distribution of the results using the same Likert scale as question 4a, with 1 being low and 5 being highly informed. A summary of the descriptive statistics for each of the dependant variables is shown in Table 4.1.8

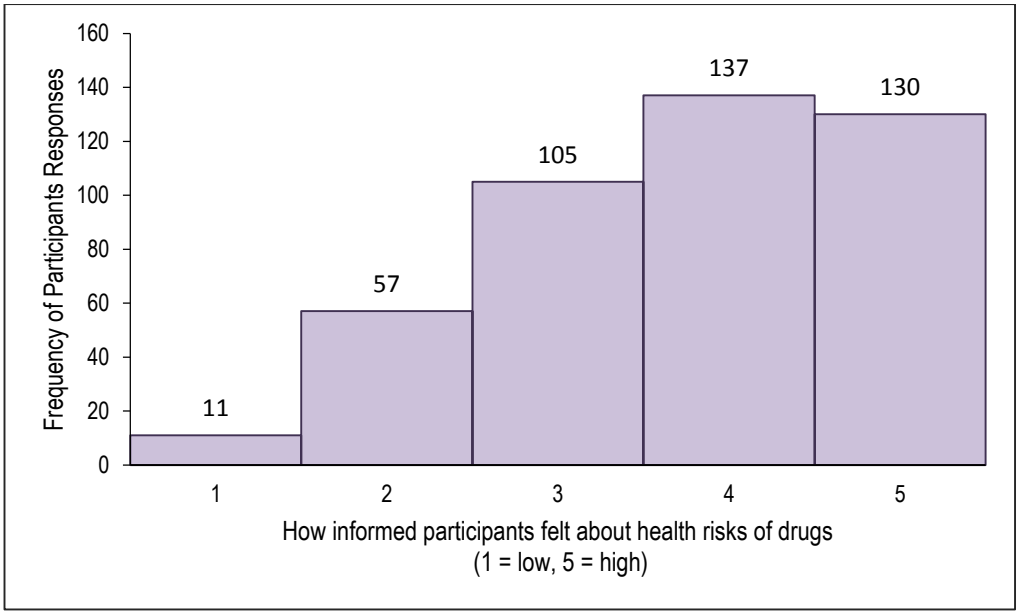


Figure 4.1.7: Frequency distribution for the total responses to Q4b – the awareness of the risks of drugs

Table 4.1.8: Descriptive statistics for question 4b – Health Risks caused by drugs

	Total	Male	Female	18-21	22-29	30-39	40-49	50-59	60+
Mean	3.97	4.06	3.91	3.88	3.61	3.72	3.51	3.53	3.65
Mode	4	4	4	4	4	4	3	4	3.5
Median	5	5	5	4	3	4	3	4	5
n	440	163	277	177	128	57	39	19	20

As with question 4a, the majority of the participants responded towards the higher end of the scale. The descriptive statistics are fairly unanimous, with 6 out of the 8 variable groups having a mode of 4, and the overall median being 5 the highest possible response on the scale. The responses given for this question from the total group were assessed using a one-way chi squared to assess whether there was a significant difference between the responses across the scale. The test returned a χ^2 value of 128.909 and a P value of <0.001, which is significant at the critical level of 0.05.

The results for Question 4b showed that no significant difference was observed between how the genders ($\chi^2 = 4.647$, P =0.311) or the different age groups ($\chi^2 = 27.546$, P = 0.086), ranked their own level of information on the health risks of drugs. The results suggest that the participants felt informed of the health risks of drugs. One question that could be asked would be whether the information they possessed was accurate? Though not specifically evaluated by this survey an estimate could be made based on the responses to the prior knowledge based questions and by later questions, which assessed the information sources participants use to find information on drugs.

Question 4c to 4g: How informed do you feel about the effects of: - 4c) Cannabis, 4d) Ketamine, 4e) Ecstasy, 4f) MDMA Powder and 4g) Mephedrone

Questions 4c to 4g examined the specific awareness of five of the drugs discussed in earlier questions. In this question Ecstasy and MDMA were separated and represented as individual terms, this was done so that a comparison between how the two terms are perceived could be achieved. The analysis of these questions gives insight not only into the public's views on how informed they feel about the effects of each substance, but how their knowledge of the drugs compares. The participants were asked to rank how informed they felt about each of the substances on the same Likert scale used in the previous questions. A summary of the descriptive statistical values of mean, mode and median for each of the substances are shown in Table 4.1.9.

Table 4.1.9: Descriptive statistics for questions 4c to 4g – Effects of Drugs

Total	4C Cannabis	4D Ketamine	4E Ecstasy	4F MDMA	4G Mephedrone
Mean	3.97	2.60	3.58	2.69	2.12
Median	4	2	4	2	2
Mode	5	2	4	1	1

From the mean values shown in the table above, the substances can be ranked by how informed the participants felt about them. The rank order is as follows: cannabis, Ecstasy, MDMA, ketamine and finally Mephedrone. The distributional analysis for each question was plotted onto individual histograms for each of the drugs and is displayed below in Figure 4.1.8.

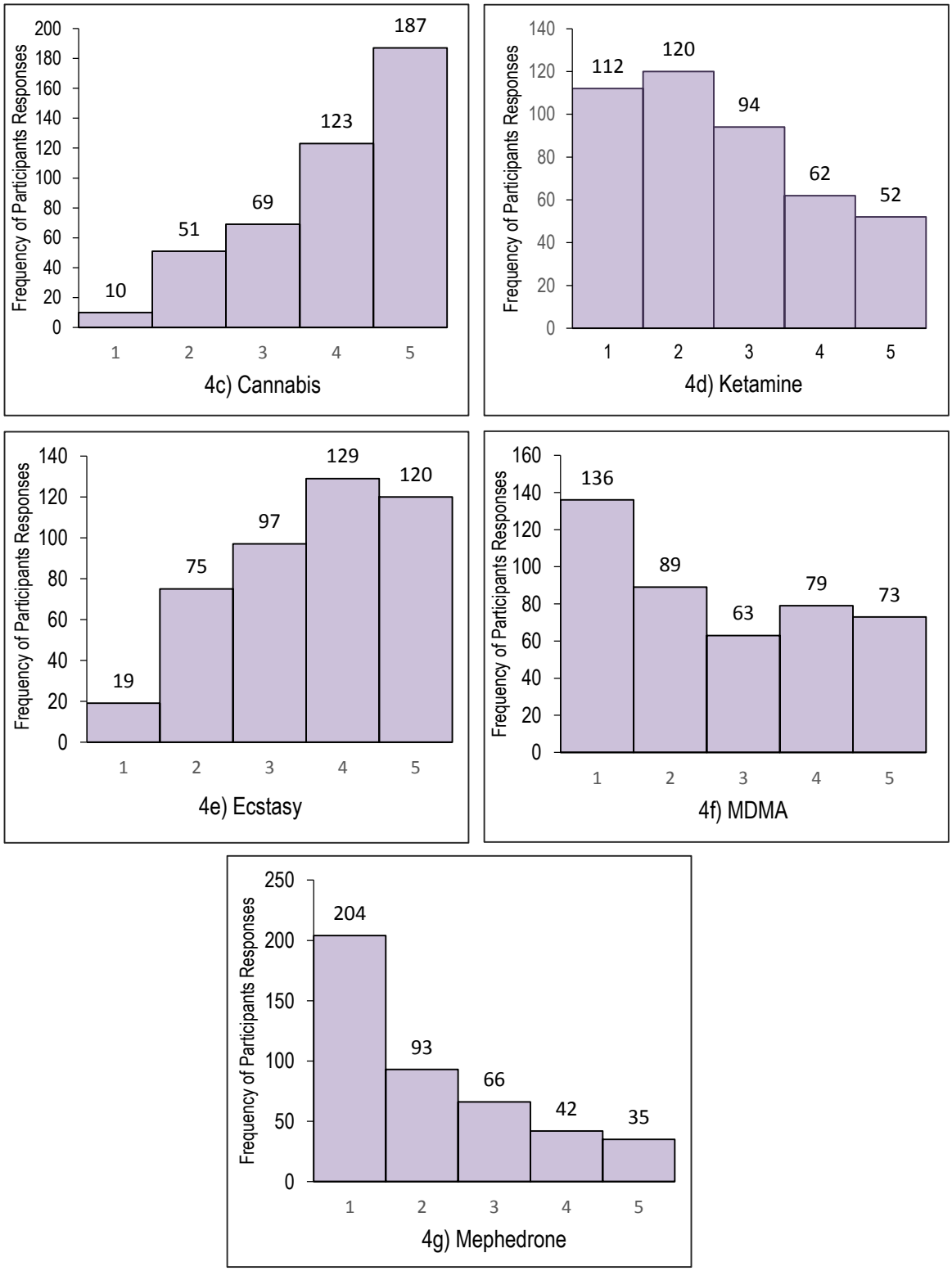


Figure 4.1.8 Histograms for responses to questions 4c to 4g – How informed does the participant feel about the effects (1 = low to 5 = high)

Results for Question 4c - Cannabis

In Figure 4.1.8 the histogram from the responses to question 4c - cannabis displays a negatively skewed distribution, with more participants reporting at the higher end of the scale. A one-way chi squared was applied to test the significance between the levels of responses, which returned a χ^2 value of 214.091 with a P value of <0.001. Therefore there is a significant difference between the numbers of participants who chose each option on the scale, with the majority of participants choosing the highest possible choice. The participants clearly felt that they very informed on the effects of cannabis. There was no observed difference in how either gender (χ^2 = 4.633, P = 0.311) or the different age groups (χ^2 = 15.746, P = 0.657) rated how informed they felt about the effects of cannabis.

Results for Question 4d - Ketamine

The results for the responses on ketamine (Figure 4.1.8 4d) displayed a positive skew and in comparison to the results for cannabis the distribution for ketamine was more evenly spread. A one-way chi squared was applied to test the significance between the levels of response across the scale, which was significant (χ^2 = 41.000, P = <0.001). The distribution was skewed towards the lower end of the scale with the majority of participants reporting to feel lowly informed on ketamine. When a two-way chi squared was applied, there is a significant difference in how the genders ranked how informed they felt about ketamine, with males reporting to feel more informed than females (χ^2 = 13.769, P = 0.008), however no significant difference is observed between the age groups (χ^2 = 21.266, P = 0.368).

Results for Question 4e - Ecstasy

The distribution of the results for Ecstasy shown in Figure 4.1.8 4e display a negative skew, which when tested using a one-way chi squared returned a significant difference between the responses (χ^2 = 87.682, P value = <0.001). The majority of participants choose the higher end of the scale. No significant difference was observed in how the two variables, gender (χ^2 = 5.500, P = 0.240) or age group (χ^2 = 21.350, P = 0.320) responded to this question. The response for Ecstasy will be considered in more detail when compared to the results for MDMA at the end of this section.

Results for Question 4f - MDMA

The histogram for the results for MDMA was positively skewed towards the lower end of the scale, with the participants' responses to this question appear to be more evenly spread across the range of responses. However when tested using a one-way chi squared, a significant difference was observed (χ^2 = 36.733, P = <0.001). There was also a significant difference in how the genders, with the male participants rating their knowledge of the effects higher than the females (χ^2 = 28.492, P = <0.001). A significant difference was also found between the results for the age groups (χ^2 = 33.891, P = 0.018).There was a difference between the younger age groups and the older, though the overall mean was only 2.69, at the lower end of the scale. MDMA is the only substance that has so far had a significant difference between both variable groups. The differences in how the participants responded to Ecstasy compared to MDMA is examined in more detail further in the section.

Results for Question 4g – Mephedrone

A significant amount of participants rated their knowledge of the effects of Mephedrone as the lowest possible option on the scale, supporting the findings from previous question that mephedrone is still relatively unknown. A one-way chi squared was applied to test the significance between the levels of responses across the scale. The test returned a χ^2 value of 214.659 with a P value of <0.001, which is significant. There was also a significant difference in how the genders ranked how informed they felt about Mephedrone, with males rating their knowledge higher than females (χ^2 = 11.525, P = 0.021), yet no significant difference was observed between how the age groups rated their knowledge of the effects of Mephedrone (χ^2 = 17.126, P = 0.609).

Comparison of results for Questions 4c to 4g

All of the substances returned a significant difference between the levels of responses for their individual questions. However the distributions of the responses varied between the substances. None of the histograms exhibited normal distribution for an expected population; both cannabis and Ecstasy exhibit negatively skewed distributions with the peaks towards the upper end of the scale. Ketamine, MDMA and Mephedrone exhibited positively skewed distributions with the peaks towards the lower end of the scale. This means that for cannabis

and Ecstasy the majority of participants rated their knowledge of the effects of these drugs highly compared to their knowledge on MDMA, ketamine or Mephedrone, which they rated at the lower end of the scale.

The mode values denote the most frequent value chosen by the participants. For cannabis the modal value was the highest possible available at 5 on the scale given. Ecstasy also attained a high modal value with a mode of 4. Ketamine however attained a modal value of 2 and both MDMA and Mephedrone gained the lowest possible value of 1.

When examining the difference in the responses between the two independent variables of gender and age the statistical analysis determined that for Ketamine, MDMA and Mephedrone there was a significant difference in how the genders ranked their perceived level of information, with the male participants consistently rating themselves higher in knowledge than the females. The only substance that received a significant difference in rating from the age groups was MDMA, which is consistent with the findings from the previous questions as it appears that the older age bands are less aware of the term.

The Comparison of results for Question 4e Ecstasy and 4f MDMA

Table 4.1.10: Cross tabulation of results for Question 4e (Ecstasy) against 4f (MDMA)

		Responses for MDMA					Total
		1	**2**	**3**	**4**	**5**	
Responses for Ecstasy	**1**	17	0	0	2	0	19
	2	40	32	2	1	0	75
	3	38	23	29	7	0	97
	4	29	25	20	52	3	129
	5	12	9	12	17	70	120
Total		136	89	63	79	73	440

Table 4.1.10 displays the cross-tabulation of results for question 4e - Ecstasy against question 4f - MDMA. The significance between the responses given for Ecstasy and MDMA can be compared using a two-way chi squared with the application of the Monte Carlo Exact test. This returns a χ^2 value of 315.441 and a P value of <0.001. The relevance of this finding is important when trying to establish how the public perceives these two terms. The fact that there is a significant difference in how informed the participants feel about two terms, both of which are used to describe the same product suggests that these two terms do have separate identities. This data can be further summarised by the number of participants who feel more

informed about Ecstasy and those that feel more informed about MDMA. This was calculated by taking the point difference between the two scored values, whereby a negative value suggests the participant feels more informed on MDMA and a positive value suggests feeling more informed on Ecstasy, this is summarised in Table 4.1.11.

Table 4.1.11: Summary of difference in participant's scores for Question 4

Difference Between Score	Frequency	Percent (%)
Higher for Ecstasy	225	51.1
Same for both	200	45.5
Higher for MDMA	15	3.4

A one-way chi squared test on the above data provides a χ^2 value of 179.29 and a P value of <0.001, which is significant at a critical significance level of 0.05. This suggests significantly more participants felt more informed about the term Ecstasy than MDMA. Yet again supporting the idea that these two terms must be considered as separate terms.

Comparative analysis for Questions 1 to 4

Up to this point in the chapter each section has summarised the individual findings from each of the first four questions, the following section will look at the differences between the participants' responses between the questions.

Cross tabulation of Question 1 responses against Question 2

The first cross tabulation computed compares the results from the participants who had heard of Ecstasy and those who had not to what each group classified both Ecstasy and MDMA as in the Question 2, shown in Table 4.1.12.

Table 4.1.12: Responses for Question 1 - Ecstasy against question 2 Ecstasy and MDMA

Q1 Ecstasy	Q2 Drug Classifications	Q2 Ecstasy		Q2 MDMA	
		Frequency	Percent (%)	Frequency	Percent (%)
Group 1: Have Heard (*n = 434)*	Class A	298	69	207	48
	Class B	85	20	87	20
	Class C	23	5	25	6
	Do Not Know	28	6	115	26
Group 2: Had Not Heard (*n = 6)*	Class A	3	50	2	33
	Class B	1	17	2	33
	Class C	1	17	0	0
	Do Not Know	1	17	2	33

The table above demonstrates that the majority of the participants who reported to have heard of Ecstasy (Group 1) were able to correctly identify its classification. The difference between the participants who choose Class A compared to those who choose any other option was tested using a one way chi squared that returned a χ^2 value of 60.47 and a P value of <0.001, which is significant. Of the participants who reported to have not heard of Ecstasy (Group 2), half chose the correct response with the remaining three responses spread across the other three options. This suggests that the classification status of Ecstasy is well known, and that it is perceived to belong with the more harmful drugs. This can be compared to the results for MDMA.

When it came to identifying the classification for MDMA the majority of participants in Group 1 chose the correct classification out of the four options. However over a quarter of participants chose the 'Do not know' option. The difference between the participants who got the question correct compared to those who did not was tested using a one way chi squared that returned a χ^2 value of 0.92 and a P value of 0.359, which is not significant at a critical significant level of 0.05. There was no significant difference in the number of participants who did identify the correct classification and those who did not, despite the fact the majority were able to classify Ecstasy correctly. A second cross tabulation was completed with the responses from participants who had and had not heard of MDMA, the results are displayed in Table 4.1.13.

Table 4.1.13: Cross tabulation results for Question 1 - MDMA against Question 2 Ecstasy and MDMA

Q1 MDMA	**Q2 Drug Classifications**	**Q2 Ecstasy**		**Q2 MDMA**	
		Frequency	Percent (%)	Frequency	Percent (%)
Group 3: Have Heard (*n = 344)*	Class A	241	70	183	53
	Class B	67	19	76	22
	Class C	16	5	21	6
	Do Not Know	20	6	64	19
Group 4: Had Not Heard (*n* = 96)	Class A	60	63	26	27
	Class B	19	20	13	14
	Class C	8	8	4	4
	Do Not Know	9	9	53	55

The table above shows that of participants who reported to have heard of MDMA (Group 3), the majority correctly identified the classification of Ecstasy. The difference between the number of participants who choose the correct classification was compared to the number of participants who choose any of the other three options was tested using a one way chi squared that returned a χ^2 value 391.19 and a P value of <0.001. Of the participants who reported to have not heard of MDMA (Group 4), the majority also correctly classified Ecstasy. The difference was tested using a one way chi square, which gave a χ^2 value of 75.08 and a P value of <0.001. The results for Ecstasy show that within both group 3 and 4 the majority were able to identify the correct classification. However this was not the case for the term MDMA.

Of the participants that reported to have heard of MDMA the majority did choose the correct classification of class A. The difference between the numbers of participants who chose each of the four options was tested using a one way chi square that returned a χ^2 value of 165.33

and a P value of <0.001 which is significant. Yet when number of participants who choose the classification correct is compared to those who did not using a one way chi squared there is no significance as the test returns a χ^2 value of 1.41 and a P value of 0.258. This means that there was no significant difference between the number of participants who correctly identified MDMA and those that could not within the group that reported to have heard of MDMA. Within the group who reported to have not heard of MDMA the majority chose the 'Did not know' option. When the significance between the four options was tested using a one way chi squared it returned a χ^2 value of 56.92 and a P value of <0.001, so the participants who had not heard of MDMA could not identify its classification.

Although MDMA is classified the same as Ecstasy and is considered the same thing under the law, there was no significant difference between the number of people who could correctly classify MDMA and those who didn't within the group who had heard of it. Thus supporting the hypothesis that MDMA and Ecstasy are not known as the same thing. A final cross tabulation in this section analysed the number of participants who got the classification correct for each term compared to whether they had heard of the terms. The cross tabulation is shown in Table 4.1.14, with the percentage calculated against the number of responses per group.

Table 4.1.14: Cross tabulation of Q1 against Q2, grouped by who had heard of Ecstasy, Ecstasy and MDMA and heard of neither substance

Question 1		Q2 Ecstasy Class A	Q2 MDMA Class A	Both Correct
Heard of Ecstasy *n=434*	Heard of MDMA *n=344*	241	183	164
		70%	53%	47.6%
	Not Heard of MDMA *n=90*	57	24	20
		63.3%	26.6%	22.2%
Not Heard of Either Term (*n* = 6)		3	2	2
		50%	33.3%	33.3%

Less than half of all participants correctly identified both as being Class A, this is despite both terms being used to describe the same controlled substance. The inconsistency in responses between the two substances within the first two questions lends support to the main hypothesis of this research, that the two terminologies for this substance are not clearly understood to be the same thing. This can be further evaluated by correlating the responses from these questions with that of Question 3 which asked participants about the association of the two terms.

Cross tabulation of Question 1 responses against Question 3

A cross tabulation was computed comparing the results from question 1 on which drugs participants had heard of to the responses they gave to Question 3 on association of terms. The responses were divided in the same manner as the cross tabulation in Table 4.1.15. The first group were those who had heard of both terms, the second those who had just heard of Ecstasy and the last those that had heard of neither. The responses for these groups were then separated into those who equated the term MDMA with Ecstasy and those who did not. The results of this comparison are shown in Table 4.1.15.

Table 4.1.15: Question 1 responses compared against responses to Question 3

Question 1: Which drugs have you heard of?		Question 3: Which terms do you associate with Ecstasy	
		Ecstasy = MDMA	Ecstasy ≠ MDMA
Heard of Ecstasy (*n* = 434)	Heard of MDMA (*n= 344)*	175	169
		51%	49%
	Not Heard of MDMA (*n*= 90)	15	75
		16.7%	83.3%
Not heard of either (*n*= 6)		2	4
		33.3%	66.7%

These results show a big difference in the awareness of MDMA as being another name for Ecstasy. The responses by the group who had heard of both terms were compared using a one way chi squared that returned a χ^2 value of 0.1 and a P value of 0.777. This is not significant at the critical significance level of 0.05, which means there is no significant difference between the participants who did associate the two terms and those who did not. Less than half the participant group associated the two terms, which suggests that the participants must consider the two terms to represent different things. This may relate to the emergence of two separate products. The analysis of the section of the survey has shown that though majority of the participants claim to have heard of both substances, over half do not associate the two as being synonymous. This raises the question - what are the perceived differences? This question cannot be directly answered based solely on the results from the questions in survey A, however will be addressed within the discussion of the whole project.

4.1.3 Questions 5 to 8 – Education and Information sources

The next section of the survey asked the participants about their drugs education, where they look for information about drugs and how much they trust various sources of information on the topic.

Question 5: Have you ever received any education in regards to drugs or drug abuse?

The first question in this section asked whether the participants had received any education regarding drugs. Within the current national curriculum, set out by the Department of Education, drugs education is integrated into the module of PSHE (Personal Social Health and Economic education) and is seen as *'an entitlement for every pupil and is supported by Section 351, of the Education Act 1996'* (Department of Education and Skills, 2004 p. 13). The focus on drugs education was renewed under the Government's Drug strategy 2010 (HMGovernment, 2010) to aid in the prevention of drug use. The aim of the drugs educational programme provided in the UK is:

'…to provide opportunities for pupils to develop their ***knowledge, skills, attitudes*** *and understanding about drugs and appreciate the benefits of a healthy lifestyle, relating this to their own and others' actions.'*

(Department of Education and Skills, 2004 p. 18)

As this survey is examining the participants knowledge and awareness drugs it was important to assess whether the participant group had received drugs education, to see whether this had an impact on how they answered the questions. The responses to this question were given as either a yes or no, with the summary of the results shown in Figure 4.1.9.

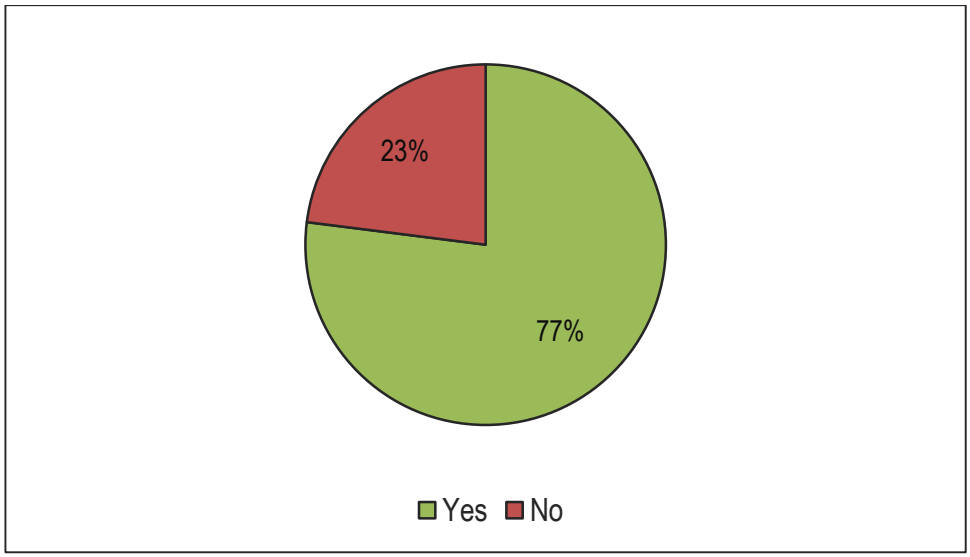


Figure 4.1.9: Total Responses for whether participants received any education in drugs (*n* = 440)

The above chart shows that there were significantly more participants who reported to have received some form of drugs education than not. A similar ratio was seen when comparing the male and female subgroups, with 74% of males and 79% of females who reported having received some education on drugs, with no significant difference between the gender responses observed ($\chi^2 = 1.487$, P = 0.223).The main difference that is observed occurs when examining the differences in the responses between the age groups as shown in Figure 4.1.10.

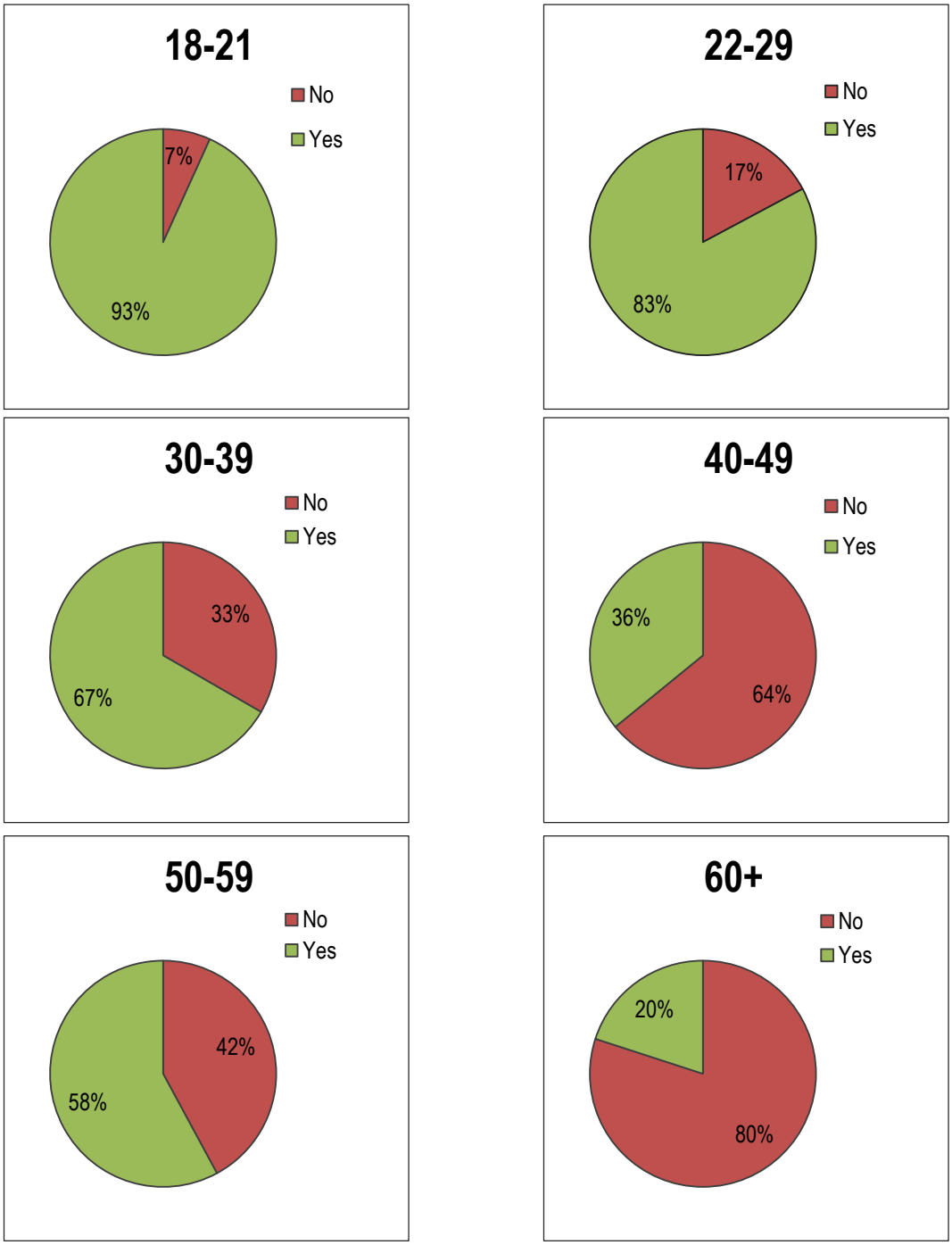


Figure 4.1.10: Responses to Question 5 separated by age group

The above figure shows the decreasing level of reported drugs education as the participant's age increases, with only 20% of the participants in the 60+ age group reporting to have received any drugs education. The significance was tested using a two way chi square. The χ^2 value returned was 101.443 and a P value of <0.001, which is significant and therefore proves a difference between the level of participants reporting to have received drugs education in the different age bands.

The differences between the age groups may be explained by looking at the time frame in which each group would have been at school and considering that the legislation regarding drugs has changed over the period of time when each groups schooling would have occurred. Table 4.1.16 shows the years that each of the age groups would have been 16, the current year at which all children in education should have received drugs education.

Table 4.1.16: Years when each age group would have been in education (given age in 2013)

Group	Year when 16 years old
18-21	2008-2011
22-29	2000-2007
30-39	1990-1999
40-49	1980-1989
50-59	1970-1979
60+	Pre -1969

Given that drugs education became an *'entitlement'* in 1996 it is likely that the majority of the participants from the 30 to 39 group and younger would have received some form of drugs education, which is illustrated in Figure 4.1.14. One reason why the 50 to 59 groups reported higher affirmation of drugs education could be due to the fact that the time period when they would have been in education coincides with when the legislation of illicit compounds first came into effect, with the introduction of the Misuse of Drugs Act in 1971. Although the participants reported to have received some form of education the extent of that education may be questionable. Fletcher, Bonell and Sorhaindo (2010) found that secondary school children reported minimal education on the topic of drugs, and that the level of education varied widely between institutions. However in the modern day formal education is just one route to education, with the advent of the internet the general public has the ability to seek out information from a range of sources. To assess the impact of the participants previous drugs education on their responses cross tabulations against the questions from the first section was computed.

Analysis of responses for Question 5 compared to Question 1: which drugs have you heard of?

The first analysis examined the impact of whether the participant had any drugs education on their reported awareness of the substances selected for this survey using a cross tabulation. The significance was calculated using a two way chi square test, the results of the chi squared test are shown in Appendix IVa Table 4.1.xii. When examining the results of the two way chi squared tests between, the participants who had education and those who had not and which drugs they had heard of, there was no significant difference between the groups reporting to have heard of amphetamine, cannabis, cocaine, crack, heroin, Ecstasy or ketamine. Yet there was a significant difference between the educated group and the non-educated groups for the drugs; LSD, MDMA, Mephedrone, Piperazine and 2CB. This may relate to the difference observed in awareness of these substances between the age groups, as some of these substances were not known before the start of this millennium and so could not have been taught to older generations.

Analysis of responses for Question 5 against Question 2: Classification of Drugs

This analysis used a cross tabulation to examine whether reporting to have a drugs education had an impact on whether the participants could correctly identify the classifications of the substances. Again the results were tested with a two way chi square, with the results grouped by whether the participants choose the correct class and by those who did not. The results are shown in Appendix IVa Table 4.1.xiii. The results from these chi square tests show that there was no significant difference between the number of correct responses by the educated group and the uneducated group across all of the substances. This suggests that drugs education had no impact on whether participants could correctly classify these controlled substances.

Analysis of responses for Question 5 against Question 3: Alternate Names

The next analysis examined whether drugs education had an impact on the number of participants who correctly identified MDMA as an alternative term for Ecstasy. The significance was tested using a two way chi square that returned a χ^2 value of 0.115 and a P value of 0.734, which is not significant. This suggests that within the participant group, previous drugs education was not a factor that impacted whether a person associated the two terms.

Analysis of responses for Question 5 against Question 4: How Informed does the participant feel?

The final analysis in this section examined the impact drugs education had on how the participants responded to the different parts of Question 4. The significance between the educated and the uneducated responses was calculated using a two way chi square with the results summarised in Appendix IVa Table 4.1.xiv. The results from the chi square tests show that there was no significant difference between the educated and the uneducated groups in how they rated how informed they felt on the topics of health risks, or the effects of cannabis, ketamine, Ecstasy, MDMA and Mephedrone. There was however, a significant difference between the educated and uneducated groups on how prevalent they believed drugs are in British society, with the educated group reporting a higher level of prevalence over the uneducated group. This finding might suggest that education makes people more aware of the topic of drugs. Whether the participants felt it was important to be aware of drugs is analysed in the qualitative responses to questions 10 and 11.

Regarding the responses to first four questions, it does not appear that having drugs education had any significant effect on how the participants responded as there was no significant difference between how the educated and the non-educated response rated their own awareness of the effects of the chosen drugs, the educated group did rate the prevalence of drugs higher suggesting education made them more aware of drugs in society.

Question 6: Where would you go if you were looking for information about drugs?

The next question in the survey asked about the participant's information seeking choices, with regards to drugs. It was divided into two parts; the first part of the question asked the participants about where they would go when searching for information about drugs for themselves, the second part of the question asked where the participant would look for information when looking for a friend or relative. The options that the participants were given to choose from span a range of possible sources that provide drugs information. Some of the choices offered provide information on an individual yet objective basis depending what the person seeking information was looking for, examples of these types of information sources were the Doctors, Drugs hotlines and Local Drug Services. These were considered the objective information sources as they should provide information based on facts opposed to personal opinion. Other options represented a subjective view of drugs, the participant's friends and family whose information would be dependent on the personal experience of these two groups. The final sources included provide broader, less direct sources of information, such as the internet and different forms of media. For this question the participants were asked to choose from a number of options on where they would look for information for either themselves (6a) or for someone else (6b). They could choose as many of the options as they wanted. The total for each option is shown as a percentage against total number of participants in Figure 4.1.11

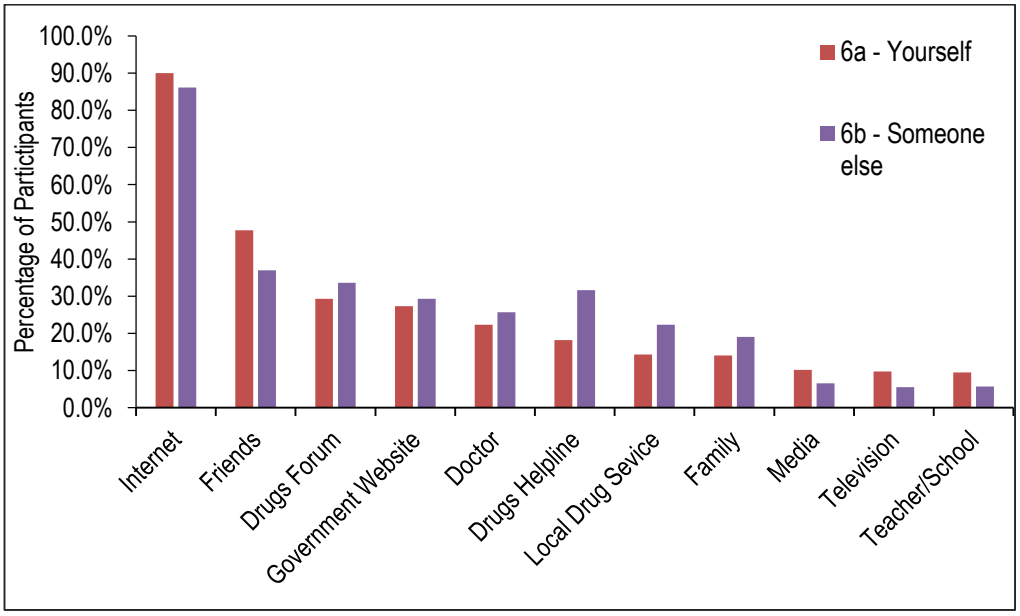


Figure 4.1.11: Percentage of responses for each option to Question 6 – where would you look for information for yourself (6a) or someone else (6b) (*n* = 440)

The most frequently chosen answer for Question 6 was the internet, which is anticipated given 73% of adults accessed the internet every day in 2013 (ONS, 2013). It is interesting to note that the user based forums come above the government website, doctors or drugs helplines as the place where more people would go for information. The reason that teachers came in last may be due to the age limit, that of over 18 and therefore out of secondary education given for this survey, had the survey been provided to school children the results may have been different. The only difference between the responses to 6a and 6b is observed with the drugs helpline, which was chosen more frequently than government website or doctors by participants when looking for someone else.

The results were also assessed by separating the response by the demographic variables, the results for question 6a -gender are in Appendix VIa Figure 4.1.i. The difference between the responses of two genders shows no significance when tested using the two way chi squared for every option except 'Drugs Forum' (χ^2 = 13.941, P = <0.001) with significantly more male participants choose this option. This may reflect that males are more likely to engage with discussions around drug use, as was highlighted in the review of previous drug use surveys in section 2.7.

The difference between the responses by the two genders was also tested for question 6b – someone else (Appendix VIa Figure 4.1.ii), this question also showed no significance when tested using the two way chi squared for every option except 'Drugs Forum' (χ^2 = 6.469, P = 0.011) and Drugs Helpline (χ^2 = 13.799, P = <0.001), with more males again choosing the option of drugs forum, however for this question significantly more females reported they would use a drugs helpline.

Across all of the age groups the top choice in both 6a and 6b was the internet, with the main differences occurring in the second and third most frequent choices, as shown in Appendix Via Table 4.1.n. For 6a all but the two highest age groups choose the friends option as the second most popular choice when looking for information for themselves, however the 50-59 and the 60+ age groups both choose more reputable sources of information, namely the Drugs Hotlines or their Doctors respectively. With the third most popular choice, two out of the six groups choose the option of drug forums, with the rest selecting the governmental website. The older age groups put more trust in the 'objective' sources compared to the younger that

rated ‘subjective’ sources, the trust each group has in different information sources is further explored in question 7.

The results between the ages for 6b question displayed more variety between the second and third choices made by the different age groups. With the younger two groups reporting the same choices as question 6a, groups 30 - 39 and above differ not only in their response given in this question but also between their response to the previous question. The 30 – 39 group choose the government website as the second most frequent response, changing from friends for the previous question. The response shift from subjective source to objective, yet for the 60+ group the change is the opposite from GP in question 6a to friends in 6b. The main difference in the responses between question 6a and 6b appear to occur between the different age groups, with the younger generations consistently picking the subjective sources and the older generations picking the more objective ones. This can be tested my examining how much each group trusts a variety of information sources, as examined in the next question.

Question 7: Who do you trust for your information?

The next question included in the survey looked at who the participants trusted to provide accurate information on drugs. This question also used a Likert scale from 1 to 5, with 1 representing low level of trust in the information source and 5 representing highly trusted. The participants were presented with six possible sources of information; the government, an independent scientist (i.e. Prof Nutt), the media, a known user, a Doctor/GP and the internet. They were asked to rank each of the options individually, as opposed to in comparison to the other options. The results of these questions can be compared to provide insight into who the public trust to provide accurate drugs information. The histograms for each option are displayed in Figure 4.1.12.

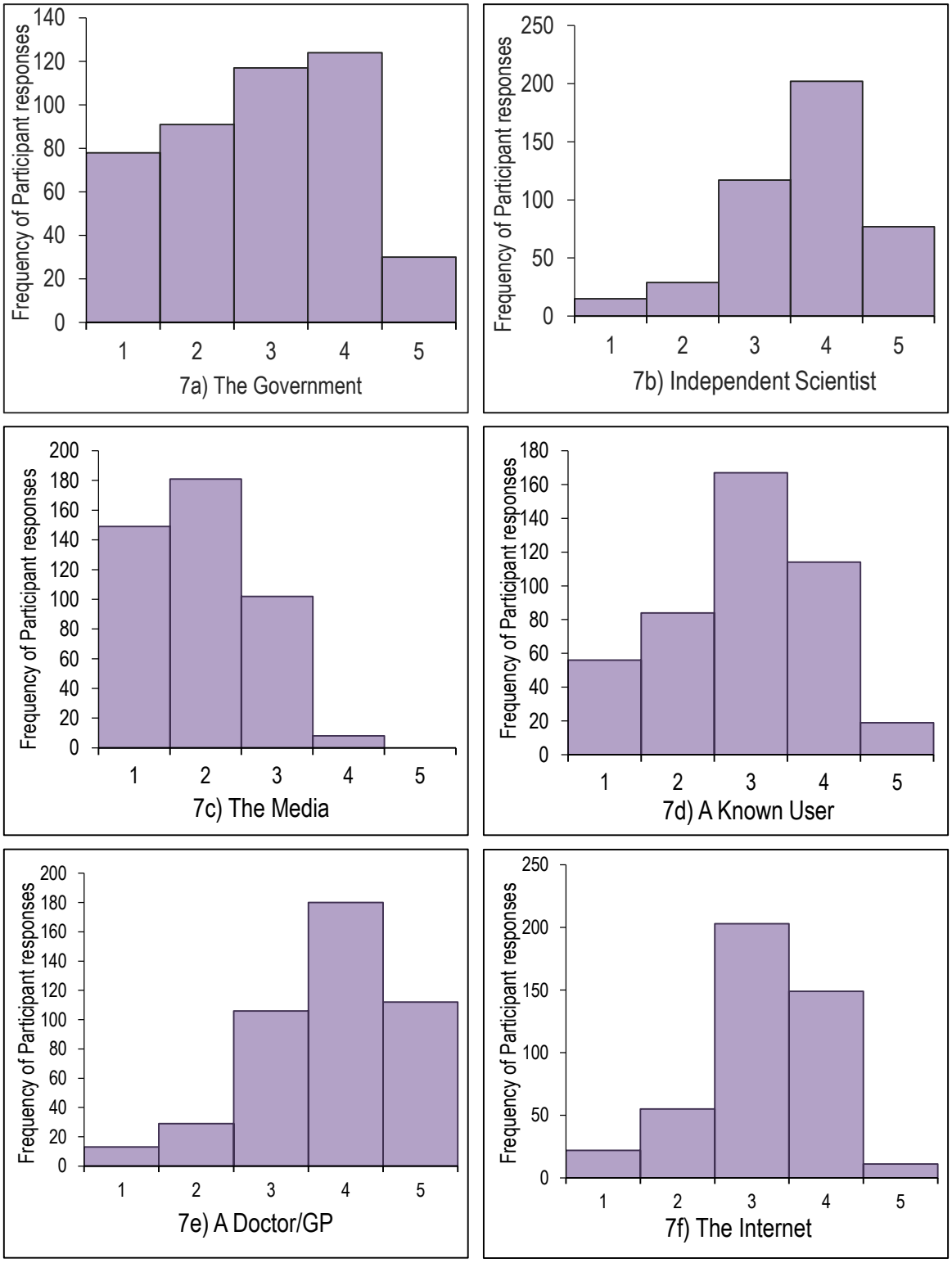


Figure 4.1.12: Histogram of results for Question 7a to 7f - Who do you trust for information (1- Low Trust, 5 - High Trust)

Question 7a: The Government

The UK Government are the foundation for legislation, policy and education on drugs. They produce numerous reports and reviews including CSEW. This question examined the public perception of this institution to provide accurate information on the topic of drugs, the results displayed in Figure 4.1.12 7a displays a distribution that is not normal and exhibits a negative skewness. The significance between the frequencies for each option was assessed using a one-way chi square test that returned a χ^2 value of 63.750 and a P value of <0.001. The results for this question are further compared with the other options later in the section.

Question 7b: Independent Scientist (i.e. Professor Nutt)?

The next source that was put before the participants was that of independent scientist. The example given was that of Professor David Nutt; the well-known and outspoken ex-governmental adviser who set up his own independent drugs review committee the Independent Scientific Committee on Drugs (ISCD, 2013). Independent scientists and researchers are information sources without direct governmental involvement, the use of the word independent was specifically chosen for this reason. The results for question 7b also do not display normal distribution and a negative skewness. Though there was less division between participants rating this question. The significance between the frequencies for each option was assessed using a one-way chi square test that returned a χ^2 value of 528.727 and a P value of <0.001.

Results for Question 7c: Who do you trust for your information - The Media?

The third choice was that of the media, a general term used to describe the technologies used to communicate to the general public. This could be in the form of television broadcasts, newspapers or other products used to convey information. This information source has the broadest reach when it comes to providing information and reiterating information from other sources. Unlike the previous two histograms, the histogram for this question displays a positive skewness, with more participants choosing the lower end of the scale. The significance between the frequencies for each option was assessed using a one-way chi square test that returned a χ^2 value of 154.818 and a P value of <0.001.

Results for Question 7d: Who do you trust for your information - A Known User?

The fourth option was that of a known user, the people who report to take the substances in question. They can provide information through a variety of methods, including direct conversation and through the use of drugs forums mentioned in question 6. This information source can relay subjective information based on personal experience opposed to objective research. The histogram for this question displays the closest to a normal distribution, though it exhibits negative skewness. The significance between the frequencies for each option was assessed using a one-way chi square test that returned a χ^2 value of 144.523 and a P value of <0.001.

Results for Question 7e: Who do you trust for your information - A Doctor/GP?

The fifth option that was given was that of doctor or GP, the health and medical experts. As the illicit substances discussed in this survey are psychologically and physiologically active, creating effects within the body, it is reasonable to assume that medical professionals should/would be able to provide information about these substances. This histogram for 7e displays a distribution similar to the one seen for the independent scientist, with little spread of the responses between the points and a negative skew. The significance between the frequencies for each option was assessed using a one-way chi square test that returned a χ^2 value of 209.886 and a P value of <0.001.

Results for Question 7f: Who do you trust for your information - The Internet?

The final option that was presented to the participants was that of the internet. As a source of information the internet encompasses all the information provided by the previous five options plus any other possible source of digital information, and it was also the more popular choice in question 6: *Where would you go if you were looking for information about drugs?* However question 7 was concerned with the reporting of accurate information, which could impact on how this option was perceived as both verified and unverified information is available side by side. The histogram from 7f also does not display a normal distribution, with the results skewed towards the upper end of the scale and the curve is steeper than expected for normal distribution. The significance between the frequencies for each option was assessed using a one-way chi square test that returned a χ^2 value of 321.818 and a P value of <0.001.

The following section compares the results for all of the options to provide insight into how each source ranks in comparison to the others, with some discussion on the possible reasons behind this.

Comparative analysis of questions 7a to 7f

The aim of question 7 was to establish who the public trust as a source of accurate information on drugs. Up to this point the questions have been analysed individually, the following section compares the descriptive statistics, which provides a ranked scale of the trustworthiness of the sources according to the participant's perceptions. Table 4.1.17 shows the descriptive statistics for each of the six options of question 7.

Table 4.1.17: The descriptive statistics for Question 7a to 7f: Who do you trust for your information?

	7a Government	7b Scientist	7c Media	7d User	7e Doctor	7f Internet
Mean	2.86	3.68	1.93	2.90	3.79	3.16
Mode	4	4	2	3	4	3
Median	3	4	2	3	4	3

When looking at the descriptive statistics in the table above the rank order as determined by the mean values is as follows; doctor, scientist, the internet, a known user, the Government and the media. It is unexpected that a known user ranked higher than that of the Government when using the mean values. When examining the shapes of the histograms, the government seemed to split opinion more than any other of the options, with almost equal weighting between the 2, 3 and 4 options. Before discussing the relevance of these results first the impact of the demographic analysis must be considered. Was there a difference in how the genders and the age groups ranked these information sources?

Demographic analysis of questions 7a to 7f

The next analysis examines the impact of comparing the response by the variables of gender and age. Firstly a two-way chi squared was applied to test whether there was a significant difference in how the different genders responded to each of the information sources, Table 4.1.18 displays the mean value for each gender as well as the test statistics and the significance.

Table 4.1.18: Analysis of Question 7a to 7f by the variable of gender

Question	Male Mean	Female Mean	χ^2 Value	P Value	Significant
7a: The Government	2.67	2.97	10.29	0.036	Yes
7b: Scientist	3.79	3.61	9.862	0.043	Yes
7c: Media	1.81	2.00	6.896	0.093	No
7d: User	2.99	2.84	6.061	0.195	No
7e: Doctor	3.69	3.86	6.185	0.193	No
7f: Internet	3.25	3.11	4.505	0.341	No

Only two out of the six information sources reported a significant difference in how the genders responded. These were the options of the Government and the independent scientist. The mean values show that the female group rated the government higher than the male group, while the male group ranked independent scientists higher than the females. The analysis was repeated using the variable of the different age groups, the mean values for each group are displayed in Appendix VIa Table 4.1.xvi.

There is variation of the mean values for the 'known users' option, with a clear difference between how the younger age groups and the two oldest age groups ranked this information source. This finding suggests that younger participants trust a known user more than the older. The younger age groups 18 to 49 also appear to rank a known user above that of the Government as a trusted information source. The results shown for doctor however are less clearly defined. Two of the age groups, the 40 to 49 and the 60+ rank the doctor significantly lower than the other age groups. The mean values given for the option of doctor can be compared by looking at the ranking in comparison to the option of scientist. A doctor was the highest ranked when looking at the results of the mean value from the total population, however there is deviation between the age groups on where it is ranked. For the age groups 18 to 21, 22 to 29, 30 to 39 and 50 to 59 the option of doctor has the highest mean value, for the other groups it comes in second behind a known scientist. The difference between the responses per age group was compared using a two way chi squared test, the results are shown in Appendix VIa Table 4.1.xvii.

Only two out of the six options returned a significant difference between how the age groups responded. There was a significant difference in how the age groups ranked the option of a known user ($\chi^2 = 32.559$, $P = 0.020$) and a doctor ($\chi^2 = 34.333$, $P = 0.007$), with the younger

groups rating the known users significantly higher than the older groups, with the reverse observed for the option of doctor.

There are three points that can be drawn from the results to question 7, which are relevant when considering the responses to question 6: *where would go if you were looking for information about drugs?* The first points that can be drawn is that the role of a doctor in providing accurate information is ranked as the highest out of the information sources the participants were asked about. Yet when this is considered alongside the fact that only 22.3% reported that they would seek information for themselves about drugs, and 25% reported that they would seek information for someone else about drugs from a doctor this suggests that there is a disconnect in how people seek information about this subject. The participants trust the information doctors provide but would not necessarily ask for it.

The second point of comparison concerns the role the government plays in drugs education. In questions 6a and 6b the governmental websites received 27.3% of participants reporting to use them to find information about drugs for themselves and 29.3% for someone else, yet the government was ranked second to last out of the information sources asked about. It also received a mean value of 2.86 that is just on the lower end of the scale. However the government did receive a mode of 4 and when examining the distributions of the histograms, the government seemed to split opinion more than any other of the options, with almost equal weighting between the 2, 3 and 4 options. What this shows is that though people are using the governmental websites as sources of information, the level to which they trust the information provided is variable. This may be an issue considering that the government and the information they provide is the basis for formal drugs education, and so if people do not trust the source of the formal education they may seek information from unverified sources, which could be harmful if the information is inaccurate. This links with the final point on the role of the internet. The internet was the categorical first choice for almost all participants, with 90% stating they would use it to find out information for themselves and 86.1% stating they would use it to find information for someone else. However as with the Government, the perception of the trusted accuracy this information source was in the middle of the scale, with a mean value of 3.16. This suggests that while most people will look for information on the internet, there is perhaps more contemplation on whether the information there is accurate or not.

Question 8: If you were considering taking a substance for the first time, or had recently taken a substance, who would you feel most comfortable discussing this with?

Question 8 posed a hypothetical situation to the participant. This question asked who the participants felt most comfortable discussing drug use with. The same options that were presented in question 6 were given with the additional option of adding their own suggestions through the use of the 'other' option. For this question the participant was limited to only choosing one of the options, compared to previous options that allowed for multiple choices.

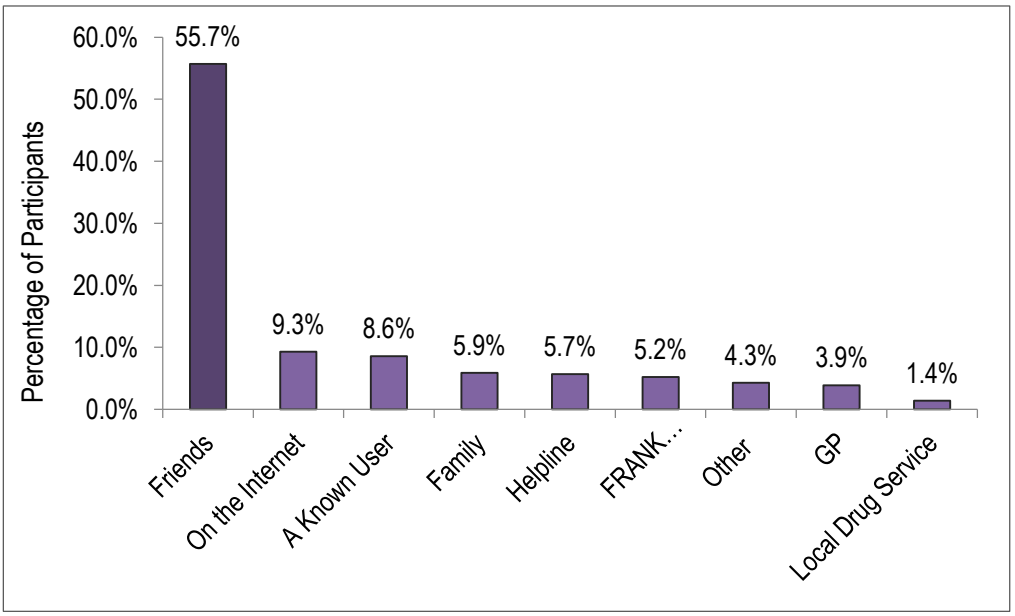


Figure 4.1.13: Results for Question 8 – who would you discuss your drug use with? (*n* = 440)

The majority of participants choose the friend option for this question, similarly to the results for question 6. However of the 440 participants only 4.3% who choose to utilize the other option the responses ranged from answers; 'n/a', no-one, nobody, and other comments along the lines of 'I would never try them'. One participant stated they would '*consult the appropriate literature*'. Very few people stated that they would feel comfortable discussing their first time drug use with a GP or doctor, despite the findings from the previous two questions that showed that the participants believed doctors to be the best source of accurate information.

4.1.4 Questions 9 to 12 – Importance of drug awareness

The last section of questions asked the participant's whether they thought drug awareness is important. It also allowed for the participants to elaborate on their reasons behind their answer in the form of two open questions, which permitted them to write as much or as little as they desired on the subject.

Question 9: Do you think it is important to be aware of drugs?

The first question in this section asked the participant about their own attitude towards drugs, did they think it was important to be aware of drugs. Due to the direct nature of this question only the options of yes or no were presented to the participants to choose from. The participant was then able to expand and comment on their choice in the open question format of questions 10 and 11. In response to whether the participants believe it is important to be aware of drugs the response was definite, with 99% of all participants responding with the yes category. This finding suggests that information on drugs is seen as important, the reasons behind the importance attached to drug awareness are discussed in the next question.

Question 10: If you responded 'Yes' to question 9, what are you reasons? (Why do you think it is important to be aware of drugs?)

This question, along with the juxtaposition of question 11: *If you responded 'No' to question 9,* were set to allow the participants to express their own opinions in as many words as they choose too. Based on the previous questions, which aimed to have made them think about what drugs in society meant to them. The two qualitative questions allowed them to articulate their own feelings on the subject if they so wished. They were voluntary question, unlike the previous 9 that required an answer to complete the survey.

Of the 440 responses to the survey only 40 of the participants declined to leave any answer to question 10. Four of the non-responses came from the participants who chose to answer No to question 9 and so answered question 11 instead. This meant that only 8% participants chose not to respond to this question, one of which responded in question 11 despite answering yes to question 9.The responses given by the participants ranged in length from a single sentence to multiple paragraphs. To analyses the key themes of the 400 responses, a

full copy of the answer transcript was entered into the online software Wordle (Feinberg, 2013) to create an image of the most prevalent words found in the text Figure 4.1.14.

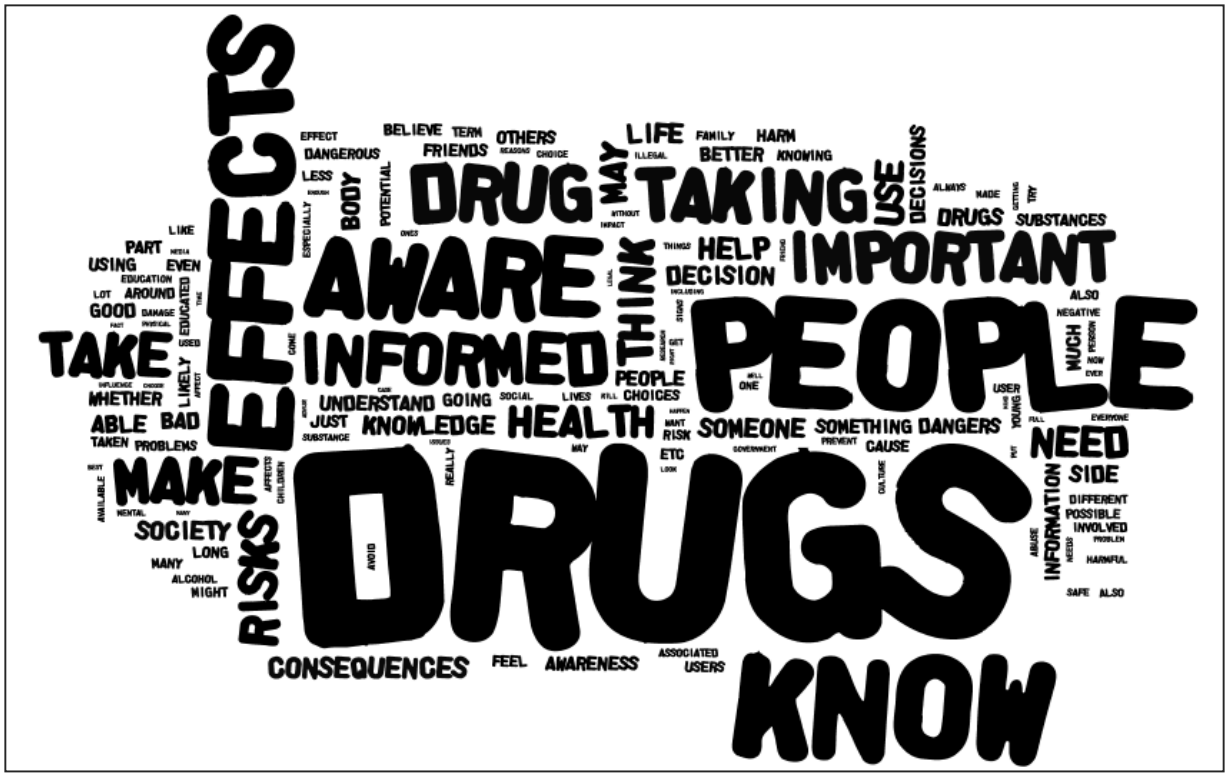


Figure 4.1.14: Worlde of the most prevalent words from participant responses to Q10 – Why do you think it is important to be aware of drugs*?)*

The image above shows a clear graphical representation of the key words that the particpants used to answer this question, with the size of the word representing how often it was repeated in text, the bigger the word the more frequent its use. The most dominant term found was the word drugs. Thematic analsysis was applied to interpret the main themes of the participants responses, through the use of NVivo software, 20 thematic words excluding the words *like*, *I* and *is* were identified. These words were then grouped into 5 main themes in which the responses from the participants could be organized, though within the responses some participants touched on more than one theme. Figure 4.1.15 displays the frequency with which each theme appeared in the participants responses.

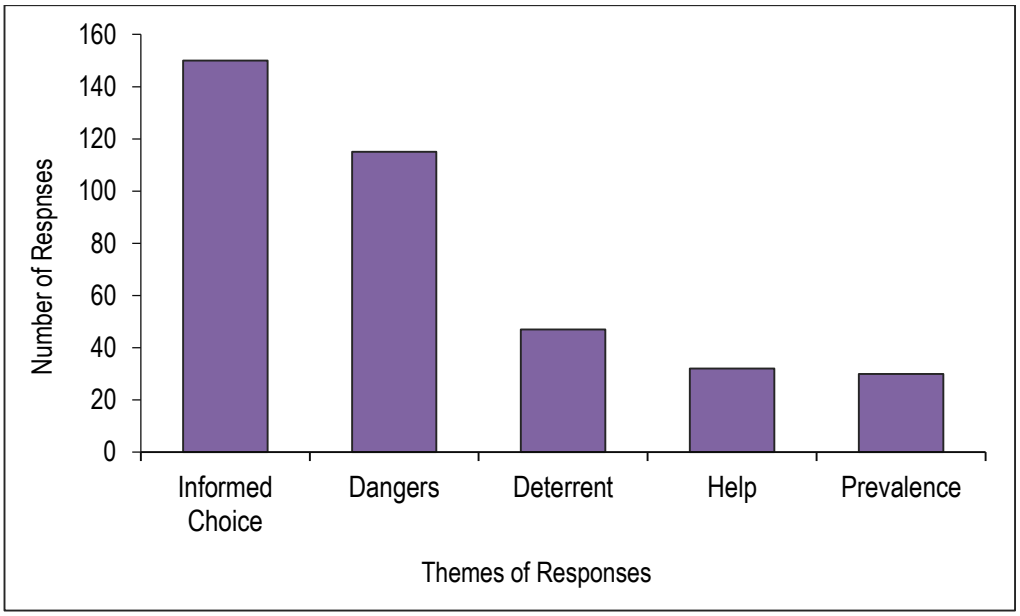


Figure 4.1.15: Frequency of responses relating to the five themes identified in response to question 10.

The first and most dominant theme identified was 'Informed Choice'. In these responses information and being informed was the most important feature highlighted by the participants on being aware of drugs. Awareness was often linked to the making of choices and decisions around using the substances. The tone of these responses were not so much concerned with the reduction of or prevention of the consumption of the substances discussed in the survey, rather that the people exposed to them can make an informed choice based objective information, as shown in the following example:

'To allow people to make informed choices as to whether they participate in drug-taking or not. As drugs are part of British culture whether you choose to take them or not, you will come in contact with people who are or have taken drugs and it's important to be aware.'
Participant 244

The responses that belonged within this theme were the most pro-choice of the responses, seeing drug use as an individual choice, which can only be helped by having the most information. This is in direct contrast to the responses from the second theme. The second thematic group focused on the 'dangers' or risks of drugs. Included into this theme were discussions on the physical, psychological, social or legal risks and harms that can be associated with drug use. There was some overlap between responses based on informed choice and those focused on the harms as to be able to make an informed choice all information must be considered. There were also responses with strong anti-drug messages,

from the simple ‘drugs are bad’ and ‘they kill’ to more elaborate answers such as the following example:

‘Because too many young people are not aware of the long term physical and mental consequences of short and long term drug taking. It's treated with such a lack of care and I believe that if more people could see the future effects of drug use, then they would think more carefully about taking drugs. Drugs are stupid and incredibly dangerous and I CANNOT understand why someone would consciously make the decision to put them into their system. So many young people die through carelessness and a lack of information - stay away from drugs and enjoy life in ways that won't kill you or damage your physical and mental health.’

Participant 426

These responses were the most negative and had the strongest antidrug message, indicating that the participants believed in strict prohibition as highlighted in the response from participant 426. The theme of prevention of using drugs linked with the responses from the third thematic group, which saw awareness of drugs as an important deterrent in reducing or preventing drug use. This again overlapped with the informed choice option, however here the participants state that they believed more information would reduce the likelihood that someone would want to use illicit substances. There is also overlap with the comments made by the group that mentioned the dangers, as being aware of the dangers is also seen a deterrent as exemplified in the following example:

‘Some do not understand the implications of taking drugs, and so enter into it not knowing the effects it could have. I think more awareness about drugs, the effects and the situations where they may be confronted with drugs (so may be able to avoid them) would help reduce the prevalence of drug abuse. I had no formal education about drugs (only learning bits in science) and have seen friends use gateway drugs, thinking they are harmless and unfortunately being led into using more hard drugs.’

Participant 149

The fourth thematic group represents the altruistic responses, where the main benefit of drug awareness was seen as the ability to help others. This ‘help’ was either in being able to provide information, or to provide some form of physical help to people who are suffering the negative effects of drugs, as in the following example:

‘Helping others by spotting the signs and getting them help. Understanding why people have taken them. Being able to get assistance if someone is in trouble from the effects of drugs. Being able to advise others of the harmful effects’

Participant 12

The final thematic group identified focused on the principle of prevalence. As drugs are seen a prevalent in society, which was demonstrated in the response to previous questions, it is therefore necessary to be aware of them. This was most eloquently described by participant 43, which is illustrated in the following example:

'They are everywhere, and whatever surrounds us we must surely appreciate as being part of human life. Even for those who do not branch into drug use, surely one must wonder what life is like on the other side of humanity, in the wild darkness where the fleeting glimpses of the hedonists and existentialists fly by. One must be aware of how humanity lives, for we are together in this mess. And drugs are a part of human life, and have been for a long time, from coffee to alcohol to heroin.'

Participant 43

Though five main themes were highlighted there was a significant amount of overlap, with most of the responses reflecting sentiments from more than one of the themes. Demographic analysis was applied to see whether any of the themes were particularly expounded by any group. Table 4.1.19 displays the frequency with which each theme appeared per demographic variable and the percentage it represents of that variable.

Table 4.1.19: Demographic analysis of responses to question 10 by theme

Themes	Male	Female	18 - 21	22 - 29	30 - 39	40 - 49	50 - 59	60+
Informed Choice	*37%*	*32%*	*37%*	*34%*	*33%*	*33%*	*32%*	*15%*
Dangers	*26%*	*26%*	*27%*	*31%*	*23%*	*10%*	*26%*	*25%*
Deterrent	*4%*	*15%*	*13%*	*10%*	*7%*	*8%*	*11%*	*10%*
Help	*8%*	*7%*	*3%*	*5%*	*12%*	*8%*	*11%*	*25%*
Prevalence	*9%*	*6%*	*4%*	*7%*	*12%*	*10%*	*5%*	*10%*
n	*163*	*277*	*177*	*128*	*57*	*39*	*19*	*20*

The data above shows that between the variables no theme is particularly dominant, with all groups proportionally being represented in each theme with a couple of exceptions. The 40-49 age group reported the least number of responses relating to the dangers of drug use. The 60+ reported the least responses for informed choice, however were more altruistic with the highest proportion reporting offering help as the key aim.

The response to question 10 were also analysed in correlation to whether the participant reported to have had education or not, the table is located in Appendix IVa Table 4.1.xvi. The results were tested using a two way chi squared and no significant difference was observed

between how the participant who had received education and those had not responded to this question. However these responses were only from the participants who thought it was important to be aware of drugs, either to make an informed decision or to know what to avoid. The next question examines the responses of the participants who thought it was not important to be aware of drugs.

Question 11: If you responded 'No' to question 9, what are you reasons? (Why do you think it is important to be aware of drugs?)

Question 11 was an opportunity for the participants who chose the no option in question 9 to elaborate on the reason behind their choice. However some participants who chose the yes in the previous question also made use of this question to either expand or repeat their previous comments. There were a total of 19 responses to this question, only three of which were from the participants who chose the no option in question 9. The responses from these participants were as follows;

'They are no more dangerous than alcohol'

Participant 46

'Not ever going to take any, will avoid them the best I can, don't see a need to educate myself on something I'll never use.'

Participant 287

'*If you aren't aware of drugs you probably aren't going to take them*.'

Participant 313

The last response is of particular interest as it contradicts the responses from the rest of the sample group, where being informed on the topic of drugs is seen as a positive, were forewarned is forearmed.

Comparison of results from Question 10 and 11

As stated in the previous section some participants choose to respond in both the section for question 10 and 11. Of these responses some participants merely repeated their response. For the ones that provided a difference responses to each questions, their responses can be found in Table 4.1.20. The responses are of similar themes to the ones discussed earlier, with no participant changing the direction of their opinion between answers the two either questions 10 or 11, when providing a reason why they believed it was or was not important to be aware of drugs.

Table 4.1.20 Responses of participants who responded in both question 10 and 11

Participant Number	Response to Question 10 Yes it is important to be aware of drugs	Response to Question 11 No it is not important to be aware of drugs
4	Because they are ever present in our city's...[sic]	Because I have 2 small children who will eventually grow up and be placed in the same situation's that I was.
123	informed choice	for family and friends
144	You can prevent [sic] people around you by informing the consequences of using drugs.	Protection of the family, friends and people around you.
178	one should know every possible outcome of drug use. ignorance leads to bad decisions.	if someone wants to use drugs, they should know the ins and outs of it and then make an informed decision, therefore if something eventually goes wrong there is no one else to blame but yourself.
228	Awareness of the law Awareness of short term and long term use in order to take educated risks.	Drug taking is a risk and it is important to understand the risks involved and why people choose to take these risks.
246	As a user it is important to be aware of the affects.[sic]	In today's society the majority of young adults use recreational drugs
354	I have worked as a Drug Education consultant in the past and know how much mis-information [sic] is out there. People need to be aware that we live in a drug taking culture/society: we go to the GP and expect to be prescribed something to enable us to feel better....So we need to build an awareness of the differences between medicines and drugs	All medicines are drugs but not all driugs [sic] are medicines. There are no medicines or drugs that are risk free.

Question 12: Do you think more should be done to educate people about drugs?

As with question 9, Question 12 was looking for a direct yes or no response to whether the participants think more education is needed to support people. Again the response to this question was a categorical yes with 91% of participants stating that they think more is needed to educate people about drugs. A one way chi squared was applied to test for significance, the test returned a chi square value of 301.13 and a P value of <0.001. This is significant at the critical significance level of 0.05.

4.2 Results for Survey B: Popularity and Prevalence

This section covers the results of the second social survey in this research. Unlike Survey A, the questions used in this survey asked the participants directly about past drug use, as well as their opinions and preferences of selected substances. There are four sections that cover questions on previous drug use, experience, choice and the participants' honesty around discussing drug use. As Survey B asked more direct questions relating to drug use the number of participants was less than that of Survey A, with the total number of respondents for the second survey being 252, the margin of error was 7% at a confidence level of 95%. The number is suitable when compared to the size of sample from previous drug surveys that ranged from 100 to over 7000 participants (GDS, 2013; Gross *et al.,* 2002; Hammersley *et al.,* 1999; Handy, Pates and Barrowcliff, 1998; McCambridge *et al.* 2005; Ogeil, Rajaratnam and Broadbear, 2013; Sherlock and Conner, 1999; Solowij *et al.,* 1992). Also, as the exact extent of the drug using community is unknown and unquantified, the results from this survey can provide a comparison to the larger cohorts collected by both the CSEW and the GDS. The participants were also asked a number of qualitative questions on their drug use, which can provide insight into the individual user's perspective.

4.2.1 Demographic Variable Results for Survey B

The second survey was run independently of Survey A and due to the anonymity of the survey method the responses from survey A cannot be directly correlated to those in survey B. However there is a similarity observed in the breakdown of the demographics collected.

Gender

The first variable that was collected was that of the participant's gender. Similar to the findings from Survey A the division of the participant's gender was weighted towards the female gender as shown in Figure 4.2.1.

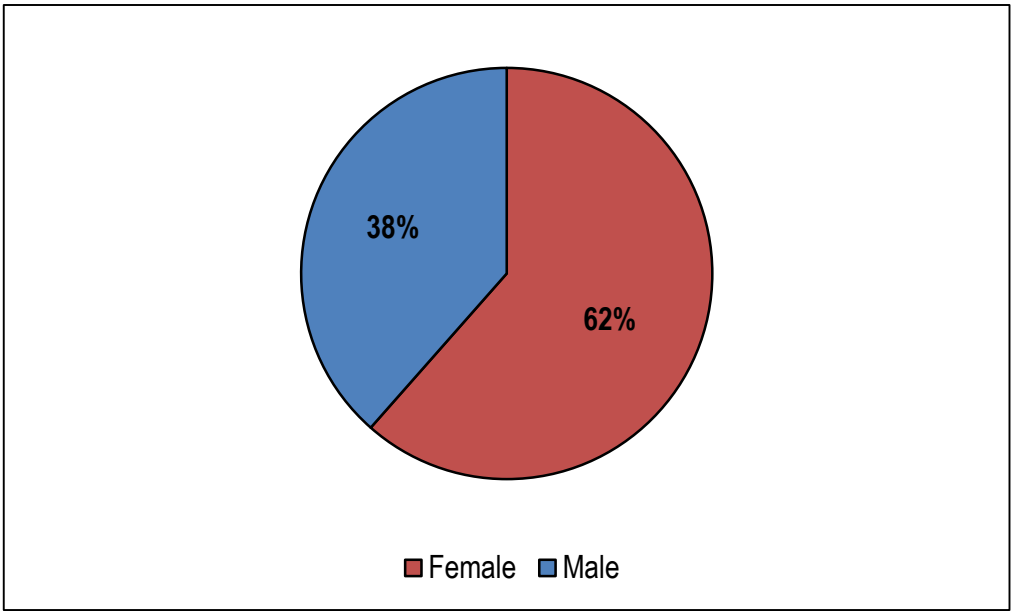


Figure 4.2.1: Proportion of male and female participants for Survey B: Popularity and Preference (*n* = 252)

The gender ratio collected for this survey is comparable to that of Survey A, which achieved 63% female participant population. The difference between the gender ratios of the two surveys was tested using a two-way chi squared that returned a χ^2 value of 0.14 and a P value of 0.708, which is not significant at the critical significance level of 0.05. This means that even though the actual number of respondents for survey B was less than survey A, there was no significant difference in the gender ratio between the two surveys and so comparisons between the two may be drawn. Gender was not the only variable, as the age of the participants was also considered.

Age

The second variable that was collected was that of the age of the participants, using the same groups that were used in Survey A. The frequency (shown as a percentage) of each band is shown in Figure 4.2.2.

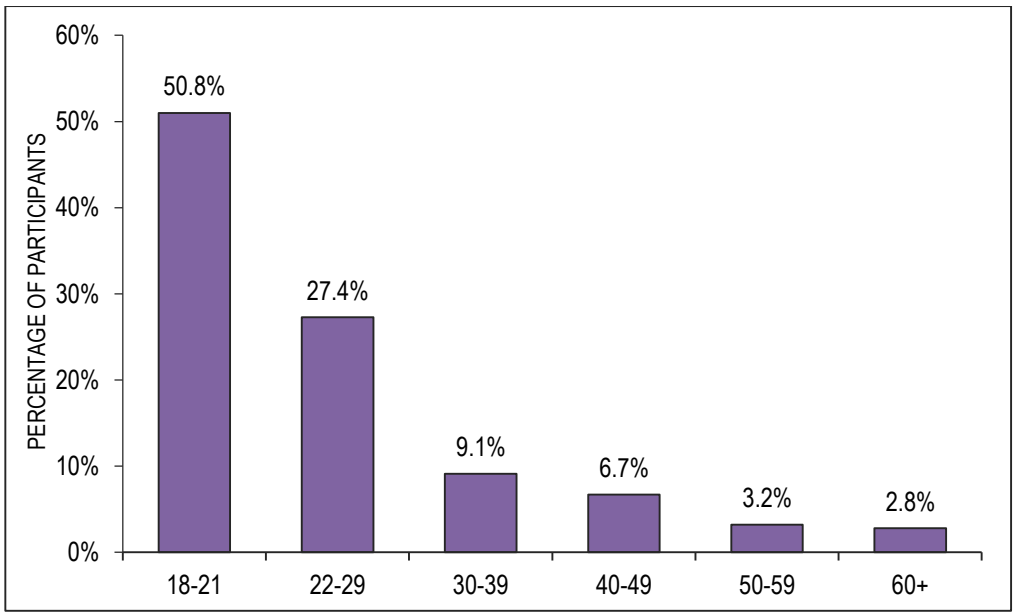


Figure 4.2.2: Proportion of participants for each age band for Survey B:Populairty and Preference (*n* = 252)

The results for this variable reflect a similar pattern to Survey A, suggesting that the distribution of the participants between the two surveys is again comparable. The difference between the proportion of age groups between Survey A and B was tested using a two-way chi squared that returned a χ^2 value of 8.96 and a P value of 0.110, which is not significant at the critical significance level of 0.05. This means that there is no significance difference in the proportion of the age groups between the two surveys.

The data was also tested to see whether the gender ratios within each age band were comparable to check that one age bad was not solely male or female, as was done with Survey A. Across all age ranges, except the 50 to 59 group the gender divide is weighted towards female participants but the proportion of males to females did not significantly vary band to band. The significance was tested using a two way chi squared that returned a χ^2 value of 4.129with a P value of 0.552, which exceeds the critical significance value of 0.05 and is therefore not significant.

Comparison of demographics to CSEW

The data collected in this research can be contrasted to the distribution reported on the participants groups collected for the CSEW. The proportion of participants that fell into the age bands specific to the CSEW as reported in 2013 are displayed Figure 4.2.3.

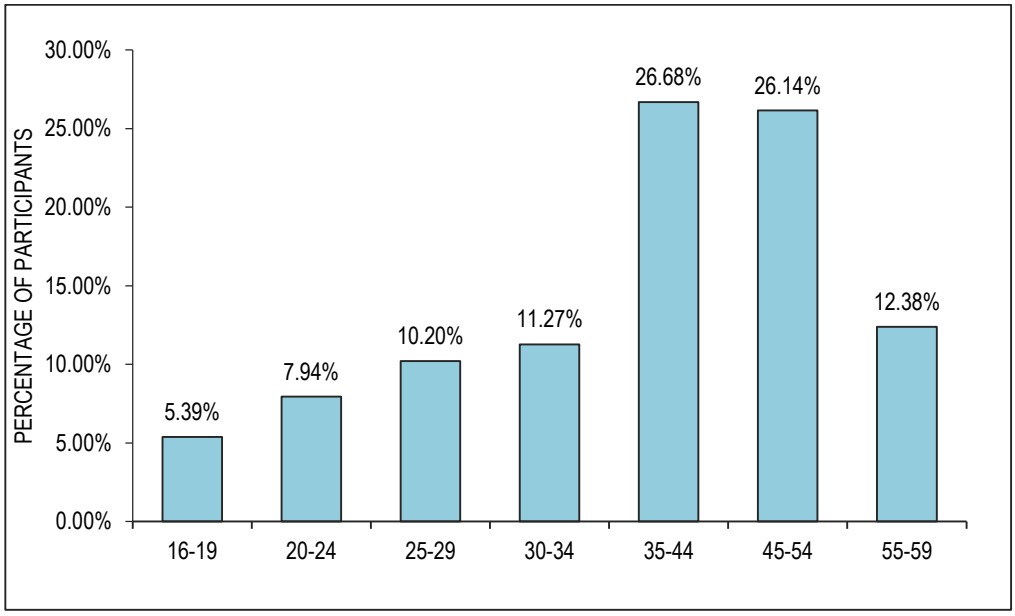


Figure 4.2.3: Percentage ratios for the age groupings as designated by the CSEW (*n* = 21363) (Home Office, 2013)

The above graph shows the weighting of participants for the CSEW is towards the upper age limit, with the majority of respondents being over the age of 35. Less than 20% of the participants fell into the age range indicative of Ecstasy use (20 to 29 years old), as indicated in section 2.7.2. This is a direct contrast to the findings from this survey in which 78% were under 30. The impact of this is examined in relation to the responses on drug use where the proportions from both surveys are compared. The specific demographic breakdown of the responses to the 2013 Global drug Survey have not been published, however for the 2012 survey only 24.5% of participants were over the age of 34 (Winstock, 2012).

4.2.2 Previous Drug Use

The first three questions in the survey asked the participants about their own drug use. These were based on the style of question that are found in both the CSEW (2013) and the GDS (2013). These questions were used to establish which participants had used which substance so they could be grouped together when analysing latter questions on specific substance use.

Questions 1 to 3: From the following list please check any substances that you have; 1) Ever taken, 2) Taken in the Last Year, 3) Taken in the last Month

For these questions the participants were asked to state which of the 19 chosen substances they had used within given time frames of stated in the questions. The significance of these results can be compared to the findings by both the CSEW (2013) and the GDS (2013), which use most, if not all of the substances selected in their own questions.

Table 4.2.1 below, displays the total number of participants reporting to have taken each substance within each of the given time frames. These responses were taken as reported, though verified to ensure that no participants claimed to have taken a substance in the last year or month, which they had not reported in their response to the first question.

Table 4.2.1: Total results for Questions 1, 2 and 3 on select substance use

	Q1: Ever		Q2: Last year		Q3: Last Month	
	Total	Percent	Total	Percent	Total	Percent
Alcohol	249	98.8%	239	94.8%	216	85.7%
Tobacco	203	80.6%	153	60.7%	111	44.0%
Cannabis	170	67.5%	98	38.9%	59	23.4%
Ecstasy	84	33.3%	42	16.7%	12	4.8%
Cocaine	76	30.2%	40	15.9%	23	9.1%
MDMA	76	30.2%	48	19.0%	19	7.5%
Mushrooms	59	23.4%	19	7.5%	2	0.8%
Ketamine	52	20.6%	27	10.7%	8	3.2%
Amphetamine	48	19.0%	18	7.1%	8	3.2%
LSD	40	15.9%	14	5.6%	3	1.2%
Mephedrone	37	14.7%	11	4.4%	1	0.4%
2CB	19	7.5%	5	2.0%	1	0.4%
Methamphetamine	14	5.6%	7	2.8%	5	2.0%
Methylone	10	4.0%	2	0.8%	0	
Crack	9	3.6%	3	1.2%	0	
Heroin	9	3.6%	3	1.2%	1	0.4%
BZP	6	2.4%	0		0	
Piperazines	6	2.4%	0		0	
Naphryone	0		0		0	
unweighted base (n)	252					

From the results it is evident that alcohol is the most prevalent drug with 98.4% of participants reporting to have 'ever taken' it, with tobacco coming in second with 80% of participants claiming to have ever used it. Unsurprisingly the most frequently reported illegal drug used by the participants was cannabis, with 67.2% claiming to have ever taken it. This finding correlates with reports from the CSEW, which states that cannabis is the most used illicit drug in the UK (Home Office, 2013). A graphical representation of the difference between the percentages of all 19 substances is shown in Figure 4.2.4.

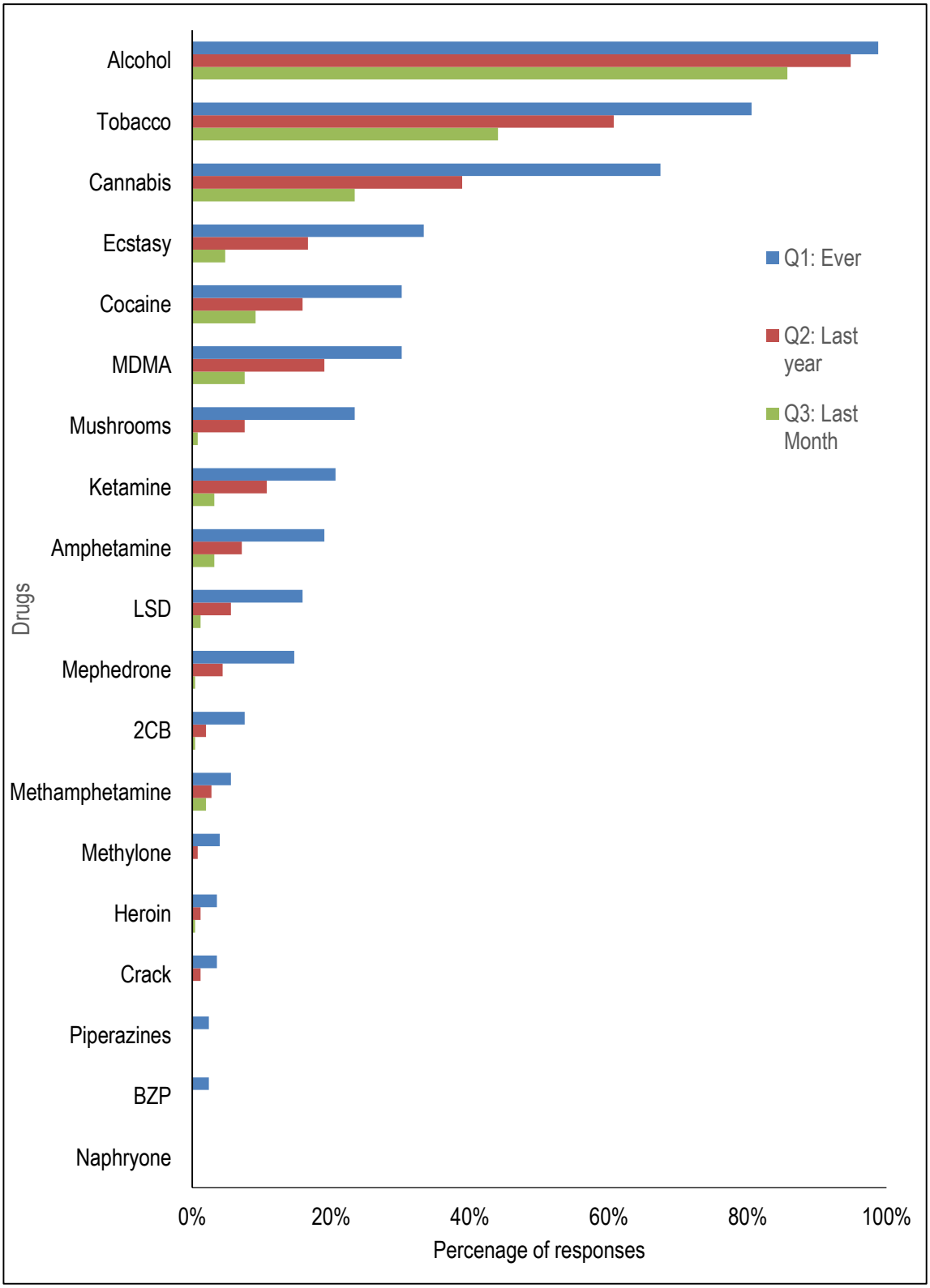


Figure 4.2.4: Reported use of select substances; ever, within the last year and within the last month (*n* = 252)

Comparative analysis of selected substances of interest from Questions 1 to 3

Further into the second survey the questions were limited to six select substances or group of substances; cocaine; Ecstasy; MDMA; ketamine; Mephedrone and the piperazines. Table 4.2.2 shows the responses just for these compounds.

Table 4.2.2: Comparison of six selected compounds assessed in Survey B (*n* = 252)

Substance Used	Cocaine	Ecstasy	MDMA	Ketamine	Mephedrone	Piperazines (including BZP)
Q1:Ever	30.2%	33.2%	30.2%	20.6%	14.6%	3.2%
Q2:Last year	15.8%	16.6%	19%	10.7%	4.3%	0
Q3:Last Month	9.1%	4.7%	7.5%	3.2%	0.4%	0

There was an increase in the reported use of MDMA compared to Ecstasy in the last month and last year categories. Yet with the category of 'ever taken' Ecstasy had a greater percentage of reported use. These results are compared to the reports from both the CSEW (ONS, 2013) and GDS (Mixmag, 2013) in Table 4.2.3. The table also includes data for cannabis as a point of reference as it is reportedly the most used substance. In the data presented by the CSEW, two different sample sizes are recorded for the questions of 'ever taken' (21,501) and 'taken in the last year' (21,363), the data is reported as presented (Home Office, 2013).

Table 4.2.3: Comparison of results between research survey, CSEW and the GDS for 2013

Substance	Survey B 2013 (this research)		CSEW 2012/13		Global Drug Survey 2013	
	Ever	Last Year	Ever	Last Year	Ever	Last Year
Cannabis	67.2%	38.7%	30%	6.4%	91.6%	78.8%
Cocaine	30.2%	15.8%	8.8%	1.9%	59.9%	41.5%
Ecstasy	33.2%	16.6%	8.3%	1.3%	64.3%	42.4%
MDMA	30%	19%	*(not included as a separate option)*		71.8%	60.8%
Ketamine	20.6%	10.7%	2.3%	0.4%	50.6%	31.5%
Mephedrone	14.6%	4.3%	*1.9%*	*0.5%*	36.1%	13.8%
n	*252*		*Ever = 21501 Last Year =21363*		*7700*	

The results in the above table show a discrepancy in the reported levels of use for specific recreational substances. In the survey produced for this research, the proportion of participants reporting to have ever taken cocaine and Ecstasy is around a third, compared to just over 8% from the CSEW and 59.9% and 64% found in the GDS respectively. When focusing on the responses for Ecstasy and MDMA it is not possible to draw a comparison with the CSEW as only used the term Ecstasy is reported, with no distinction between the two. However this doctoral research and the GDS used both terms independently and both reported a greater level of use in the last year for MDMA over Ecstasy. The use of Mephedrone is reported to be the least ever taken and having the lowest reported usage for last year in both this research and the GDS and the second lowest usage in the CSEW, of the selected substances examined.

The differences between the reported levels between these three surveys is evident when looking at the results for the drug cannabis. In the reports by the CSEW only 30% of the participants questioned in 2013 had ever taken cannabis (Home Office, 2013), compared to the 91.6% reported in the GDS (Mixmag, 2013) and the 67.2% in the survey conducted for this research. The evidence presented here supports the earlier criticism made in section 3.3.3, that estimating drug-using populations is problematic and dependant on sampling methodology. The range observed between the two surveys criticised here show the variation in data that can be collected. However the results from this survey, despite being a smaller sample set, had proportional responses closer to the GDS than that of the CSEW. This is most likely due to the demographic characteristics of the participants in this survey, with 78% of the participants from this survey in the age range highlighted in section 2.7 as when drug use is most likely to be reported.

Separating participants into 'User' and 'Non-User' group

As no exclusionary questions were asked at the beginning of the research survey to exclude non-drug users the participants' responses can be separated into two groups; the users and the non-users. The groups can be further subdivided by users of the selected substances of interest. This survey sought to learn what the perceptions users had of taking Ecstasy, MDMA and Mephedrone. The non-users can provide a control group for comparisons as well as for providing further insight as to why these substances do not appeal to the non-users. The 'total user' group was defined as any participant who reported to have ever taken any substance other than alcohol or tobacco, this equates to 171 of the participants for this survey or 67.9% of the participant population. As this survey focused on six selected substances each substance had a user group of varying size, shown in Table 4.2.4.

Table 4.2.4: Number of users reporting to have taken six selected substances

Substance	Cocaine	Ecstasy	MDMA	Ketamine	Mephedrone	Piperazines (including BZP)
Users	76	84	76	52	37	8

Of the 252 participants registered, only four reported to have ever taken all six of the substances of interest. A further 21 reported to have taken cocaine, Ecstasy, MDMA, Mephedrone and ketamine. Two further participants reported to have taken all bar ketamine. Of the substances related to the rest of the thesis, an additional three participants reported to have taken Ecstasy, MDMA and Mephedrone and a further eight reported to have taken just Ecstasy and MDMA. As these numbers are quite small the 'user' group included users reporting to have taken at least one of the substances in question, as the questions later in the survey relate more to hypothetical scenarios and perceptions relating to the other substances.

Demographic analysis of Drug using groups

The demographic variables were applied to the user groups determined whether a particular substance was preferred by one set over another. Firstly the questions were assessed by the gender of the participants, whether the user groups of the substances of interest were more male dominated as was suggested in previous studies. Figure 4.2.5 displays the percentage of male and female users who reported to have ever taken each of the five substances.

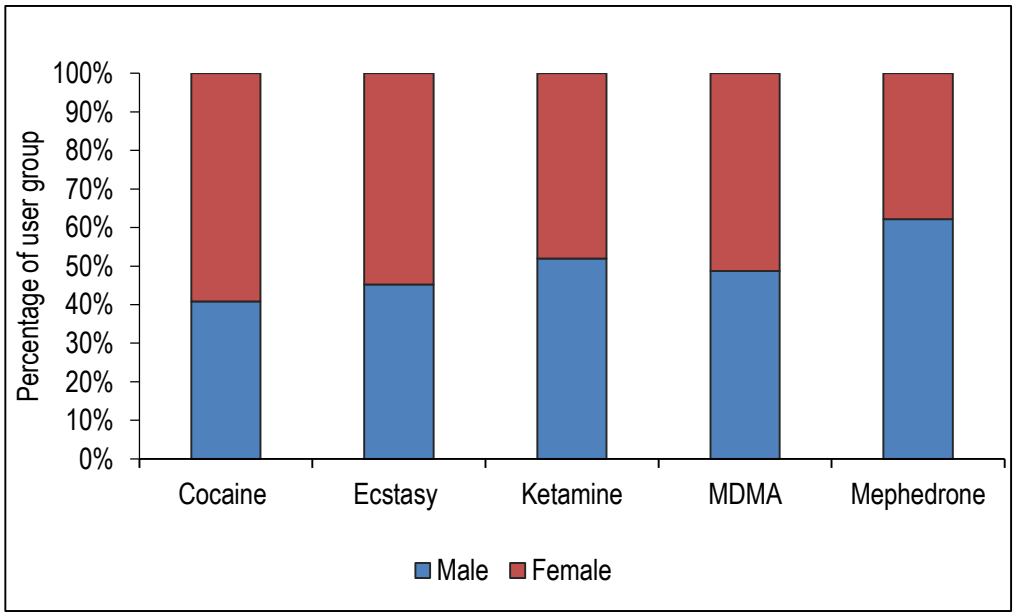


Figure 4.2.5: Percentage of male and female participants reporting to have 'Ever Taken' each of the five substances (*n:* Cocaine = 76, Ecstasy = 84, Ketamine = 52, MDMA = 76 and Mephedrone = 37)

The graph above shows that for cocaine, Ecstasy and MDMA the user group was more heavily female, whereas for ketamine and Mephedrone the user group was more male-weighted. The piperazine user group was not included as it was 100% male. To test whether there was a significance difference between the number of males and females within each user group a one way chi squared test was applied, a table of the full test statistics is located in Appendix IVb Table 4.2.i. When tested using the one way chi squared, there was no significant difference observed between the genders for any of the five user groups. However, as the ratio between the genders was not evenly split, a two way chi squared was applied to test whether there was a difference between the genders who reported use of the substances and those who did not. The results for this are shown in Appendix IVb Table 4.2.ii.

The results showed that four out of the six substances did have a significant difference in the reported usage between the using and the non-using males and females. For the substances MDMA, ketamine, Mephedrone and the piperazines a significantly larger proportion of the male participants reported to have ever taken these substances. So although there were more females reported in the using groups, there was a greater proportion of male users in relation to the male non-users. The tests were also applied to the questions of '*Taken in last year*' and '*Taken in the last month*', with the results shown in Appendix IVb. The only responses that showed a significant difference were the responses to Ecstasy – *last month*, Ketamine – *last year* and Mephedrone – *last year*, all of which reported significantly more male participants. Although a greater proportion of the male participants reported to have taken these substances compared to the non-using population, the actual division of participants within the using groups was not significantly different between the two genders.

The other variable that was assessed was the impact of age on the use of substances, which was assessed in two ways. Firstly by the number of participants from each age group that made up the user group, and secondly the percentage of each age group reported to have used the substances. Figure 4.2.6 displays the results for each user group responding to the question 'Ever Taken' separated into age group, shown as the actual number of participants.

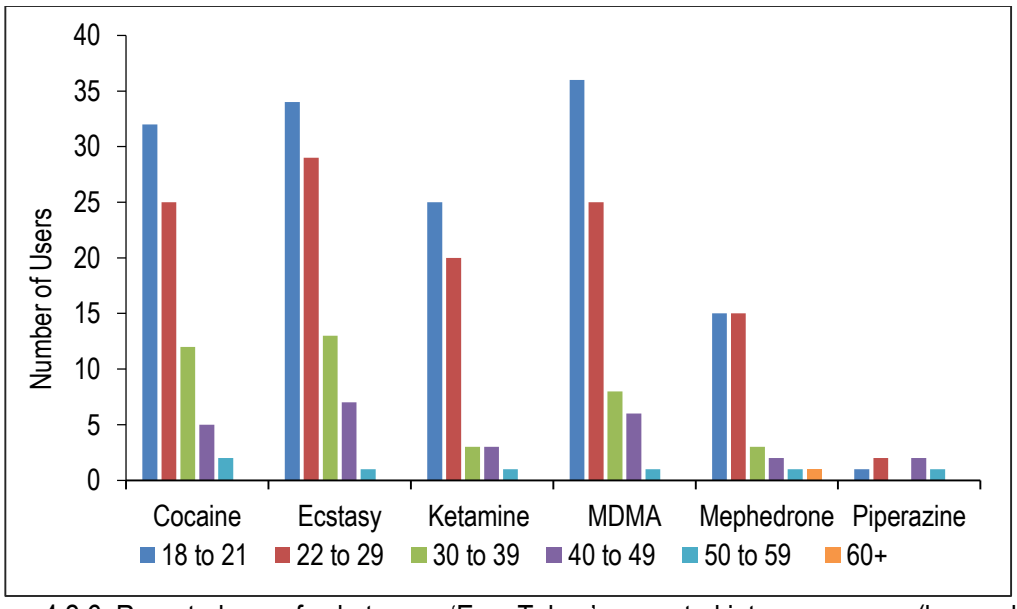


Figure 4.2.6: Reported use of substances 'Ever Taken' separated into age groups (by number)

In all groups except piperazine the majority of the users responding to this survey fell into the first two age groups. However, as with the variable of gender, the participants were not equally distributed between the age groups, Figure 4.2.7 displays the results to question 1 as a proportion against the total for each age group.

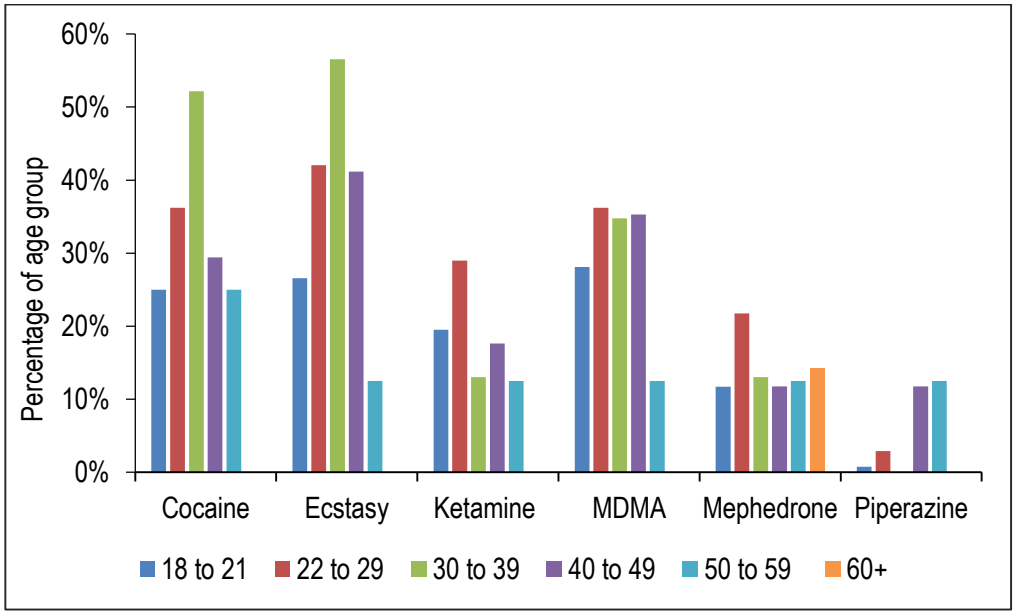


Figure 4.2.7: Reported use of substance separated into age group (by percentage calculated against size of age group)

When the proportional size of users per age group is considered there is a difference in the most prevalent users. For both cocaine and Ecstasy the group with the highest proportion of users was the 30 to 39 age group. For ketamine, MDMA and the Mephedrone age group it is the 22 to 29 age group, piperazine was an anomaly with a high proportion for 40-49 and 50-59 groups. This is due to the relatively low sample size for both these age groups and the low level of response to piperazine. The analysis of question 2 (taken in the last year) and question 3 (taken in the last month) with regards to the variable of age is located in Appendix IVb Figures 4.2.iii through to 4.2.vi. The implication of the difference in the gender and age group will be considered alongside the user and non-user group when analysing the rest of the survey.

4.2.3 Questions on the Participants Experience of the Substances

The second section of this survey focused on the user experience of the six selected substances discussed previously. The questions sought to discover how the participants rated their physical and emotional experience of the substances. The differentiation in experiences was based on the fact that the chemical MDMA, the focus of this research, has well documented empathogenic as well as stimulant properties as discussed in section 2.3 (Curran and Travill, 1997; Downing, 1986; Freese, Miotto and Reback, 2002; Greer and Tolbert, 1986; Harris *et al*., 2002, Kirkpatrick *et al.*, 2015; Peroutka *et al., 1988;* Sumnall, Cole and Jerome, 2006; Vollenweider *et al.,* 1998).

Question 4: How would you rate your physical experience on the following substances?

Question 4 sought to learn from the participant about their physical experience when taking the selected substances. The participants were presented with four options to answer this question: *negative*; *indistinct*; *positive* and *'have not taken this substance'*. It was anticipated that the participants who indicated in the first three questions that they had not taken a substance would choose the '*not taken*' option. The participants who did report to have taken the substance were asked to rate their subjective experience of the substance in question. The frequencies for each option, separated into the two sub-groups of users and non-users, shown in Table 4.2.5.

Table 4.2.5: Frequencies for each substance shown for user and non-user groups answering question 4 on Physical experience of selected drugs

	Substance	Cocaine		Ecstasy		MDMA		Ketamine		Mephedrone		Piperazines	
		User	Non-User	User	User	User	Non-User	User	Non-User	User	Non-User	User	Non-User
Effect	Negative	9	0	5	0	5	0	13	2	11	0	3	2
	Indistinct	25	1	13	1	6	1	9	1	9	2	3	1
	Positive	42	5	64	1	65	2	29	1	15	1	1	0
	Have Not Taken	0	169	2	166	0	173	1	196	2	212	1	241
	Total	76	175	84	168	76	176	52	200	37	215	8	244

The data in the previous table shows that despite claiming not to have taken a substance some of the non-users rated the physical experience and some of the user participants now state not to have taken the substances. As the survey has been taken at face value the change in the participants recording was noted but was not included in the further analysis of the question, and so the user group totals were adjusted to reflect only the participants responding consistently between question 1 and 4.

Table 4.2.6 shows the results for question 4 as a percentage of each user group, with the percentage calculated by dividing each frequency by the total for the respective group. For example 76 participants reported to have taken Cocaine, 9 reported to have had a negative experience, the percentage represented is a proportion of the 76 participants as opposed to a percentage of the total participant population. In this analysis the responses of 'Not Taken' were not included. The difference between the responses for each substance was tested using a one way chi squared, the results displayed in the table below.

Table 4.2.6: Percentage of user group responses and significance for question 4

Substance	Negative	Indistinct	Positive	χ^2 Value	P Value	Significant
Cocaine *(n = 76)*	11.8%	32.9%	55.3%	21.62	<0.001	Yes
Ecstasy *(n = 82)*	6.1%	15.9%	78.0%	75.14	<0.001	Yes
MDMA *(n = 76)*	6.0%	7.9%	85.5%	93.40	<0.001	Yes
Ketamine *(n = 51)*	25.5%	17.6%	56.9%	13.18	0.0014	Yes
Mephedrone *(n = 35)*	31.4%	25.7%	42.9%	1.61	0.447	No
Piperazine *(n = 7)*	42.9%	42.9%	14.2%	1.15	0.563	No

Across all of the selected drugs except the Piperazine group, the majority of the users reported that their physical experience of these drugs was positive. Though there is a range in the percentages for the positive ratings, from an 85.5% for MDMA to only 42.9% for Mephedrone. If the substances are ranked by the proportion of users who rated their experience as positive the order would be as follows; MDMA, Ecstasy, ketamine, cocaine, Mephedrone and lastly the piperazines.

The indistinct category provides an interesting insight, as all of these drugs should provide some form of physiological response. The proportional rank order according to those who

described their experience as indistinct (neither good nor bad) were; piperazines, cocaine, Mephedrone, ketamine, Ecstasy and lastly MDMA. Whether this suggests that the quality of these substances is more variably or that the expectations the participant had were not meet can only be speculated. However it is clear that of these drugs, MDMA and Ecstasy have a comparably high positivity of physical experience attributed to their use.

The results of the significance test show that four of the substances – cocaine, Ecstasy, MDMA and ketamine did display a significant difference between how the users rated their experience. However for Mephedrone and piperazine no significance was observed, this could reflect the relative effects of these substances or may be due to the small numbers of participants who reported taking them. This difference will be explored through the use of qualitative questions later in the chapter.

The results for question 4 were also assessed based on the gender of the respondents, to see whether there was a difference in the experience between the male and female users. The results were tested using a two way chi squared, which returned no significant difference between how the genders responded to this question for any of the substance that were assessed. Piperazines were not included as the user group was completely male. The table of results for gender and the two way chi squared is located in Appendix IVb Table 4.2.iv. As the results for variable of age had many groups with no responses a reliable statistical comparison between the groups was not possible to determine whether there was a difference between how the age groups rated question 4.

Question 5: How would you rate your emotional experience on the following substances?

Question 5 asked the participants to rank their 'emotional' experience of the selected substances. The choice of the word 'emotional' was perhaps not the most accurate description when it comes to describing the feelings experienced under the influence of these substances, however it was included because MDMA/Ecstasy belong to the empathogenic subclass (Curran and Travill, 1997; Downing, 1986; Freese, Miotto and Reback, 2002; Greer and Tolbert, 1986; Harris *et al.*, 2002, Kirkpatrick *et al.*, 2015; Peroutka *et al., 1988;* Sumnall, Cole and Jerome, 2006; Vollenweider *et al.,* 1998) and Piperazines and Mephedrone are reportedly mimics or replacements for MDMA (Measham *et al.,* 2010; Wood and Dargan, 2012). It also provides a contrast between what is felt physically under the influence of these substances and what is felt psychologically. The participant was presented with the same four options as the previous question to answer this question – *negative*; *indistinct*; *positive* and '*have not taken this substance*'. As with Question 4 the responses were divided into the two groups, which were indicated by the responses to Question 1. The frequencies for each option were separated into the two sub-groups and shown in Table 4.2.7.

Table 4.2.7: Frequencies for each substance shown as user and non-user groups for Question 5 on emotional experience

	Substance	Cocaine		Ecstasy		MDMA		Ketamine		Mephedrone		Piperazines	
		User	Non-User	User	Non-User	User	Non-User	User	Non-User	User	Non-User	User	Non-User
Effect	Negative	8	0	4	0	3	0	14	3	9	0	2	0
	Indistinct	27	1	3	1	1	1	13	1	7	1	3	3
	Positive	41	5	75	1	72	2	24	0	19	1	2	0
	Have Not Taken	0	169	2	166	0	173	1	196	2	213	1	241
	Total	76	175	84	168	76	176	52	200	37	215	8	244

The data in the table on the pervious page shows similar results to those for Question 4, with some participants who claimed not to have taken a substance rated the emotional experience and some of the user participants now state not to have taken the substances, with the same participants as Question 4. As the survey has been taken at face value any changes in the participants recording were again noted and the user group totals reflect this change. Table 4.2.8 shows the frequencies from Table 4.2.7 as percentages of each substances user group. This analysis also did not include the responses of 'Not Taken'. The difference between the responses for each substance was tested using a one way chi squared, the results displayed in the table below.

Table 4.2.8: Percentages of users who rated each substance and the significance for question 5

Substance	Negative	Indistinct	Positive	Chi Square Value	P Value	Significant
Cocaine *(n = 76)*	10.5%	35.5%	54.0%	21.78	<0.001	Yes
Ecstasy *(n = 82)*	4.9%	3.6%	91.5%	124.21	<0.001	Yes
MDMA *(n = 76)*	4.0%	1.3%	94.7%	128.49	<0.001	Yes
Ketamine *(n = 51)*	27.4%	25.5%	47.1%	4.35	0.114	No
Mephedrone *(n = 35)*	25.7%	20.0%	54.3%	7.10	0.029	Yes
Piperazine *(n = 7)*	28.6%	42.8%	28.6%	0.29	0.869	No

The results show that across all substances the majority of each user group rated the 'emotional experience' of each substance as a positive one, again with the exception of the piperazine group. The size of the percentage differed between substances and so a rank order can be established. The order being: MDMA; Ecstasy; Mephedrone; cocaine; ketamine and lastly piperazines.

The rank orders between the responses to questions 4 and 5 are almost identical across all three options with the exceptions of the results for ketamine and Mephedrone, which swap position in each option. Mephedrone is consistently ranked lower in the physical response, whereas ketamine ranked lower in the emotional. This will be due to the reported negative effects of these substance, which the participants discuss in their responses to the qualitative questions later in the section.

The results of the significance test shows that there is a difference in how the participants rated their emotional experience for cocaine, Ecstasy, MDMA and Mephedrone. Neither the piperazines nor ketamine displayed a significant difference in how the participants rated their emotional experience. This may be anticipated in the case of ketamine, which does not have the same effects as the other substances, as it is not a stimulant but a dissociative anaesthetic (Curran and Morgan, 2002). Again the reason for the non-significant result for piperazine may be due to the small sample size.

The response to question 5 were also assessed by the variable of gender, to see whether there was a difference between the emotional experiences of the two genders. This was tested using a two way chi squared, which again returned no significant difference across any of the substances. The table of these results are located in Appendix IVb Table 4.2.v. As the results for variable of age had many groups with no responses a reliable statistical comparison between the groups was not possible to determine whether there was a difference between how the age groups rated this question.

A cross tabulation of Question 4 against Question 5 for each of the substances was compiled to see if there were any major differences in the participants' responses for physical and emotional experiences. The variability observed between responses was low across all substances. These tables are located in Appendix IVb (Tables 4.2.vi to xi).

Question 6: Have you or do you know someone who has ever had a bad experience on any of the following substances?

Carrying on the theme of the previous questions, this question asked about the participants bad experiences with the substances. Unlike the previous questions that were dependant on the participant having first-hand knowledge of the selected substances, this question allowed for the non-user group to answer based on their knowledge of someone else reporting to have had a bad experience with the substances. This question examines the user based experiences but also the reputations of the substances in question. Table 4.2.9 displays the frequency for each response and its percentage of the total participant group.

Table 4.2.9: Frequency and percentage of responses to Question 6 (*n =252)*

	Cocaine	Ecstasy	MDMA	Ketamine	Mephedrone	Piperazines
Yes Myself	11	15	9	23	15	2
	4.4%	6.0%	3.6%	9.1%	6.0%	0.8%
Yes Someone else	89	84	62	88	39	14
	35.3%	33.3%	24.6%	34.9%	15.5%	5.6%
No	152	153	181	141	198	236
	60.3%	60.7%	71.8%	56.0%	78.6%	93.7%

The above table shows that the responses for '*yes-myself*' are relatively low; with all substance reporting less than 10% of the participants, the highest being ketamine at 9.1%. Of the responses to '*Yes – Someone else'* cocaine, Ecstasy and ketamine reported similar levels at over a third of participants having heard of someone else having a bad experience. The findings for Mephedrone and piperazines correlate to the findings from Survey A as both these substances appear to be relatively unknown to the public. To further explore this question the results were separated into user and non-user groups to establish whether the users were more likely to have responded to the '*Yes-someone else'* option. The first option of '*Yes-Myself*' should be exclusive to the user group. The results are shown in Table 4.2.10.

Table 4.2.10: Question 6 User responses vs non-user responses to having or hearing of bad experiences with the substances

	Cocaine		Ecstasy		MDMA		Ketamine		Mephedrone		Piperazines	
	Users	Non	Users	Non	Users	Non	Users	Non	Users	Non	Users	Non
Yes - Myself	11	0	15	0	9	0	20	3	14	1	1	1
	14.4%	0.0%	17.9%	0.0%	11.8%	0.0%	38.5%	1.5%	37.8%	0.5%	16.7%	0.4%
Yes - Someone else	28	61	36	48	25	37	23	65	13	26	4	10
	36.8%	34.9%	42.9%	28.6%	32.9%	21.0%	44.2%	32.5%	35.1%	12.1%	66.7%	4.1%
No	38	115	33	120	42	139	9	132	10	188	1	235
	50%	65.1%	39.3%	71.4%	55.3%	79.0%	17.3%	66.0%	27.0%	87.4%	16.7%	95.5%
Total	*76*	*176*	*84*	*168*	*76*	*176*	52	200	*37*	*215*	*6*	*246*

As mentioned previously the responses to this question can provide insight into the reputations of the substances in question. The reputations can be assessed by analysing the responses to the '*Yes-Someone else*' option, as this option suggests a second-hand knowledge or association of this substance with negative reactions, which can be further assessed by identifying whether there is a difference between the user and non-user groups. Using the figures generated from Table 4.2.10 a bar graph of the proportional responses to Question 6 – *Yes - Someone Else* was generated and is shown as Figure 4.2.8.

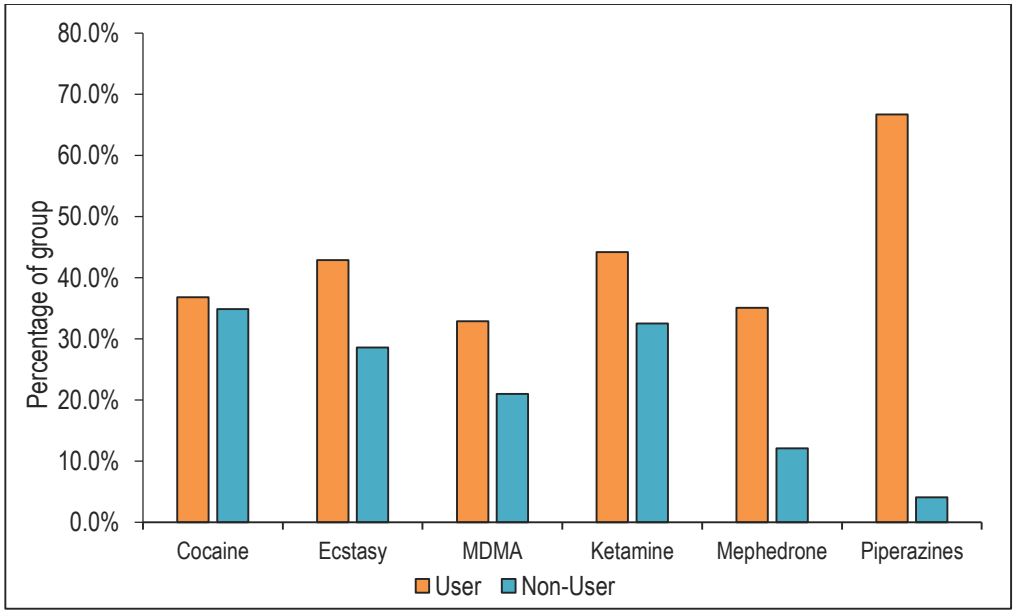


Figure 4.2.8: Proportional percentages for the response to Question 6 – 'Yes-Someone else'

The data displayed in the chart above shows that across all substances the user group are proportionally larger. The significance between the user and non-user group was tested using a two way chi squared, the results are shown in Table 4.2.11.

Table 4.2.11: Significance test between users and non-user group when responding 'Yes – someone else

Substance	χ^2 Value	P Value	Significant
Cocaine	0.11	0.740	No
Ecstasy	5.14	0.023	Yes
MDMA	4.03	0.045	Yes
Ketamine	2.50	0.114	No
Mephedrone	12.81	<0.001	Yes
Piperazine	43.75	<0.001	Yes

The piperazines group of substances had the highest proportion of its user group reporting to know someone who had a bad experience; it also had the biggest difference in proportion between the user and non-user groups. This lends support to the theory of the relative anonymity of this substance outside drug using groups.

The responses relating to Mephedrone were similar to those for piperazine showed a far greater proportion of users who knew of someone else having a bad experience compared to the non-user group. This was a significant difference when tested using the chi squared at the critical significance level of 0.05. This could again be due to the relative anonymity of this substance, as suggested in the results from Survey A.Ecstasy had the third highest response rate, for the user group having heard of someone else having a bad experience. MDMA on the other hand had the smallest proportion of users reporting knowing someone who had had bad experience. The responses from non-users were closer with Ecstasy obtaining 29% and MDMA 21%.

The responses to question 6 were also assessed using the variable of gender. The responses to '*Yes-myself*' were compared using a two way chi square to see whether there was a difference between the genders in who reported having had a bad experience. Across all substances no significance was reported between the genders and bad experiences, the results are shown in Appendix IVb Table 4.2.xii. The responses for '*Yes – someone else'* were also compared to test whether there was a difference between how the genders in the users and non-users responded to this question, again tested using a two way chi squared. The results are shown in Table 4.2.12.

Table 4.2.12: Gender responses to Question 6 'Yes-someone else' and statistical significance using two way chi squared (critical significance level 0.05)

Drug	Gender	User	Non-user	χ^2 Value	P Value	Significant
Cocaine	Male	16	18	6.21	0.013	Yes
	Female	12	43			
Ecstasy	Male	18	13	4.64	0.031	Yes
	Female	18	35			
MDMA	Male	16	9	3.63	0.057	No
	Female	9	28			
Ketamine	Male	15	19	9.28	0.002	Yes
	Female	8	46			
Mephedrone	Male	8	8	3.39	0.065	No
	Female	5	18			

More male users reported to know someone who had had a bad experience using cocaine, compared to more females for the non-user group. Ecstasy had the same number of each gender from the user group reporting to know someone who had had a bad experience, but significantly more females from the non-user group. Ketamine followed the same pattern as cocaine, with more male users reporting to know someone who had had a bad experience, compared to more female from the non-users.

The results from question 6 support the hypothesis that there is a definite disparity in how the two terms, Ecstasy and MDMA are being perceived. MDMA reported less negative experiences in question 4 and 5 and less bad experiences in question 6 for the responses '*Yes – myself*' and '*Yes – someone else'* compared to Ecstasy, despite both supposedly containing the same chemical. These findings further support the results from 'Survey A: Knowledge and Awareness', that these two terms represent two completely separate entities/products.

Question 7: Has your personal experience changed your drug use of the following?

This question examined whether the participants experience of the selected substances had had an effect on changing the participant's behaviour towards the selected substances as self-reported. The participants were given the choices of Yes, No and Not Taken. The reasons behind the participant's choice for both question 7 and question 8 were further explored with the qualitative open responses analysed in questions 9 and 10. The results for this question are shown in Table 4.2.13, which shows the overall percentages for each of the options per substance.

Table 4.2.13: Responses for question 7 on changing behaviour on use of the substances shown as percentage of total population (*n* = 252)

	Cocaine	Ecstasy	MDMA	Ketamine	Mephedrone	Piperazines
Yes	12.3%	11.9%	11.9%	11.9%	8.3%	2.4%
No	20.2%	21.0%	19.4%	10.3%	7.1%	3.2%
Not Taken	67.5%	67.1%	68.7%	77.8%	84.5%	94.4%

The same number of participants reported changing their drug use based on personal experience for cocaine, Ecstasy, MDMA and ketamine, with around 12% of the total participant population reporting a change in their use of these substances. A one way chi squared was applied to test whether there was a significant difference between the responses

to *Yes* and *No* for each of the six substances. The responses to '*Not Taken'* were not included as this indicated that this question was not applicable. The results of the chi square returned a significant difference for; Cocaine (χ^2 = 4.88; P = 0.036), Ecstasy (χ^2 = 6.37; P = 0.016) and MDMA (χ^2 = 4.57; P = 0.043) all of which are significant at the critical significance level of 0.05, with more participants stating their use had not changed. The other three substances (ketamine, Mephedrone and piperazines) did not report a significant difference between the responses of *Yes* and *No*.

However as this question was based on personal experience the responses should be considered in the context of the user groups. As the number of participants who reported to have used each substance varied between the selected substances, the proportion of users reporting to have changed their use will vary between substances.

As was seen with previous questions some participants in the non-user group responded to this question, reporting to have changed their behaviour, shown in Table 4.2.13. As this was inconsistent with their responses to question 1 '*ever taken'*, these responses were not included in the user group analysis. There was also inconsistency within the using group, with some participants reporting to have not taken the substance. The user groups were adjusted to the same values as seen in questions 4 and 5. Table 4.2.14 displays the responses from the user group as a frequency and a percentage of each respective drug-using group. The significance was also tested using a one way chi square, with the results shown in the table.

Table 4.2.14: User responses to Question 7: Has your experience changed your usage (percentage shown against total for user group)

Substance	Yes	No	χ^2 value	P Value	Significant
Cocaine *(n = 76)*	40.8%	59.2%	2.58	0.136	No
Ecstasy *(n = 82)*	36.6%	63.4%	5.90	0.020	Yes
MDMA *(n = 76)*	39.5%	60.5%	3.37	0.085	No
Ketamine *(n = 51)*	54.9%	45.1%	0.49	0.572	No
Mephedrone *(n = 35)*	60.0%	40.0%	1.40	0.312	No
Piperazine *(n = 7)*	71.4%	28.6%	1.29	0.446	No

The responses of the user groups for cocaine, Ecstasy and MDMA indicate that the majority of participants had not changed their behaviour based on previous experience. When examining

the results from the chi squared the only substance that showed a significant difference between the numbers of responses for Yes and No was Ecstasy, with significantly more participants claiming not to have changed their behaviour. This is the first question where these two terms are showing similar levels of responses. The majority of responses from the user groups of ketamine, Mephedrone and piperazine all indicated that experience had changed their usage. Yet none of the chi square tests returned a significant difference. This might in part be due to the relatively small sample sizes for these substances. What this question failed to identify is how the usage changed, whether it had increased or decreased, which is something that will be addressed in the qualitative questions at the end of this section. The results were also tested using the variable of gender using a two way chi squared test, all of which returned no significant difference, are shown in Appendix IVb Table 4.2.xiii.

Question 8: Has your knowledge of another person's bad experience changed your drug use of the following?

Instead of asking whether the participants own experience had changed their usage, this question asked about the impact of the knowledge of another person's bad experience with a substance affecting the participant's usage. Using the same options that were provided in question 7. However, whereas question 7 was dependent on previous use to establish a change, this question is interpreted based on knowledge of someone else's experience. This could therefore affect both the user and non-user groups. Table 4.2.15 shows the results as a percentage of the total participant population.

Table 4.2.15: Percentage of responses to Question 8 changing behaviour on use of the substances shown as percentage of total population (*n = 252)*

	Cocaine	Ecstasy	MDMA	Ketamine	Mephedrone	Piperazines
Yes	7.5%	8.3%	5.6%	7.5%	8.7%	1.6%
No	28.2%	29.0%	27.8%	12.7%	17.5%	6.3%
Not Taken	64.3%	62.7%	66.7%	79.8%	73.8%	92.1%

The results indicate that the knowledge of someone else's bad experience is less likely to change a person's usage of these substances, as all received less than 10% of the participants stating it would affect their usage. A one way chi squared was applied to test whether there was a significant difference between the responses to yes and no for each of the six substances. The responses to 'Not Taken' were not included as again this indicated that this question was not applicable. The results of the chi square are shown in Appendix IVb Table 4.2.xvi.

The results show that for cocaine; Ecstasy, MDMA, ketamine and piperazine there was a significant difference at the critical significance level of 0.05, with more participants stating that someone else's bad experience had not changed their own usage. For Mephedrone there was no significant difference. However as this question sought to discover whether the participants' usage had changed based on knowledge rather than experience, the difference between the response from the user and non-user group is important, which is shown in Table 4.2.16. There were more of the non-user group participants who choose options other than '*Not Taken'* in response to this question than in previous questions, there were also more participants from the user groups who chose the '*Not Taken'* option in this question, for consistency these results were not considered in further analysis.

Table 4.2.16: Comparison of the results for Question 8 - Knowledge of a bad experience affecting participant usage separated by user and non-user status

	Cocaine		Ecstasy		MDMA		Ketamine		Mephedrone		Piperazines	
	Users	Non	Users	Non	Users	Non	Users	Non	Users	Non	Users	Non
Yes	12	7	12	9	10	4	10	12	12	7	3	1
	15.8%	4.0%	14.3%	5.4%	13.2%	2.3%	19.2%	6.0%	32.4%	3.3%	42.9%	0.4%
No	62	9	69	4	63	7	37	7	22	10	4	12
	81.6%	5.1%	82.1%	2.4%	82.9%	4.0%	71.2%	3.5%	59.5%	4.7%	57.1%	4.9%
Not Taken	2	160	3	155	3	165	5	181	3	198	1	231
	2.6%	90.9%	3.6%	92.3%	3.9%	93.8%	9.6%	90.5%	8.1%	92.1%	14.3%	94.3%
Total	76	176	84	168	76	176	52	200	37	215	7	245

The responses to this question is the first to provide an insight into which substances are affected by second hand knowledge of experience, as both user and non-user group participants indicated that this knowledge had changed their behaviour. Ketamine had the most non-users reporting that knowledge of someone else's experience had changed their behaviour, with the second highest being Ecstasy. Interestingly less than half the number of respondents from the non-MDMA using group reported a change in behaviour compared to the non-Ecstasy group. Cocaine and Mephedrone received the same number of non-user responses and piperazine had the least, with only one non-user reporting a change. The first analysis tested whether there was a significant difference in how the user groups responded to this question using a one way chi squared test, displayed in Appendix IVb Table 4.2.xvii.

The results of the one way chi square test showed that for cocaine, Ecstasy, MDMA and ketamine significantly more user group participants reported that their behaviour had not changed due to the knowledge of someone else's bad experience. For both Mephedrone and piperazines there was no significance observed between the responses of yes and no, in the case of piperazine it was an almost equal split between the two responses, due to the small sample size limited conclusions can be drawn from this finding. The non-user group responses to this question were also assessed using a one way chi squared, the only group that returned a significant difference were the response for piperazine non-using group, with the full results located in Appendix IVb Table 4.2.xviii. The variable of gender was also assessed to see if there was a difference between how the male and females within both the user and the non-user groups responded to this question. The results of the two way chi squared for both groups are located in Appendix IVb Table 4.2.xix. No significant difference was observed between the response of the genders for either group or substances at a 95% confidence level.

Question 9: If you answered 'Yes' to either question 7 or 8, how has your usage changed?

This question was the first of the open answer qualitative questions, which allowed the respondents the opportunity of expanding on their reasons for changing their drug taking behaviour. This was an optional question whereby participants could choose not to respond. Out of a possible 252 responses only 28.6% participants shared their experiences and opinions on this question. There was no significant difference in levels of responses between the two genders (χ^2 =0.01; P =0.920) or the age groups (χ^2 = 3.579; P = 0.611) to this question. This means that of the qualitative responses received are spread between these variables.

The first stage of the analysis of these responses examined the direct reference to the substances discussed in the previous questions namely; cocaine, Ecstasy, MDMA, Mephedrone, ketamine and piperazines. The number of direct references to the substances varied, with the most mentioned substance being cocaine with 13. Ketamine and Mephedrone were each mentioned 10 times, these two substances also had the most negative comments in the discussion. Ecstasy and MDMA were mentioned only 5 and 7 times respectively.

The second stage of analysis examined the themes that emerged from the respondent's answers, not all the responses were negative, with 12.5% who choose to respond stating that their use of these substances was either positive or had increased. Three participants specifically stating that they enjoyed using MDMA. There were also responses from participants that were in the non-drug using group who discuss the change in their behaviour in terms of avoiding the substances discussed, using examples of other people's bad experiences with the substances as the reason for their own non using status. The most frequently referenced substances in these responses were ketamine and cocaine. Of the remaining responses 22% of participants responded merely stating that they had stopped taking drugs with no further elaboration. The rest revolved around three main themes; personal experiences, the negative effects and the fear or results of dependency and addiction.

The responses that dealt with experience either discussed the change in the context of a bad experience that had *'put them off'* the experience or as a result of personal growth. The following statements are examples of how the users expressed their own interpretation of their change in usage. The gender and age group of each participant is also included.

Example of personal experience impacting use:

I stopped taking drugs 5 years ago. This decision was based on personal experience, a desire to pursue my career and becoming better educated about the impact they may have on my body. I guess generally 'growing up' also played a huge part on my decision to stop.'

Participant 180 [Female, 22 to 29]

I know how much I need to have a good time without taking too much. Knowledge of a friend's health problems, particular with ketamine and Mephedrone, has stopped me taking these things, though I occasionally have a little ketamine. It has certainly made me more aware of the problems of over-use. Moderation is key. With the rest, the more experience you have with a drug the more will learn to know what to expect and to do to have a good night (and what not to do). Experience is the same as learning, and learning = change, hence experience will always change what you do (in an exponential manner, i.e. after a great deal of experience less change is seen, but I believe there is still change).'

Participant 213 [Male, 22 to 29]

The first example provides an interesting insight into the transient nature of recreational drug use, that it is something that is a 'stage' that can be 'grown out' of. With regards to Ecstasy and MDMA this had been supported by work on the trajectories of young adults ecstasy use (Smirnov *et al.,* 2013; von Sydow *et al., 2002*). These studies support the statement made by participant 180, finding that *'young people's Ecstasy use is relatively transient' (*Smirnov *et al.* 2013, p.2670), often stopping without the need of intervention.

The second example highlights the importance of education and self-awareness when it comes to recreational drug taking, themes that were touched upon in Survey A. The participant suggests experience is the best way to have a positive use of these substances, however this maybe dangerous given the uncontrolled nature of the illicit drug market where products do not necessarily contain what is believed to be in them.

The second theme that was mentioned by the participants was addiction, either the fear of becoming addicted or overcoming their addictions to change their behaviour. The following examples provide two statements by the participants on this theme.

Example of participant's responses to addiction

'I now have no desire to take these kinds of drugs. Whilst some give you temporary 'ups' the coming down got worse as time went on. Which meant I wanted to take more. I never wanted to have an addiction.'

Participant 185 [Female, 22 to 29]

Only tried e twice and bad experience both times- never tried since even though it was popular with friends. Took cocaine for about two years. To start recreationally, but after few months was taking it during day on occasions. Usage ended being continuously. Only stopped after scaring myself when I didn't think I would make it to the morning but this happened more than once before I seriously acted on it. Now been clean for 10 years.'

Participant 134 [Female, 30 to 39]

Both examples touch on the two themes of addiction and negative experiences. The first demonstrates that there was the possibility for this participant to become addicted, and so they changed their behaviour to avoid it. The second participant was candid in her discussion not only of her own use but also how she overcame an addiction to cocaine. Though the participant reports addictive behaviour towards cocaine, they did not report the same experience for '*e*', this may be due to the difference between cocaine and Ecstasy (MDMA), whereby the latter is generally described as non-addictive (Jansen, 1999; Peroutka, 1990). The final theme centred on the various negative effects that are attributed to the substances in question. These effects could further be separated into physically, psychologically and social/economically negative effects. More than one participant negatively referenced the relative expense of cocaine in relation to what is experienced. The following are a selection of participants' comments on the variety of negative experiences of the substances in question.

Example of negative effects (both physiological, psychological and social) impact use

'Realising that emptying one's wallet at the end of a hard day merely to stuff all the notes back into the black hole of one's nostrils is utterly futile, for the meagre buzz it momentarily provides barely reconciles the daft mistakes one makes in being so confidently obnoxious the whole night. In that way, after experiencing cocaine a plethora of times, I handed myself no blame, for I am young, and that is what we do, and came to the conclusion that to spend a fortune on petty highs worth nothing more than a tuppence should not be indulged in until I become a millionaire, which, of course, if fate has ever taught me anything, will be never.'

Participant 22 [Male, 18 to 21]

'Drone - Found it to be very addictive with horrendous comedowns. Eventually there was no nice feeling coming from taking it so the thought of it now makes me sick.'

MDMA: was fun for a while, but after regular use (once a week / 2 weeks for a year) the effects often led to anxiety. It's very rare for me to touch it now.

Ketamine: was fun at first as there were no effects on the mind or body the following day. However after doing it for a while, began feeling like a space cadet for the next (if not several) days.'

Participant 63 [Male, 18 to 21]

'Basically I tried them, enjoyed them and then felt absolutely cripplingly awful for about a week afterwards. I do not feel the benefits outweigh the costs and I do not socialise with people who do that sort of thing anymore. With MDMA my mouth was so ulcerated all over I could not eat for days. I also know people who have spent a lot of money on cocaine and I feel it makes their personality change for the worse. I also felt quite indifferent when I tried it. I had a boyfriend who took Mephedrone behind my back and felt it was a childish thing to do. Also people who take hallucinogens disturb me as I believe they can cause long term damage.'

Participant 95 [Female, 22 to 29]

'I think Mephedrone is a very unpredictable substance. I would never take it again. My experience wasn't terrible - just lots of memory loss which made me realize how dangerous the drug could be, I felt very out of control.'

Participant 192 [Female, 22 to 29]

The first example eloquently describes that participants experience with cocaine, commenting on the negative social and monetary effects he had experienced in a rather polemic fashion. Though the choice of language used is emotive two key points are highlighted; the social stigma from being '*confidently obnoxious',* a psychological effect of the drug in question and

the cost benefit analysis and economic viability of supporting those choices. From the parting statement from this response it appears that for this participant at least it is the monetary effect that was the driving force behind his change. This is in contrast to the other three examples that all state that their change was driven by either the physical or the psychological impact of the negative effects. In the examples chosen all three mention either Mephedrone or MDMA, with each of them giving a specific effect that changed their usage. The difference in perception between these drugs is further explored in questions 11 through to 14.

Question 10: If you answered No to either question 7 or 8, why didn't your usage change?

In converse to question 9 this question looked at why people reported to have not changed their usage. The responses to this question were divided between the participants who were reported users who continued to use the substances and the respondents whose usage had not changed as they had never used the substances in the first place. Again the format of the question was an optional open ended question allowing participants to respond however they liked. This question gained more responses than the previous with 93 of the participants responding.

Of the participants responding to this question 29 reported that the reason they had chosen 'no' was that they would not take nor had taken any of the substances mentioned in questions 7 and 8. Two participants made direct references to the bad experiences of others that had impacted their own attitude, with one relaying a personal story observed of a friends actions under the influence of cocaine.

One of the reasons given by the user group for choosing the 'No' option for either question 7 or 8 was that the participants either had had no bad experiences or that they did not know anyone who had. Other users further expanded and explored the impact of other people's experiences on their own usage, below are examples of their responses. A key theme is a lack of validity given to others experiences compared to self-experience.

Examples of participants' responses on the subjective nature of experience

'My usage had to be based upon my own opinion and amalgamation of information from my personal experiences. Someone else's opinion would not be valid as interpretations are different between various individuals. Also, the press, most doctors and politicians are judgemental and shake their finger disapprovingly at drug use when they have no experience apart from what has been communicated by moral panic media and other middle/upper class batty men who don't have a clue about working class leisure activities but feel that they should voice their opinions on them anyway because of the misinformed and biased perceptions.'

Participant 21 [Male, 22 to 29]

This first example holds much politicised opinion on the discussion of drugs, though touching on the subjective nature of experience at the start it develops into a diatribe against the 'establishment'. The mention that doctors are '*judgemental'* and '*have no experience'* is important in that it conflicts with the findings from the first social survey that found that doctors were the most trusted to give accurate information. Other responses focused more on the difference between self-experience and the reporting from other sources:

'The experiences of others are always laced in hyperbole to make the storyteller in question sound preposterously cool and unbeatable. I never trust humanity, not even myself; which can often be a problem.'

Participant 23 [Male, 18 to 21]

'Because the effect of drugs affects people very much on an individual basis [sic]. If I was inclined to use a drug that I had heard other people had not always had a possible experience with, I would just make sure I tried it in a small amount and also in a safe environment.'

Participant 56 [Female, 18 to 21]

'Some people are stupid. They don't examine the information behind what they're taking. They allow themselves to be put into situations where they blindly take whatever happens to drift along. I am an informed drug user. And whilst I do my best to inform others, it's not my responsibility to save everyone.'

Participant 62 [Male, 22 to 29]

'Other people's physical and emotional experiences cannot be described more accurately to me than I know my own; therefore using the experience I have with certain drugs would form my decisions about usage'

Participant 67 [Male 22 to 29]

Participant 62 is particularly dismissive of other drug users calling them stupid, while the other participants examine the experience of drug use as an individual experience, one that cannot easily be explained to someone outside that experience. Another participant was quite frank about the fact that a bad experience is likely when experimenting with illicit substances:

'You will usually have at least one bad experience on most drugs if you push them hard, that doesn't sway me, it's all experience and there's too much to benefit from to hold one bad avoidable and totally my fault experience against'

Participant 215 [Male, 22 to 29]

One participants comment was of specific interest as it touched upon the perceptions of quality around what is known as 'Ecstasy':

'I prefer to base my usage on what I know to be true. The notoriously impure 'Ecstasy' market often results in user's obtain cut MDMA and/or a drug that is not actually MDMA, but is labelled as so. As a result, they have a bad experience and attribute that to MDMA. When in fact it was a result of a combination or different drug entirely. Thus, when I take MDMA I ensure my product and base my usage on my own experiences.'

Participant 238 [Male, 18 to 21]

The difference in perception between the qualities of the substances is further explored in the responses to question 11 to 14. Another key theme that emerged from the responses to this question was the importance of the environment in which people took these substances, the response below highlight the participants' need to be in a 'safe' environment.

'I believe people's emotional or psychological state before they take the drug will influence their drug experience, and that is often why people have a bad time. I wouldn't have taken drugs if I was not feeling mentally sound beforehand.'

Participant 187 [Female, 40 to 49]

'I have taken ecstasy sensibly - tested the pills before I took them and had a great experience using it. I will only ever take drugs from people I know and trust - not strangers - and I rarely do drugs. I do them at festivals or with a group of close friends, not on a night out. Due to this I have never had any bad experiences and so would not change my usage apart from with Mephedrone which I felt unsafe using. I wasn't afraid of overdosing, just of being vulnerable even though I was with friends.'

Participant 192 [Female, 22 to 29]

'The circumstances in which I took drugs were isolated to one occasion (a festival) where I was surrounded by a big group of friends who were all doing the same thing and with whom I felt very safe with. Therefore I think that feeling secure, being in the right moment and place and being with friends definitely effects the decision on whether to take drugs.'

Participant *227 [Male, 18 to 21]*

The concern of safety appears to be more dominant theme with females than males, as 3 of the 4 participants who mentioned safety in this this question were female. This total included participant 56 whose example also highlighted the individual nature of drug use.

Only one participant answered that the legality of the substances in question impacted their usage, responding specifically about the piperazine class of substances. The legality of the substances and the subsequent recriminations did not appear to be a concern of the drug taking participants, nor was it given as a reasons as to why non-users would not try these substances compared to the known and reported negative effects. This raises a question which has been broadly discussed earlier in Chapter 2 and has become a focus of much media debate and was included in party manifestos before the governmental election. One question that needs to be addressed is that if the Misuse of Drugs Act does not stop users from using, but is also not a key reason for why people choose not to take substance anyway is it fulfilling its basic requirement? This question will be addressed further in the final discussion chapter.

Comparative analysis for questions on Experience

Comparison between results for Questions 4 and 5

As this thesis is examining the perceptions between Ecstasy, MDMA and Mephedrone, Table 4.2.17 summarises the results of Questions 4 and 5. It shows the percentage of the user group responses for each of the experience options. Question 4 relating to physiological experience and Question 5 the emotional.

Table 4.2.17: Comparison of Results for Questions 4 and 5 for Ecstasy, MDMA and Mephedrone

Responses	Ecstasy (*n* = 82)		MDMA (*n* = 76)		Mephedrone (*n* = 35)	
	Q4: Physical	Q5: Emotional	Q4: Physical	Q5: Emotional	Q4: Physical	Q5: Emotional
Negative	6.10%	4.88%	6.58%	3.95%	31.43%	25.71%
Indistinct	15.85%	3.66%	7.89%	1.32%	25.71%	20.00%
Positive	78.05%	84.15%	85.53%	94.74%	42.86%	51.40%

In all cases the percentage of the user population who reported positive experiences was larger for the emotional experience than the physical one, which is not unexpected as the chemical MDMA is an empathogen, and Mephedrone has been reported to be a substitute for MDMA (Harris *et al.* 2002; Measham *et al.* 2010; Wood and Dargan, 2012). The results for Ecstasy and MDMA are comparable, with the only major difference being that 15.9% of participants reported indistinct physical experiences for Ecstasy, which is almost double that reported for MDMA.

Though Mephedrone has been touted as an alternative for Ecstasy/MDMA the results reported are less consistent. The participants' reported experiences of this drug varied greatly in both the physical and the emotional. Although the number of users who responded to this survey was 37, which is relatively small in comparison to other larger surveys the findings relate to not only what has been found in the literature (Green *et al,* 2014*)* but is also supported by personal communication the researcher has had with users of both substances outside of the surveys.

Comparison between user responses who choose negative for both Question 4 and 5 and the self-reported bad experience in Question 6

From the results collected from each question the negative user responses can be compared to see whether the users who reported negative experiences and those reporting 'bad experiences' are comparable. The data was collated for Ecstasy, MDMA and Mephedrone and is represented in Figure 4.2.9.

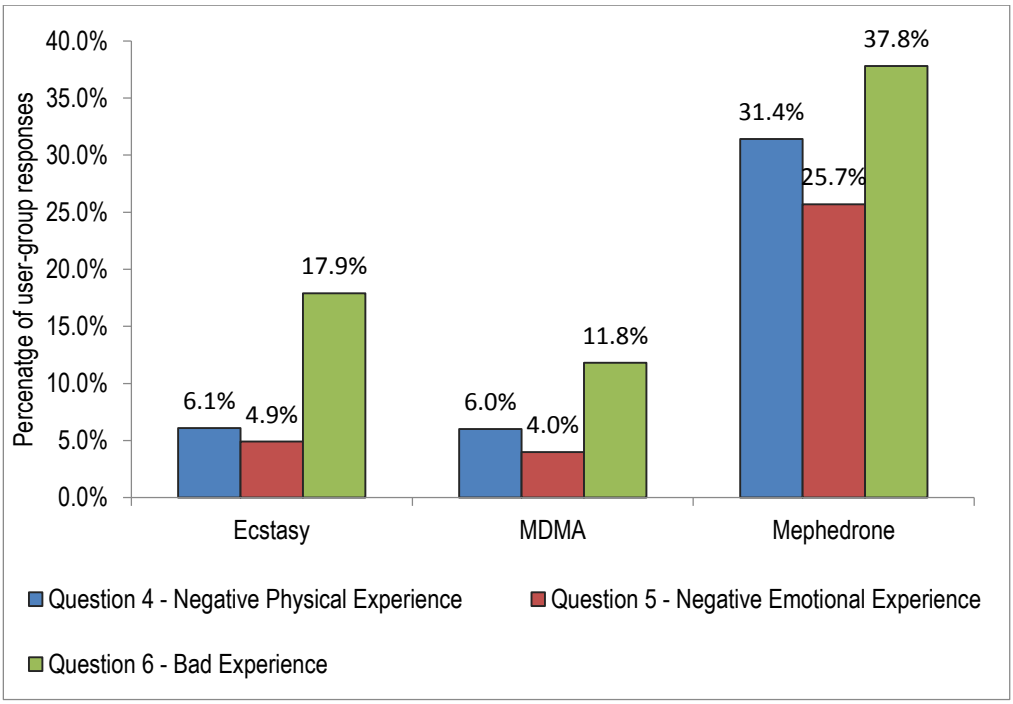


Figure 4.2.9: Comparison of Negative user group responses for Questions 4, 5 and 6

The above figure shows that in comparison, Ecstasy and MDMA display greater reported levels for bad experiences against what was reported for physical or emotional experience. This can be explained by the nature of the question, for example a participant may have used the substance on numerous occasions and found that they generally had a positive reaction. However out of those numerous occasions they may have had one or more bad experiences, as evidenced in the comment made by participant 215. Mephedrone by comparison has far greater levels of both bad experiences and negative physical and emotional experiences. The significance between the responses for questions 4, 5 and 6 for each of the three substances was tested using a one way chi square. The results of the chi square test of significance found that there was a significant difference for the results for Ecstasy (χ^2 = 9.25; P = 0.010), however no significance was observed for the results for MDMA or Mephedrone.

Comparison of User group response to Question 7 versus Question 8

A comparison of question 7 and question 8 provides further insight into the differences in the effect of personal experience and knowledge to change usage behaviours. Question 7 asked whether personal experience had changed usage whereas question 8 asked if knowledge of someone else's bad experience changed usage, shown in Figure 4.2.10.

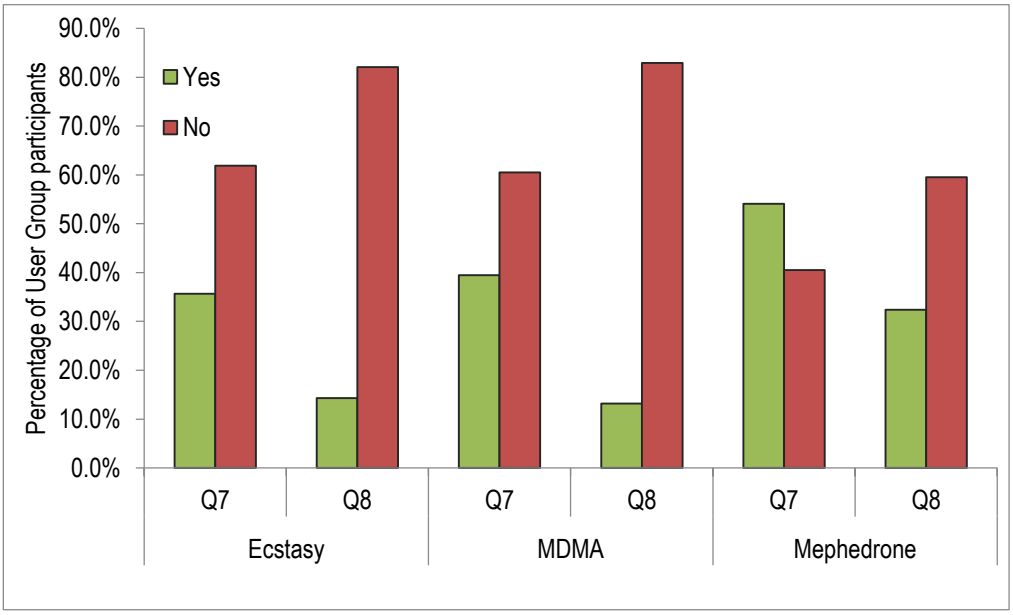


Figure 4.2.10: Comparison of user group responses for Question 7 and Question 8

Across all three substances the personal experience was more likely to be a factor in changing usage than knowledge of someone else's bad experience, and this finding was supported by the statements provided in question 9 and 10. In all cases, bar Mephedrone in question 7, more participants reported having not changed usage. The reasons for this are reflected by the large percentage reporting bad experiences and negative effects, supported by the statements from the open ended questions 9 and 10. Mephedrone, as reported in section 2.6, has been touted as the new 'replacement' drug of choice for Ecstasy, however the responses so far indicate that this drug is seen as comparatively negative. The significance between the two questions for each substance was tested using a two way chi squared test. All three substances returned significant difference; Ecstasy (χ^2 = 10.1; P = 0.003), MDMA (χ^2 = 12.6; P = <0.001), and Mephedrone (χ^2 = 4.22; P = 0.04). This means that across all three drugs significantly more user participants reported that they had not changed their behaviour.

4.2.4 Questions on the participants choice of drugs

This section of the survey asked the participants to choose between two substances, with the focus on Ecstasy and MDMA powder in comparison to ketamine, Mephedrone and piperazines. The participants were also given the option to choose neither. They were then asked to give the reason for their choice in an open text question. Each question is split into two parts; the first a quantitative analysis of the number of participants who choose each option, followed by the qualitative analysis of the reasons behind that choice.

Question 11a: If given the choice between Ecstasy Pills and MDMA powder which would you choose?

The first question in this section offered the participants the option of a choice between Ecstasy pills or MDMA powder. The difference between the two products was emphasised by including the form, either pills or powder. Figure 4.2.11 displays the breakdown of responses with the option of neither included, as has been previously highlighted a number of the participants had not and would not take these substances even hypothetically.

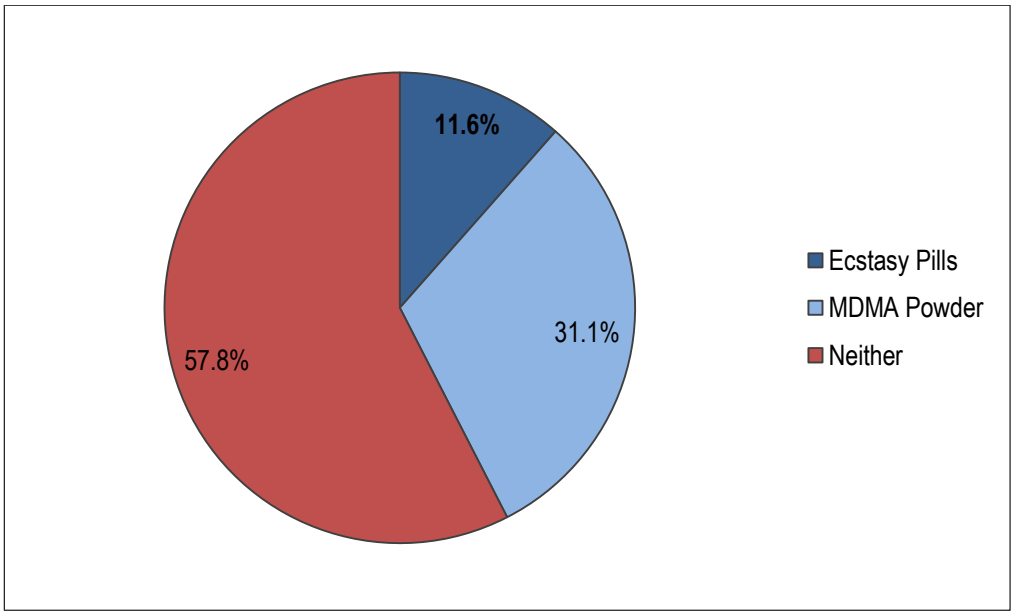


Figure 4.2.11: Participants responses to the choice between Ecstasy Pills and MDMA Powder (*n* = 252)

The majority of the participants choose the neither option, this was anticipated based on the responses to previous question and from the number of participants in the 'non-user' category.

Of the participants who did make a choice there is a clear preference for MDMA powder. The responses were further analysed by looking at the choices reported by the user and the non-user groups, as shown in Table 4.2.18.

Table 4.2.18: Results for Question 11a choice between Ecstasy pills and MDMA powder by user and non-user groups (*n* = 252)

Choice	User	Non-User
Neither	6%	52%
Ecstasy Pills	6%	6%
MDMA Powder	26%	5%

The user group for this question included the participants who reported to have tried both and those who just used one. Of the participants who had tried both 83% chose MDMA powder over the other two options, this was matched by the participants who had just tried MDMA powder with 80% also choosing MDMA. Of the participants who had just tried Ecstasy most chose the neither option.

The difference in the frequency of the choices made by the user group was tested using a one way chi square test, which included the neither option. The results of the chi squared test returned a χ^2 value of 54.25 and a P value of <0.001, which is significant. The significance of the non-user group choices were also tested using a one way chi square, however this time the neither option was excluded. The test returned a χ^2 value of 0.14 and a P value of 0.842, which was not significant, therefore there was no difference in the choices between the two made by the non-user group. The variable of gender was also tested to see whether there was a difference in preference between males and females, tested using a two way chi squared there was no significant difference observed with both genders reporting a preference for MDMA over Ecstasy Pills. The results of this test are located in Appendix IVb Table 4.2.xx. The results of this question showed that among the user group there was a unanimous preference for MDMA powder. This correlates with the findings from the Global Drug Survey, which reported that users are taking the powdered form over the tableted or pill form (Mixmag, 2013). Whether this is a consumer driven choice or merely reflects what is available in the marketplace has yet to be established. The prevalence of the different types of Ecstasy/MDMA found on the street is investigated in Chapter 6 with the seizures found in Cambridge. The second part of the question asked the participants for the reasons behind their choices.

Question 11b: Qualitative analysis of reason for choice

The second part of this question asked the participants to record their reasons behind their choice from the previous question. Responses were recorded from participants who choose all three options and so the analysis in this section is divided between the participants who chose neither, the ones who chose Ecstasy pills and the ones who chose MDMA powder. Overall 79% of the participant population responded to this question. Of the participants who choose the neither option 67% choose to respond, for Ecstasy pills it was 97% and for MDMA powder 94%.

Reasons given for choosing the neither option

The first group whose reasons were assessed were the participants who had chosen neither in the previous question. The most stated reason for their choice was that they did not take drugs or had no interest in taking them. One participant mentioned their illegal status, a further seven mentioned the health and mental health risks associated with them. The overall tone of the response reflected the perception of the substances in a negative way. However some of the responses given were in themselves contradictory, for example:

'Although never heard of MDMA I am fully aware of the effect that drugs have to your body! [Sic]'

Participant 147

'*I don't have an interest in taking either. If there was no 'neither' choice I would choose MDMA.'*

Participant 170

One participant did however state that the two were effectively the same thing and that there is a perception about the purity:

'They are ultimately the same thing. Just one is supposedly a little bit more pure than the other.'

Participant 226

Reasons given for choosing Ecstasy Pills

The second group of responses that were analysed were the ones who choose Ecstasy pills over MDMA powder. There were number reasons the participants gave for choosing Ecstasy pills over MDMA powder, the foremost being that they felt more informed about Ecstasy and had more experience of it, yet as was highlighted by participant 226 they are the same chemical. This supports the hypothesis that the two terms are definitely perceived as being separate. Other justifications for the choice of Ecstasy was that the pills were easier to take, and that there was a preference over the method of 'bombing' or 'sniffing' as highlighted by the response from participant 164:

'I prefer ecstacy [sic], bombing MD is unpleasant'

Participant 164

A number of participants made references to the method of ingestion, and a number also discussed this in terms of getting a dosage and knowledge of purity based on imprinted designs.

'Convenient dosage unit, stamps are often indicator of quality.'

Participant 239

This is interesting as it conflicts with the statements made by the participants who chose MDMA powder as will be shown in the next section. Another statement that is contradicted by the responses from the MDMA choosing group was that:

'Media say they are less likely to be cut with other substances [sic]'

Participant 109

This statement is of interest as it is in direct contradiction not only with what the participant who said they would choose MDMA powder over Ecstasy but also with the majority of media and academic perception as assessed in the section 2.5.

Reasons given for choosing MDMA powder

The final responses assessed were the ones who stated that they would choose MDMA powder over Ecstasy. Within this group the majority of the participants gave the reason that they believed that the powder was purer than the pills, with some using the word 'cleaner'. Some of the participants even indicated the perception in difference in purity between MDMA powder and Ecstasy Pills as shown in the examples below.

'A belief that the drug is more pure maybe. Less side effects experienced [sic].'

Participant 10

'Never used MDMA Powder but have been told by several people the effects are much more prominent when using MDMA Powder as opposed to Ecstasy Pills.'

Participant 20

'It's more potent, ecstacy [sic] pills are on average only 30-40% MDMA'

Participant 21

Some participants noted the reason behind their choice was that they believed that the pills were more likely to contain adulterants, a dissimilar belief to the participants in the Ecstasy choice group. There was also links to the method of delivery of the powders. Some participants reported that the powdered and crystal forms of the compound were easier to check. That powders were easier to use with home testing kits that can be purchased over the internet. Or the participant said they could be checked by sampling a small portion of the sample before consuming the whole amount. This is specifically mentioned by 4 participants:

'Pressed pills are more likely to be compounded with adulterants. Powder or crystalline MDMA is rarer – but worth it as one is more able to check what it is via the Marquis reagent and other diagnostic tools.'

Participant 62

'You never know what's in the pill. You can however taste MDMA to check that what you're buying is legit.'

Participant 63

'usually mdma [sic] as more user control - dab a bit at a time to test strength and effect, with a pill that involves halving etc [sic] which is a hassle - however sometimes a pill form is better than powder e.g. high humidity - so I would take pills instead'

Participant 208

'I know the effects of mdma [sic] on me, and the [sic] can tell about the quality of the product by looking at it - whereas you never really know what you're getting in a pill. Also it's much easier to take a little bit of mdma [sic] than a little bit of a pill!!'

Participant 210

Some believed that the powder form was safer, however there is a definite difference in the perception and understanding between what is MDMA and what is Ecstasy as shown in the following response:

'I have heard it is one of the safest drugs if pure: so it would have to be from someone I trusted who knew wether [sic] it was cut with anything else. I wouldn't take ecstasy as someone I knew died from taking one.'

Participant 224

Despite the person stating that they have heard MDMA is 'one of the safest drugs' they wouldn't take Ecstasy as they knew someone who had died. This is a inconsistency as both are technically the same chemical however as Participant 238 makes the point that:

'Both are risky but powder is less likely to contain something dangerous (e.g. PMA)'

Participant 238

The compound PMA (para-Methoxyamphetamine) that the participant referenced is a substance of a similar chemical structure to MDMA, which has been used as an adulterant in Ecstasy pills and is believed to be responsible for over 20 deaths in 2013 (Saner, 2013).

What is clear from the responses to question 11b is that there is a persistent contradiction in the understanding of what Ecstasy and MDMA actually refer to. Even among the 'user' communities, they are perceived to be different things. The main difference being that one is perceived to be 'purer'. As has been consistently stated throughout this document there has yet to be any evidence to support this claim, however this is addressed in Chapter 8 when both forms are assessed analytically to either prove or disprove this hypothesis.

Question 12a: If given the choice between MDMA powder and Mephedrone which would you choose?

The second question offered the option between MDMA powder and Mephedrone. This question was asked as there was prevalence in both the media and academic literature in 2013 when the survey was run that stated that Mephedrone had 'replaced' MDMA (BBC, 2013; Measham *et al., 2010*). This research was interested in investigating this claim, as evidence suggested that the use of Mephedrone was dropping (GDS, 2013). Figure 4.2.12 shows the proportion of participants who choose each option for this question.

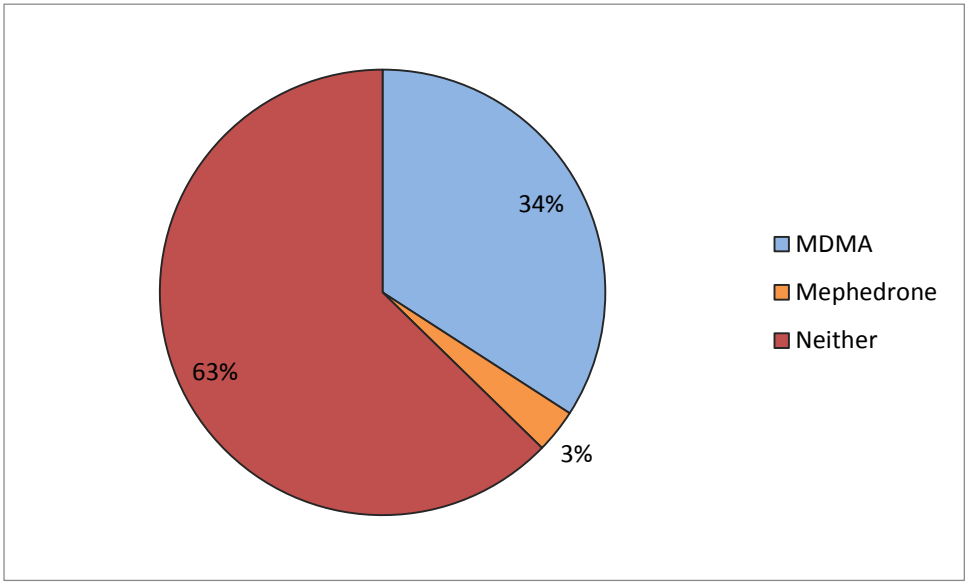


Figure 4.2.12: Participants responses to the choice between MDMA powder and Mephedrone (*n* = 252)

The majority of the participants responded to this question again chose the neither option. However of the participants that did choose between the two substances there is a clear preference towards MDMA. The results were separated into the user and non-user groups to identify whether there is a preference between the two substances, shown in Table 4.2.19.

Table 4.2.19: Responses to Question 12a choice between MDMA Powder and Mephedrone by user and non-user groups (*n* = 252)

Choice	User	Non-User
Neither	3.6%	59.1%
MDMA Powder	27.0%	7.1%
Mephedrone	1.2%	2.0%

The difference between the choices made by the user group was tested using a one way chi square test, which included the neither option. The test returned a χ^2 value of 96.75 and a P value of <0.001. The significance of the non-user group choices was also tested using a one way chi squared with the neither option excluded. The test returned a χ^2 value of 7.35 and a P value of 0.012. Therefore for both groups there was a significant preference for MDMA powder. The variable of gender was also tested to see whether there was a difference in preference between males and females, tested using a two way chi squared there was no significant difference observed, with both genders preferring MDMA powder. The results of this test are located in Appendix IVb Table 4.2.xx. There were 80 participants identified as the user group for this question, of the participants identified as having tried both 82% stated they would choose MDMA. Of the participants identified as having tried just Mephedrone half picked MDMA, the other half picked the neither option. Of the group which had only used MDMA 92% reported they would choose MDMA over the other two options. The reasons behind these choices are assessed in the responses given to question 12b.

Question 12b: Qualitative analysis of reason for choice between MDMA and Mephedrone

Again the responses to the second part of the question were recorded from participants who chose all three options and so the analysis in this section will be divided between the participants, who choose neither, the ones who choose MDMA Powder and those who choose Mephedrone. Overall there were 190 responses to this question, from the participants who choose the neither option, 66% choose to respond. For MDMA powder it was 92% and 100% gave a reason for choosing Mephedrone.

Reasons given for choosing the 'neither' option

The vast majority of the participants who choose the neither option to this question either repeated their previous comment from question 11, or stated '*see above/11b'*. These responses are from participants who have stated categorically that they have no desire in taking any of the substances. Some however did mention that they had not heard of or did not know of the drug Mephedrone, while others referred to the negative reputation it has earned, as exemplified by the following participant extracts:

'Heard awful stories about Mephedrone and would never sniff anything.'

Participant 121

'I've never taken MDMA and I don't like m-cat, it's a dirty drug'

Participant 197

The reference to m-cat, a synonym for the drug Mephedrone, as a dirty drug was not only expressed by the participants who choose the neither option, it also was given as a reason behind the participants' choice when choosing MDMA powder.

Reasons given for choosing MDMA powder

The reasons the participants gave for choosing MDMA powder over Mephedrone can be separated into five main themes. The first was a lack of awareness of what Mephedrone was in comparison to MDMA, as illustrated in the following example:

'I'm just not sure what mephredrone [sic] really is...'

Participant 217

The second theme was the participants who had heard of both but stated that the lack of knowledge of the effects of Mephedrone, both short and long term was a deciding factor. What is interesting is that one participant points out the lack of research available on this substance compared to that of MDMA.

'More research to back effects' (referring to MDMA)

Participant 17

'Mephedrone seems to be 'newer' with less known about potential effects.'

Participant 241

'Mephedrone is dirty man. Also have very little knowledge of its long term effects. MDMA has been "road tested" for longer.'

Participant 216

As with the comment highlighted from participant 197 in the previous section, the word dirty is again used to describe Mephedrone, this is in contrast to the responses in Question 11 that used the word clean to describe MDMA. The perception and reputation was the third theme identified as a reason behind the participant's choice in choosing MDMA over Mephedrone.

'Never heard any good stories from Meow Meow [sic]'

Participant 226

'I have heard bad things about the latter.'

Participant 227

'Had MDMA powder before, heard Mephedrone isn't as good'

Participant 14

'Heard a lot of bad things about Mephedrone'

Participant 16

The fourth theme identified however supports the negative reputation that Mephedrone has, with a number of the participants recounting their negative experiences of this substance. Whereas the participants who stated they would not try it because they had heard bad things these participants state in their own words their negative experience of this drug.

'Mephedrone does nothing but give the user a blinding headache and a prolonged insight into utter desolation: a futile drug by all means.'

Participant 23

'Mephedrone is awful. I mean seriously, compulsive redosing [sic], it's a substituted cathinone, give me MDMA any day of the week. Once, and then I can't take it again because it's self-limiting like that.'

Participant 62

'Mephedrone is a horrible drug and more addictive than people think. I have taken mdma before so would know what to expect, I know I would enjoy it.'

Participant 95

The final theme to the responses focused not on the negatives of Mephedrone but on the perceived positives of MDMA, as with the responses seen for question 11, there were statements made about MDMA's that it was cleaner or 'purer, with some claiming that it gave a better or preferred high.

If Mephedrone has such a negative reputation and reportedly negative effects, as suggested by the responses above, it is interesting to note what the 8 participants who stated that they would choose it gave as reason for their choice.

Reasons for choosing Mephedrone

Of the eight people that choose Mephedrone for this question only three had tried it before. The reasons that were given were that; it was cheaper, it gave a better experience and that it had less of an effect and put less strain on the body. The other five response were from the non-user group, the reasons that they gave were; *'Friends had done it',* two stated that it '*had less of an effect'*, and lastly because it was not MDMA.

Question 13a: If given the choice between MDMA powder and piperazines which would you choose?

The third question in this section asked the participant to choose between MDMA powder and Piperazines. The term piperazines covers a broad range of substances that are derived from the compound piperazine, the most commonly encountered substances being BZP, TFMPP and mCPP. These substances were introduced in early 2000's as an alternative to Ecstasy and have often been sold in tablet form (Staack, 2007, Wood *et al., 2007)*.

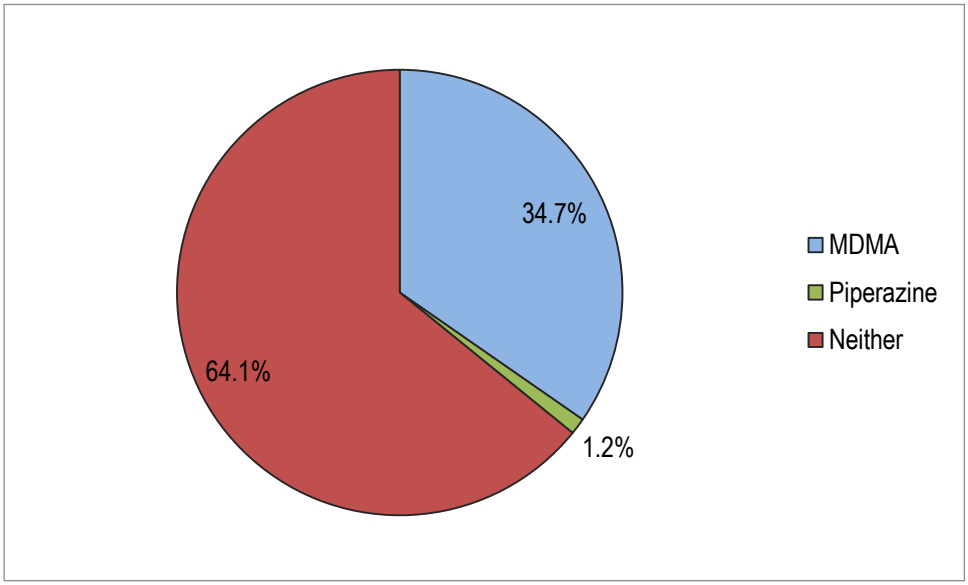


Figure 4.2.13: Participants responses to the choice between MDMA and Piperazines (*n* = 252)

Following on the trend from the previous two questions the majority of the users still choose the neither option. MDMA Powder also continues to appear to be the more popular option when a choice was made by the participants. When the results are separated by user and non-user group, as shown in Table 4.2.20.

Table 4.2.20: Results for Question 13a choice between MDMA powder and Piperazines by user and non-user groups (*n* = 252)

Choice	User	Non-User
Neither	3.2%	61.1%
MDMA Powder	27.0%	7.5%
Piperazines	0.8%	0.4%

The difference in choice by the user group was tested using a one way chi square test, which included the neither option. The test returned a χ^2 value of 102.46 and a P value of <0.001. The significance of the non-user group choices was also tested using a one way chi square, excluding the neither option. The test returned a χ^2 value of 14.46 and a P value of <0.001, which is significant. Therefore for both groups there was a significant preference for MDMA powder. The variable of gender was also tested to see whether there was a difference in preference between males and females, tested using a two way chi squared there was no significant difference observed, with both genders preferring MDMA powder. The results of this test are located in Appendix IVb Table 4.2.xx.

The number of users who choose MDMA powder in this question is the same as for the previous question, when the choice was between MDMA and Mephedrone. Only three participants stated they would choose piperazines, two users and one non-user. There were 78 participants identified as the user group for this question, of the participants identified as having tried both 100% chose MDMA. Of the participants identified as having tried just Piperazines half picked MDMA, the other half picked the neither option. The MDMA only group reported 87% would choose MDMA over the other two options. The reasons behind these choices are assessed in Question 13b.

Question 13b: Qualitative analysis of reason for choice between MDMA and Piperazines

As the third in a series of very similar questions at this point in the qualitative question the responses for the choices made are repetitive of the previous two questions. However of the 252 participants who had responses recorded for question 13, 74% participants wrote a response to this question. For the neither option the response rate was 65%, for MDMA the response rate was 91% and 2 out of the three participants who choose piperazines gave a reason.

The responses from the 'neither' group of participants are reiterative of their responses to the previous questions, yet there is also a frequent mention of a lack of awareness of what piperazines are. This is also reflected in the responses from the MDMA choosing group, with 64% of the responses stating the reason they had chosen MDMA was because they had not heard of or were aware of the effects of piperazines. One participant however gave an emphatic description of their opinion on how they felt about piperazines.

'Because all of the piperazines are like drugs Satan pulled out of Hell. No, a better analogy. They're like drugs Satan's been working on for a while [sic], every Sunday in his hobby room, perfecting them, making sure they're just awful and just right and blend in with all the other insane drugs out there. Piperazine derivatives are Satan's masterpiece.'

Participant 62

So although piperazines appear to be relatively unknown in comparison to the other drugs that have been assessed, they elicited one of the strongest comments. Of the participants who did choose piperazines over MDMA, one reason was that they mimicked the effects of Ecstasy; the other reason that was given was;

Because I have never tried it, and what would be the use in living without trying everything at least once, or twice to make sure?

Participant 23

The last example is of particular interest when considering drug using behaviours, do the majority of people stick to what they know or are they after new experiences? This was touch upon in section 2.7.1 with Werse and Morgenstern's (2012) '*omnivores'* and *'psychonaughts'* typologies and is examined in question 25 of this survey, which asked participants to choose between something they had taken before and something new.

Question 14a: If given the choice between MDMA powder and Ketamine which would you choose?

The final question in this series offered the option between MDMA powder and ketamine. This question was included as was reported in the context chapter, the use of ketamine was being stipulated as an alternative to Ecstasy or MDMA in a BBC documentary (BBC, 2013). This is despite the fact that the two drugs have different effects and belong to different classes of drug. MDMA is a part of the Amphetamine Type Stimulant (ATS) family of compounds with purported empathogenic effects (Harris *et al., 2002)*, whereas ketamine is a dissociative anaesthetic (Curran and Morgan, 2000). The difference between the expected outcomes in taking these substances is further highlighted in the participants' responses. The results for this question are shown in Figure 4.2.14.

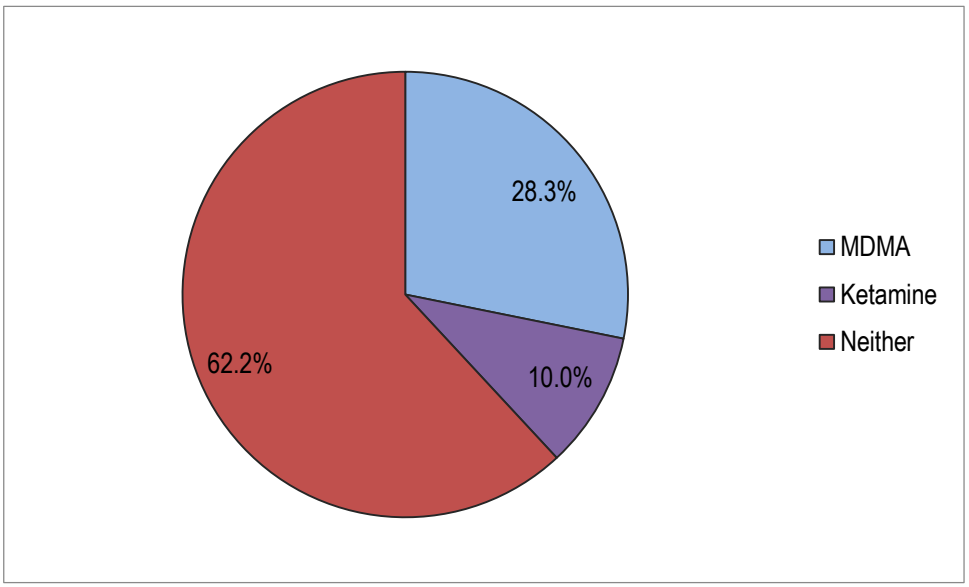


Figure 4.2.14: Participants responses to the choice between MDMA Powder and Ketamine (*n* = 252)

The number of participants who choose the 'neither' option are still in the majority for this question. Although MDMA powder still is the more preferred substance (28%) there is a marked increase in the number of participants who would choose the alternative ketamine (10%), compared to when the choice was against Mephedrone (3%) and piperazines (1.2%). The difference is apparent when comparing the of the user and non-user groups. The user group that chose MDMA powder is smaller than it was for the previous two questions, these results are shown in Table 4.2.21.

Table 4.2.21: Results for Question 14a choice between MDMA and ketamine by user and non-user groups (*n* = 252)

Choice	User	Non-User
Neither	3.6 %	58%
MDMA Powder	23%	6%
Ketamine	7%	3.2%

The significance of difference in the choices made by the user group was tested using a one way chi square test, which included the neither option. The test returned a χ^2 value of 47.79 and a P value of <0.001. The significance of the non-user group choices was also tested using a one way chi square, with the neither option excluded. The test returned a χ^2 value of 1.64 and a P value of 0.286, which was not significant. Therefore though there is a significant preference for MDMA by the user group, there was no significant difference between these two substances for the non-users. The variable of gender was also tested to see whether there was a difference in preference between males and females, tested using a two way chi squared there was no significant difference observed, with both genders preferring MDMA powder. The results of this test are located in Appendix IVb Table 4.2.xx.

There were 83 participants identified as the user group for this question, of the participants identified as having tried both 64% chose MDMA, with 24% choosing ketamine. Of the participants identified as having tried just ketamine, 43% picked MDMA, and 43% picked ketamine. The MDMA only group reported 81% would choose MDMA, and 10% would choose ketamine. The reasons behind these choices are assessed in Question 14b.

Question 14b: Qualitative analysis of reason for choice between MDMA and Ketamine

As stated at the start of question 14, these two drugs provide a different set of experiences with one a stimulant and the other a dissociative. This was a theme that was highlighted in the response by participant 62 who discussed the relative properties of the two compounds:

'I don't see how either of these drugs are comparable. Would depend on how the mood took me. Ketamine is a dissassociatve psychedelic. MDMA is a stimulant entacto-empathogen. As I said, would depend on the mood I was in. [sic]'

Participant 62

The response rate to this question was still high with 189 participants choosing to answer. The percentages for each option stood as 64% for neither, 93% for MDMA powder and 96% for ketamine. The neither responses were again reiterative of the previous three questions, that the participants had no interest in taking these substances and/or had not heard of them.

Reasons given for choosing MDMA powder over Ketamine

The reasons given for the choices with this question can be divided into two main factions, the people that have heard or experienced the negative effects of ketamine and those that preferred the experience of MDMA. Many of the participants commented on the fact that it depended on what kind of effect one was after when consuming a substance, however there was a distinct negative tone when describing taking ketamine. There was also a frequent reference to horses and horse tranquilizers, which is one of its legitimate uses, when providing an example of the negativities of ketamine. Of the participants who wrote about the negative effects of ketamine one participant described it as;

'If I were inclined to sit in dark corners on my own and fathom detestable fates for myself whilst wriggling uncontrollably and yet imagining myself to sit unfathomably still, then I would choose ketamine. But being the putrid waste of an evening that it is, I would chose MDMA every night, without question.'

Participant 23

A number of participants' stated that they felt or perceived ketamine as a 'dirty' drug, a word that was also used to describe Mephedrone and used in contrast to the perception that MDMA is perceived as clean. There was an overriding preference for the effects of MDMA, over the other substances. The context for taking and the desired effect received by these substances was also consideration for a number of the participants. One participant stated that ketamine was not a social drug and another claiming to only to enjoy ketamine when mixing the two substances.

'Depends on context, (in some situations ketamine would be my preference) but ketamine is not a very social drug.'

Participant 213

'Only enjoy ketamine when having MDMA first, not on it's own [sic]'

Participant 78

Reasons given for choosing Ketamine over MDMA Powder

The reasons given for choosing ketamine over MDMA powder came down purely to a preference for the effects that ketamine provides, the fact that it was not a stimulant was the most prevalent factor stated. Though other reasons provided included; potential weight loss, its classification - the first time legality had been addressed as a consideration, and that the participant felt better the day after than when they took MDMA. Other reasons given were:

'As I have chronic sleeping problems, I think Ketamine. It would be nice to actually get a decent sleep!'

Participant 80

'You can't do too many stupid things when you're knocked out.'

Participant 223

'Ketamine but only because I haven't used it before and I've wanted too [sic]. The dissociative effect is interesting, but I'd probably prefer MDMA after I had tried ketamine'.

Participant 237

'Ketamine is an experientially preferable choice for me, I have outgrown the shallow hedonism of MDMA and find it counterproductive, ketamine is a deep and powerful psychoactive'.

Participant 240

The choice between ketamine and MDMA powder came down to a preference of the type of high the user was after. This is in contrast to the comparisons drawn between MDMA powder, Mephedrone and piperazine, which related to how the compounds were perceived or previous negative experiences.

Question 15: Please rank the following substances in order of your personal preference

The participants were next asked to rank the selected substances based on their personal preference on a scale. The scale was from one to five, with a score of one indicating low or no preference for the substance and five indicating the most preferred. The format of the question enabled the participants to pick the same value for each of the substances if they choose. It also allowed them to not answer if they did not wish too, this is shown as a no answer in the table. Table 4.2.22 displays the results and mean value for each substance are shown for the whole sample population.

Table 4.2.22: Percentage of responses for each rank score for the selected substances (*n* = 252)

Rank (1 = least, 5 = most)	Substances (%)					
	Cocaine	Ecstasy	MDMA	Ketamine	Mephedrone	Piperazines
1	49.2	42.9	44.0	58.	62.3	72.2
2	9.9	6.7	4.4	8.3	12.3	4.8
3	10.3	9.5	8.7	9.1	6.3	4.4
4	8.7	17.5	9.1	4.8	3.6	0.4
5	10.3	10.7	21.8	4.8	2.0	1.2
No Answer	11.5	12.7	11.9	13.1	13.5	17.1

The modal value for all six substances is 1, as it was the most frequently chosen response from the participants; this is anticipated when considering the responses from the answers to the previous questions and the number of non-user participants. The significance between the responses was calculated using a one way chi square test, which returned a significant result for all six substances, shown in Appendix IVb Table 4.2.xxi.

A mean value was obtained by adding the scores for each drug and dividing by 5, excluding the non-answers. The mean values were then used to compare the substances and a rank order established. The order of preference observed when all the participants' responses are included is as follows from highest to lowest: MDMA (2.55), Ecstasy (2.36), cocaine (2.11), ketamine (1.8), Mephedrone (1.74) and piperazines (1.24). However as preference denotes usage of the substances the user groups responses may provide a different rank order. The mean values for the users groups were calculated using the groups generated by the responses from Question 1 less the participants who did not supply an answer. The mean values for each substance shown for each user group is shown in Table 4.2.23.

Table 4.2.23: Mean values for Question 15 for each substance separated by user groups

	Mean of responses to Question 15					
User Group	Cocaine	Ecstasy	MDMA	Ketamine	Mephedrone	Piperazine
Cocaine	3.30	3.33	3.79	2.18	1.53	1.13
Ecstasy	2.96	3.68	3.91	2.25	1.59	1.10
MDMA	2.69	3.51	4.31	2.23	1.64	1.10
Ketamine	3.02	3.59	4.10	2.84	1.66	1.10
Mephedrone	3.03	3.51	4.08	2.84	2.06	1.17
Piperazine	2.50	3.50	4.00	3.38	2.88	1.57
Overall Mean	2.92	3.52	4.03	2.62	1.89	1.20

The rank order of the substances by preference by the user groups reflect the same order of preference as was shown with the total participant population, with the exception of the piperazine user group. The rank order according to the preference of the piperazine users was; MDMA, Ecstasy, Ketamine, Mephedrone, Cocaine and Piperazine.

In all cases MDMA was ranked as the most preferred substance supporting the findings from Questions 11 through 14. It is also observed that across all users groups and the total population there is a difference in the mean rank values obtained by MDMA and Ecstasy. This clearly supports the hypothesis that these two are considered to be separate products. Both Mephedrone and piperazines received low scores for preference, not only from the total population but from the participants reporting to have taken them, which is again consistent with the responses from previous questions.

Question 16: Have you ever bought a substance over the internet?

In recent years there have been reports that there has been an increase in the purchasing of substances, both illicit and uncontrolled over the internet (Martin, 2014). This question asked the participants whether they had ever bought a substance over the internet. This was to establish whether there has been a significant change in how people are obtaining their substances. The percentage of the participants who reported to have bought a substance over the internet was only 13% out of the total population of participants for this survey. This figure increased to 19% when measured against the participants who reported to have taken any substance other than alcohol and tobacco in Question 1 (n = 172). This can be compared to the findings from the GDS (2013) that found that 22.1% their participants reported to have bought a substance over the internet. This suggests that the use of the internet and the purchasing of substances online is not the most prevalent method used to obtain substances.

However Martin (2014) suggests that in the future this percentage may increase. This question was also assessed to see whether there was a difference between the genders on purchasing substances online, the two way chi squared test returned a χ^2 value of 12.732 and a P value of <0.001. Significantly more males reported to have bought a substance over the internet compared to females.

Question 17: Have you ever tried a substance without knowing exactly what you were taking?

It is unlikely that a user of an illicit substance will know with 100% certainty that it is what they believe it is, without the use of advanced analytical testing. However this has not stopped the use of illicit substances. This question asked the participants whether there was ever a time when the participants felt they did not know what they were taking.

The percentage of the participants who reported to 'have tried a substance without knowing exactly what it was' was 27%, out of the total population of participants for this survey. This figure increases to 40% when measured against the participants who reported to have taken any substance other than alcohol and tobacco in Question 1 (n = 172). This means that 2 out of 5 of the participants who stated to have known that they used illicit substances had at some time taken something without knowing exactly what it was.

This can be compared to the findings from the GDS (2013) that found that 11% of their participants reported to have taken a 'mystery white powder'. The difference in levels reported between the two surveys may be due to the phrasing of the question. This survey asked whether the participants had 'ever' taken an unknown substance without specifying type, whereas the GDS asked specifically about powders and within a time frame of 12 months. The next question asked the participants what they believed the substance to be.

This question was tested to see whether there was a difference between the genders when it came to taking an unknown substance. A two way chi squared test was applied and returned a χ^2 value of 1.245 and a P value of 0.265, which is not significant at the critical significance level of 0.05. This shows that when it comes to taking unknown substances there was no differences in the gender responses on this behaviour.

Question 18: What did you believe it was?

When asked what the participant believed the substance was that was mentioned in question 17 they were able to choose from a selection of substances as well as contribute their own choices. Table 4.2.24 displays the most frequent choices provided by the participants, the total number of participants who responded to this question was 68, however participants could choose to reply with multiple substances and so percent is calculated against total number of responses. The list of the other substances that received only one or two mentions in this question is shown in Table 4.2.25.

Table 4.2.24: Responses given when asked what the participant believed the substance was from Question 17

	Percent of responses (n = 68)
MDMA Powder	30.9%
Cocaine	14.7%
Ketamine	13.2%
Ecstasy	11.8%
Mephedrone	7.4%
Speed/Amphetamine	5.9%
Cannabis	2.9%
Other	22.1%

Table 4.2.25: List of other substances mentioned in Question 18

Other Substances mentioned	Piperazines Antidepressants Opium DMT Poppers Nitrous Oxide BZP MXE/something similar to ketamine Benzo Fury MDAI MDPV

There are assumptions that are made by the drug using community, on the identity of and purity perceptions around specific substances, which are based on subjective experience only. This survey had discovered some of the perceptions held around Ecstasy and MDMA, which will be tested through chemical analysis of seized street samples in Chapter 8.

4.2.5 Questions on the participants honesty when discussing drug use

The last section of the survey dealt with how the participants discussed their own drug use, the perception around what is deemed an 'acceptable' drug and what is 'unacceptable' and addressed the question of choice between something taken before and trying something new.

Question 19: Do you ever talk about your own drug use?

The opening question to this section asked the participants whether they ever talked about their own drug use. They were given three options to choose from; yes, no and not applicable (N/A), Figure 4.2.15 shows the percentage of responses for each option from the total participant population.

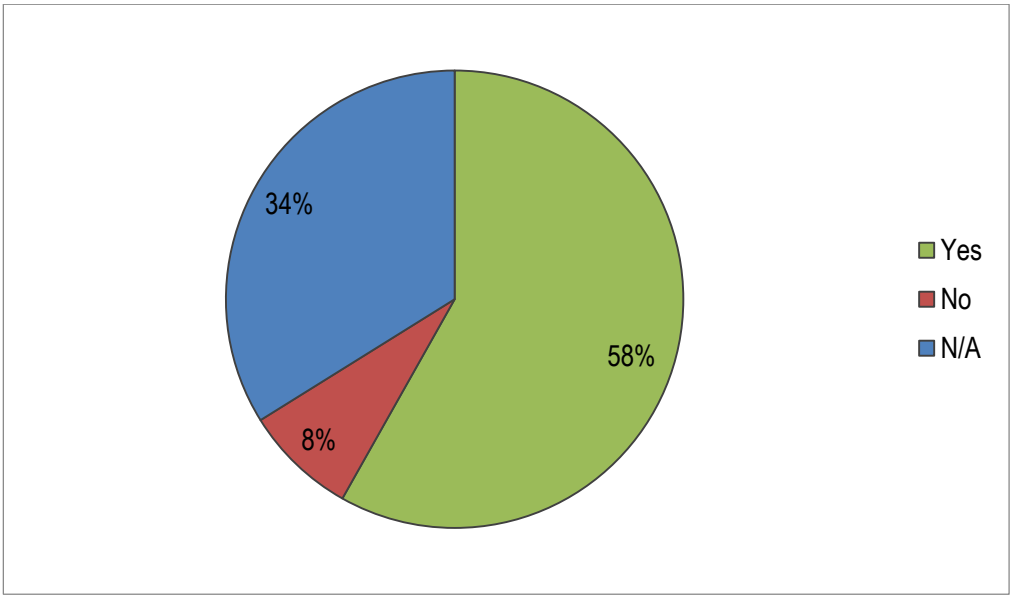


Figure 4.2.15: Responses to the question 'Do you ever talk about your own drug use?' (*n* = 252)

The majority of the participants reported that they had talked about their own drug use, with just over a third choosing the not applicable option. The difference between the options was tested using a one way chi square that returned a χ^2 value of 94.57 and a P value of <0.001, which is significant. When the responses for the user group of participants is examined the percentage of participants that choose the yes option increased to 79%, the percentage for the no option remained the same as the total population at 8%. However 12% of participants who reported to have tried a substance other than alcohol or tobacco in Question 1 stated that it was not applicable to them at this stage in the survey.

Question 20: Have you ever discussed your drug use with any of the following?

Following on from the previous question the participants were asked who they discussed their drug use with. The participants were provided a number of different options from which they could choose as many that were applicable to them. The results are shown in Figure 4.2.16.

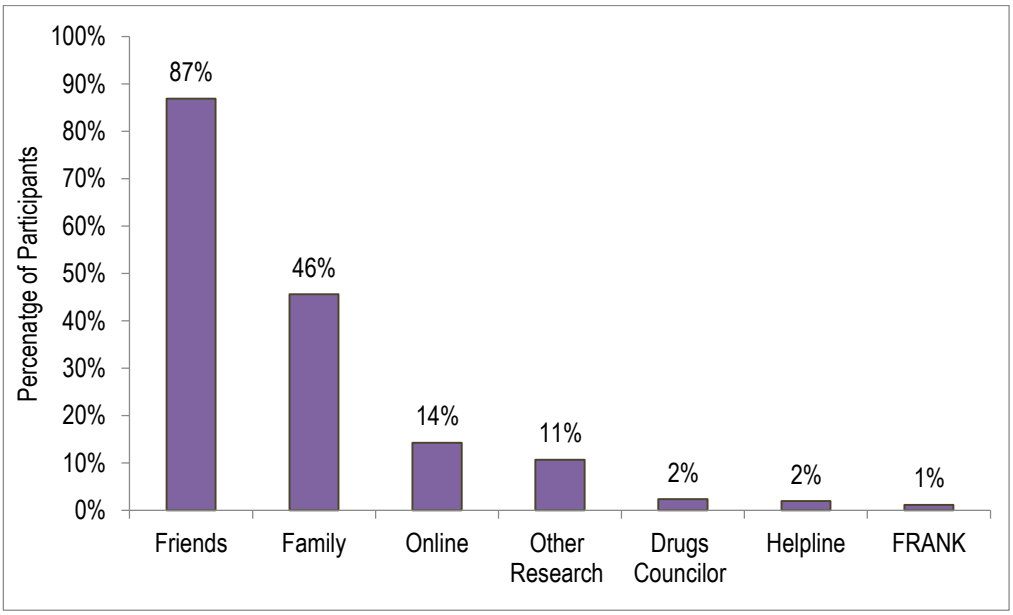


Figure 4.2.16: Percent of participant who gave each option as a response to Q20 - Have you ever discussed your drug use with any of the following? (*n* = 252)

The most popular answer was the participant's friends followed by family; these results reflect the similar findings from survey A. Question 6 of survey A asked the participants where they would look for drugs information, with the first choice being the internet, followed by their friends in second. The option of 'Family' came in 7th out of eleven options in question 6. Question 8 from survey A asked the participant who they would be most comfortable discussing drug use with, as with this question the most popular option was friends followed by; online, a known user and family as the fourth most popular option. In all three questions the options relating to governmental options such as helplines and TalktoFrank received low levels of responses. Only 1% of the participants reported to have ever used FRANK. This correlates to the findings on trust of information sources that placed the government at the lower end of the scale and the second to last out of the options provided in trust. As people distrust the information providers and are obviously not using these sources to obtain their information this prompts the question, what is the best way to provide accurate and unbiased information on drugs to the public?

Question 21: Who do you feel you can be honest about your drug use with?

This question took a slightly different approach to the discussion of drug use, introducing the concept of honesty. As was mentioned in Chapter 3, bias can be introduced into drug research surveys through the principal of social desirability (Caetano, 2001). An example of this would be when the participant is not honest about behaviours that may be deemed undesirable, like the use of controlled substances. This question asked the participant directly who they felt they could be honest with about their own drug use. It utilised the same options as the previous question, the participants could also provide their own answers through the other option button. The results are shown in Figure 4.2.17.

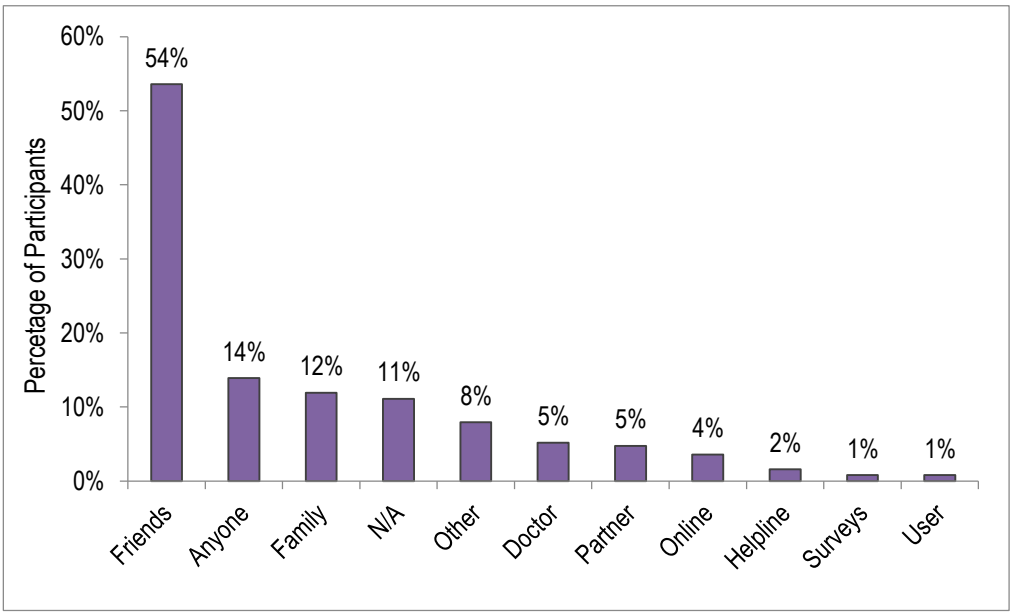


Figure 4.2.17: Participant responses to who they can be honest with about drug use (*n* = 252)

Again the most frequent response chosen by the participant was friends; however the second most popular response was anyone. Though it should be noted that some participants who choose to write 'anyone' did go on to provide caveats to this statements, such as '*anyone but my mother'* or employer or other select family members. One participant stated they would be happy to talk to anyone who wasn't going to prosecute them. The overall results suggest that the participants are willing to be honest about their drug use with a range of different people, indicating that it is perhaps no longer such a taboo subject as it once was.

Question 22: Do you think some drugs are more acceptable than others?

In this question the participants were asked to consider their perceptions about the different drugs, specifically about whether they believed there to be a difference between the substances and whether there are any substances that they deem more acceptable than others. The results are shown in Figure 4.2.18, for this question one participant's response did not register so the sample number was adjusted to 251.

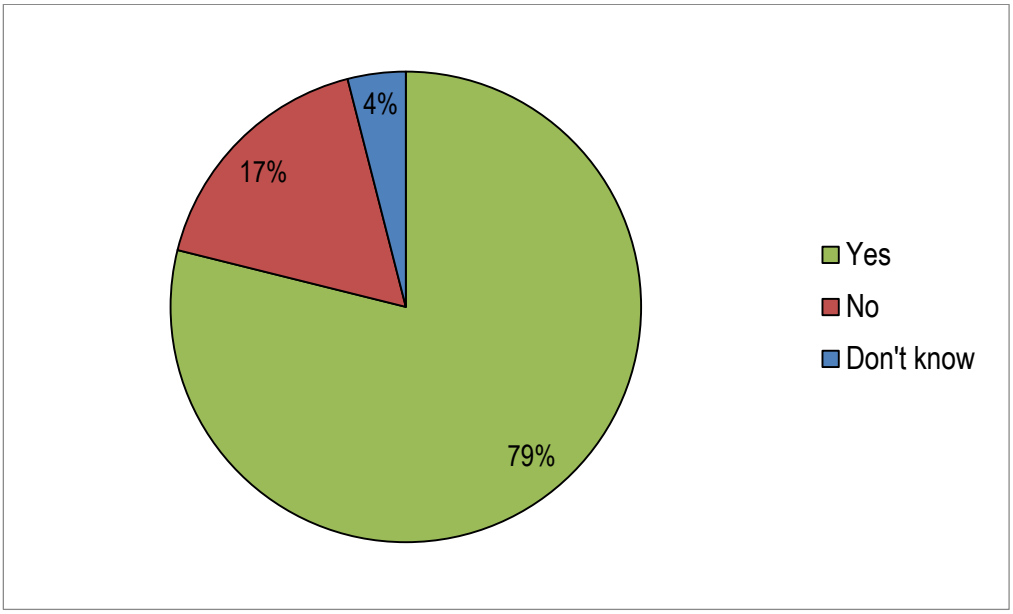


Figure 4.2.18: Percentage of participant responses to question 24 on the acceptability of drugs (*n* = 251)

The majority of participants did believe that some drugs are more acceptable than others, the significance was tested using a one way chi squared, which returned a χ^2 value of 237.22 and a P value of <0.001. The results were then compared between the responses for the non-drug using group and the total drug using group using a two way chi squared to establish whether there was a difference between who thought some drugs were more acceptable. The test returned a χ^2 value of 7.56 and a P value of 0.02, which is significant. More non drug users responded that they did not think some drugs were more acceptable than others compared to the drug using group. In the next two questions they were asked to provide an example of a drug they deemed acceptable and one that they deemed unacceptable.

Question 23: Can you give an example of a drug you think is acceptable?

The participants were asked to give an example of any substance that they thought was acceptable. In this question they were able to provide as many examples as they liked, however the majority choose to respond with just one example. The most frequent responses are shown in Figure 4.2.19, again one participant's response was not recorded so the sample population is 251.

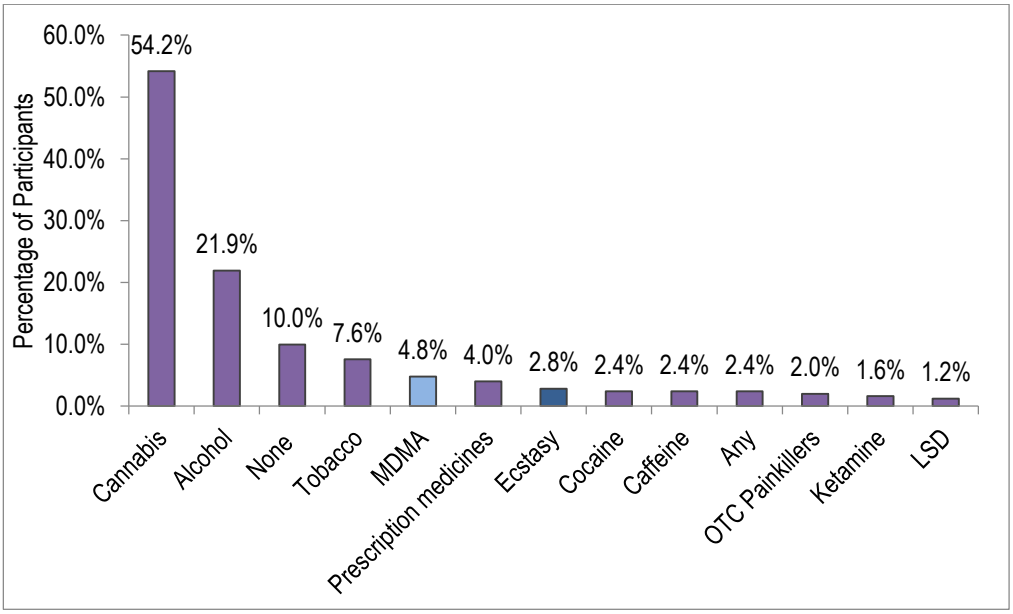


Figure 4.2.19: Responses give for an example of an 'acceptable' drug (*n* = 251)

The most frequent drug that the participants mentioned was cannabis (54%). Only 10 % of the participants stated that they believed there were no acceptable drugs, compared to the 17% from the previous question. Analysis of the results of the responses given to this question based on the participants who choose no previously showed that the ones who did give an example gave responses for; alcohol, tobacco, caffeine, over the counter medicines (OTC painkillers) and prescription medicines.

Other responses that occurred only once or twice included: Morphine, Codeine, Herbal Legal Highs, Magic Mushrooms, Methadone, GHB, and Amphetamine, 2-CE, 2-CB and DMT. Most participants responses were single word answers, however a couple of the participants, provided a longer answer to this question as shown in examples below:

'Anything that someone takes within their own home, that doesn't cause any other person, or government service any hassle - If that makes sense? Therefore, any drug that people may take within their own homes, that does not yield medical problems (e.g. ambulance needed) or require the police (e.g. a fight), or aggrieve any other people (e.g. me!). As I am no expert on drugs, I'm afraid I cannot give a specific example, but I think I've given wide criteria, that at least a few drugs may fit into.'

Participant 80

'None really, but if you were to order them somehow, 'party drugs' like ecstasy would rank above drugs like heroin, just because of the impact they have on a person's life'

Participant 179

I think it is not about a certain drug but amounts. One small line of ketamine may be no different to one pint in a pub.

Participant 209

The recurring theme that the participants brought up was the impact these substances had on the user and on the wider society. There was a clear preference for substances that are perceived to cause less of an impact, such as 'party drugs', which was reflected in the responses overall for this question. What this questions shows is that there is now a broad range of substances, some that are controlled under the highest classification, which are perceived to be acceptable.

Question 24: Can you give an example of a drug you think is unacceptable?

In contrast to the previous question the participants were also asked to give an example of a drug that they believed was unacceptable. The results for this question are shown in Figure 4.2.20.

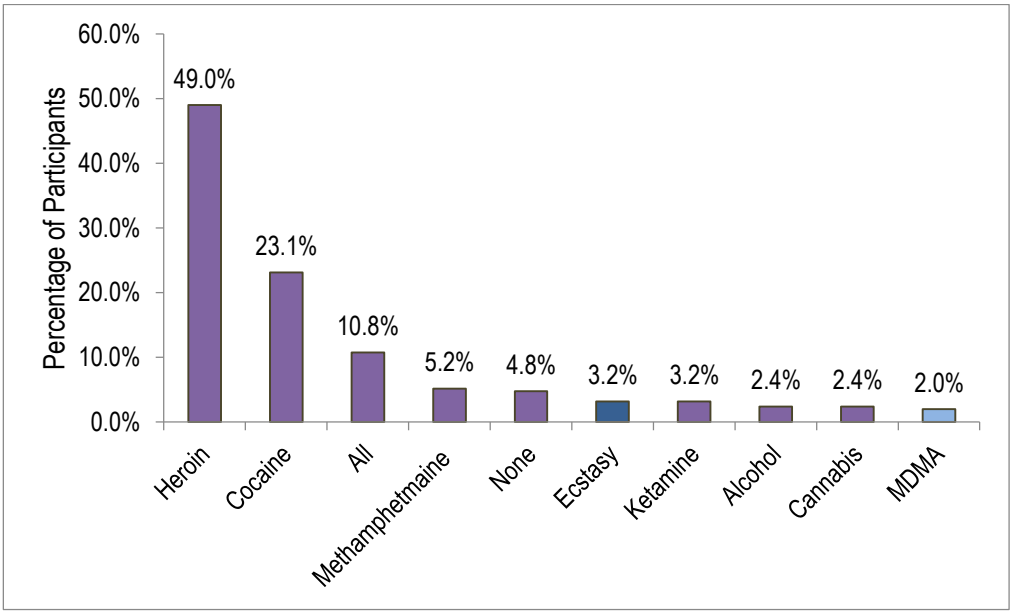


Figure 4.2.20: Responses give for an example of an 'unacceptable' drug (*n* = 251)

The most common example given of an unacceptable drug was heroin (49%), with the second most being cocaine. However the participants mentioned both cocaine and crack, which obtained 13.1% and 10%, when considered individually. 11% of the participants thought all drugs were unacceptable, though some provided caveats such as prescription medicines. Conversely 5% thought no drugs were unacceptable with one participant stating;

'It's not the drug it's the context and whether or not it has a harmful effect on the individual and/or 'society"

Participant 206

Both Ecstasy and MDMA appear infrequently, with 3.2% and 2% of the participants mentioning them as an example of an unacceptable drug. As with the acceptable drugs there were a number of substances that appeared only once or twice, these were; nicotine and tobacco, piperazine derivatives, caffeine, Spice/Synthetic cannabinoids, Krokodil, any hallucinogen, LSD, Mephedrone, any non-prescription drugs, anything injected, Fentanyl and speed. The list of drugs that are unacceptable was a broad as the one of acceptable drugs, though there was a distinct disapproval of opiates and injected substances.

Question 25: If given a choice between something you have taken before and something completely new which would you choose?

The last part of the survey asked the participants a hypothetical choice between taking a substance that they had tried before and something new. They then provided a reason for their choice in question 26. The results for this question are shown in Figure 4.2.21.

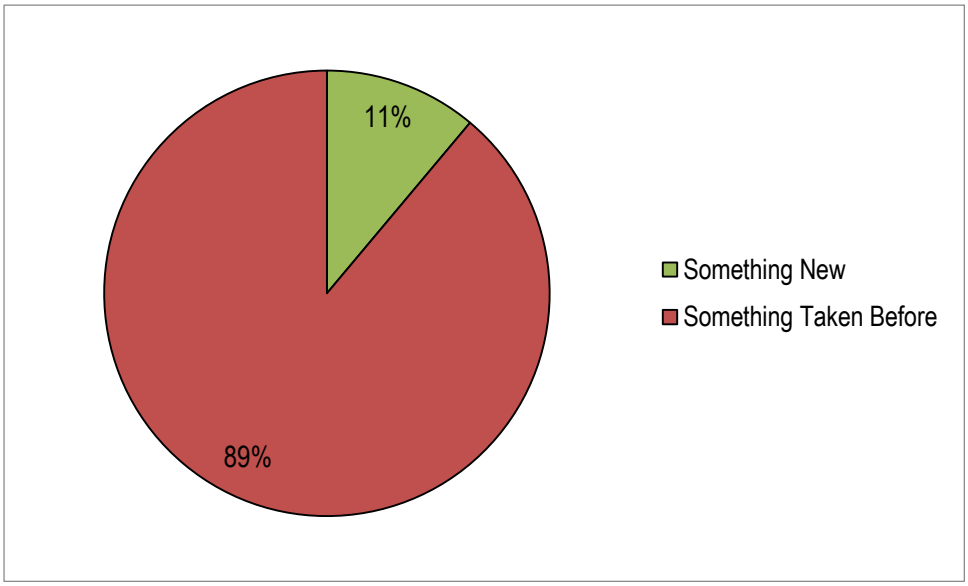


Figure 4.2.21: Responses for the choice between something new and something taken before (*n* = 251)

The majority of the participants stated they would choose something taken before, the significance was tested used a one way chi square, which returned a χ^2 value of 149.94 and a P value of <0.001 and is therefore significant. The participants were not offered a not applicable option, which may have affected the participants' choices. However they were given the opportunity to provide a justification for their decision in question 26.

Question 26: What is your reason for your answer to question 25?

The responses to this question were divided by how the participants responded in the previous question. Only 11% of participants stated that they would have chosen something new, if given this hypothetical option. The reasons given in answer to this question fall into two categories; the first and more prominent reason that was given by the participants was that the participants sought new experiences, with 9% of the population giving this as the reason. These participants could be considered specialist psychonaughts or omnivores under Werse and Morgenstern's typologies of drug use (2012 p.228). The other 2% of the participants rationalised choosing something new as they had never taken anything to begin with.

More participants choose to answer with the option of something taken before, however due to the survey design some stated they choose this as no other option was available and that the choice was 'Not Applicable' to themselves, with 15% of participants using this or other synonymous terms in their response. Of the final 74% of the participants a number of key words and themes emerged in the analysis of their responses.

The most prominent theme to emerge was knowledge of the substance, with 38% of participants using the terms to describe their choice. Knowing about the effects, past reactions, *'knowing it won't kill me'* being the most frequently occurring phrases related to these responses. The use of 'know' as a key phrase also corresponds to a second key word 'experience', which as was seen with the people who choose something new, was an important factor in the participant's choice. Whereas with the participants who choose something new were looking for new experiences, the participants who choose something known were relying on their own past experiences, both positive and negative to make their decision. Other key words to emerge, which corresponded to similar answers given in question 10 and 11 of Survey A, were the themes of 'risk', 'safety' and 'fear'. With the perception being that a known substance would be safer, less risk and that there was a fear of what the new substances could do if taken. The theme of trust, or rather a lack of trust of the newer substances was also evident.

The responses to this question suggests that both sets of participants rely on experience to guide their actions, whether it is to go out an experience new things or relying on past experience knowing about effects and personal reactions to substances.

4.3 Key findings from social research surveys

Ecstasy is not synonymous with MDMA

The first key finding from the social research surveys was that there is a disassociation between the terms Ecstasy and MDMA. This was highlighted throughout both surveys, with the two terms obtaining separate scores across the range of questions. The first question that identified this difference was Question 1 from Survey A which asked the participants which drugs they had heard of. It was found that the majority of the participants had heard of the term Ecstasy (99%), with 78.2% reporting to have heard of MDMA (Figure 4.1.3). This was proven to be a significant difference when tested with the two way chi square ($\chi^2 = 89.92$, $P = <0.001$). Ecstasy was the better known term and no participants reported to have heard of MDMA but not Ecstasy.

The hypothesis that Ecstasy and MDMA are not synonymous was further supported with the findings from the second question, which found that 68% of the participants correctly identified the classification of Ecstasy, while only 48% correctly identified MDMA despite both being controlled under the same class (Table 4.1.1). The amount of people who were able to correctly identify both as being Class A was only 42%. This meant that of the total population 58% were unable to correctly identify both of these terms, thus supporting the theory that the public has not formed a synonymous association between the two terms, despite both relating to the same chemical compound. This was further supported by the 13% who correctly identified Ecstasy but claimed that they 'did not know' what the classification of MDMA was (Table 4.1.2).

Building on the concept of separate identities of the terms Ecstasy and MDMA in the social consciousness was the third question which asked the participant about colloquial name association of a number of drugs, again with the key focus on Ecstasy. In this question instead of having the two terms as separate items the term MDMA was included into the list of possible synonyms the participant could choose from for Ecstasy. This question reinforced the concept of two identities of the terms Ecstasy and MDMA as only 44% of the participants identified the latter as being an alternative name for the former (Table 4.1.4). A further point of interest is the low association with the term Ecstasy and the term Crystal at only 6%. As the term Crystal relates to the form in which the compound is found, there appears to be a strong

association between Ecstasy and the pill/tableted form, whereas crystal has a greater association with the term MDMA. This is further supported by the alternative names suggested by the public, of which the terms tabs and pills were mentioned.

The final question from the first survey that established the difference in perception between the two terms examined the participants' perception of their own knowledge of these terms. Again the findings from this question supported the idea that there are two separate products that are being identified by the public, with Ecstasy obtaining a mode of 4 the second highest possible value on the scale whereas Ecstasy obtained a mode of 1, the lowest. The fact that the majority of people feel highly informed about Ecstasy but gave the lowest possible value for MDMA suggests that these are separate in the public perception.

This theory was also supported by the results for the second research survey into the use of these substances, with the terms representing different forms as either Ecstasy pills or MDMA powder. Across the range of questions asked the two terms received different responses, supported by the qualitative responses that there was a definite perception that these two represent different and separate products on the recreational drug market.

Ecstasy no longer is a catch all term for MDMA, there has been a clear separation in the identities of these two terms. What has also been highlighted is a lack of awareness or understanding of what MDMA actually represents and perhaps a lack of clear information. This is a problem when considering the results of the second survey, where MDMA use was more prevalent than Ecstasy and the contradicting responses from the survey participants around preference. The impact of information sources is the second key finding from these surveys.

Information sources which are used and the ones that are trusted are not necessarily the same

There was a clear lack of information and understanding around not just Ecstasy and MDMA but also the other drugs that were also discussed. These surveys have examined who and what the main information sources are, as well as establishing which are the most trusted. From the first survey, Question 6 asked the participants where they would look for information about drugs. For both parts of this question the results were unanimous in the top three options, with the most popular answers being; the internet, friends and drug forums. The governmental sources were outside the top 3 choices, with doctors receiving less than a quarter of participants stating they would seek information from this source. This was in stark contrast to the results for question 7, which found that doctors were the source that elicited the highest level of trust, just a head of independent scientists. So although doctors were seen as the most trusted to provide accurate information the majority would not actively seek advice from them. One explanation of this contrasting reporting may be given by examining responses to the second survey, when asked about actual drug use one participant stated:

'the press, most doctors and politicians are judgemental and shake their finger disapprovingly at drug use when they have no experience'

Participant 21 [Survey B]

The perceived bias of the sources to provide accurate information may be due to the politicised nature of the question, as the substances are controlled there is the perception that this may impact in the information that is provided. The response by participant 21 also summarises the findings from question 7, which found that the media and the government were not trusted by the majority to provide accurate information.

In Question 8 of survey A, the participants were posed the hypothetical questions of who they would feel comfortable discussing their drug use with. The vast majority chose the option of friends, with the internet and a known user coming in second and third. This question was reworded and asked again in Survey B, this time asking participants who they had talked about their drug use with, the majority responded that they had discussed it with their friends (87%) this correlates to the findings from Survey A. The second highest option was that of family (46%) followed by online (14%) and other research (11%). The participants were then

asked who they could be honest about their drug use with, again the most popular response was their friends (54%), and the next most popular response at 14% was that the participants felt they could be honest with anyone.

At the end of survey A the participants were asked whether they thought awareness of drugs was important. The vast majority (99%) stated that they did believe it was important, with the main reason being that it is important to be aware to be able to make informed choices around drugs and to be aware of the potential risks. Yet when asked whether they believed enough is done to educate about drugs 91% stated that they did not think that there was.

The different perceptions around Ecstasy pills, MDMA powder and Mephedrone

The second survey explored in more detail the perceptions the participants had about these two forms of the same chemical and the new competition. Questions 4 and 5 asked the participants about their physical and emotion experiences with the substances and in both questions the majority of the participants' from the 'user' group stated that their experiences were positive. The proportion of participants who rated the physical experience of the substances as positive varied between substances; MDMA received the greatest proportion of positive responses at 86% of the user group population stating their experiences were positive. Ecstasy was the second highest at 78%; this is compared to only 43% who rated the physical experience of Mephedrone as positive.

The proportion of participants who rated the emotional experience of MDMA as positive was greater than for the physical at 95%. This is logical as the purported effects of the chemical MDMA are empathogenic (Harris *et al.*, 2002). However what is of interest are the perceived differences between Ecstasy and MDMA. Only 92% of the users rated Ecstasy as positive, what is interesting is not the size of the difference but the fact that there is a difference at all. Both supposedly contain the same chemical yet these results suggest that the users are having different experiences on these two forms of the same drug, which may indicate inconsistencies in the chemical composition that is found in the products on the street. As there are no publications on composition of crystal/powder MDMA, this is a question which is examined in the analytical section of this doctoral research. The results for Mephedrone were

again much lower with only 54% of user participants rating the emotional experience as positive.

The participants were also asked whether they had ever had a bad experience or knew of someone who had ever had a bad experience with the substances. The responses for 'Yes-myself' for all three substances was low with 3.6% having a bad experience with MDMA and 6% reporting a bad experience for both Ecstasy and Mephedrone. However the response for 'Yes-someone else' were far greater. A third of the participants knew of someone who had a bad experience with Ecstasy, a quarter knew of someone who had had a bad experience with MDMA and 16% knew of someone who had had a bad experience with Mephedrone. The last is a bigger proportion than the amount of participants who reported to have ever taken Mephedrone to this survey.

The next questions from survey B dealt with how experience had affected the participant's behaviour towards these substances. The first, question 7, asked whether the participants own experience had changed their usage. The results for the user responses for Ecstasy and MDMA were close at 36% and 40% respectively. However over half of the users of Mephedrone (54%) stated that their own experience had changed their usage. The second question, question 8, asked whether knowledge of someone else's bad experience had changed their own usage. This received less 'yes' results across all three substances, Ecstasy received 14.3%, MDMA received 13.2% and Mephedrone receiving 32.4% of its user group stating changing their behaviour based on someone else's bad experience.

The participants were asked to provide a justification for their choice in the previous questions. The main reasons that the participants gave for changing their usage were; the bad experiences, negative side effects and the fear of addiction. The key reasons the participants who stated their usage had not changed gave were based on; a lack of validity given to other people's negative experiences or that the participants had had no negative experiences only positive ones. Analysis of the individual drugs found that both Ecstasy and MDMA received more positive comments than negative, whereas Mephedrone received mostly negative comments. There was also a perception that MDMA was seen a '*clean*' or '*pure*' compared to both Ecstasy and Mephedrone, with the latter described as '*dirty*'.

The purity of MDMA was also a key theme that was established when the participants were asked to choose between the substances. There was an outright preference for MDMA powder stated by the participants over either Ecstasy pills or Mephedrone. The reasons for this were also assessed with open questions asking for a reason for each choice. Again MDMA powder had mostly positive responses relating to previous experiences of the participants, whereas Mephedrone had negative comments as well as a distinct lack of actual awareness of the properties and affects it has. When the participants were asked to rank the drugs by order of personal preference MDMA was ranked as the highest by the user and as the second highest by the non-user groups. Conversely, Ecstasy was ranked the highest by the non-users but was third behind cocaine for the user group. Mephedrone was second from last in the order by both the user and non-user groups.

The findings from these questions, along with the results provided by the Global drug survey (2013) suggests that this new form of MDMA powder has supplanted Ecstasy and is now the preferred form of this drug. The main reason that this has occurred appears to be the perception that this new form is somewhat 'purer' than the tablet form, with one participant mentioning the '*notoriously impure Ecstasy market'*.

What is yet unknown is the relative abundance of the alternative powder form in the market or whether there is any truth to the perception that it is purer. These two questions are examined and answered in the remainder of this thesis.

Chapter 5 Analysis of Trend and Seizures of Drugs

5.1 Review of Organisations examining drug trend data

The use of population surveys is just one method of estimating drug use, another is to examine the level of seizures. The second part of the research project examined the changes in the size and types of 'Ecstasy' seized. This chapter critically examines how global, European and the national markets are estimated, comparing the data provided by the United Nations and the European Monitoring Council on Drugs and Drug Addiction. This will then be compared to the findings in the next chapter from the analysis of the seizures in Cambridge.

5.1.1 United Nations World Drug Report

The controlled status of drugs in most of the countries of the world can be traced back to the United Nations Convention on Psychotropic Drugs in 1971 (United Nations, 1971). The convention was the foundation of what would become the British response to the issue of drugs, namely the introduction of the MoDA 1971. The United Nations Office on Drugs and Crime (UNODC) report on the global drug trends, releasing an annual report on the changes in trafficking and production. The World Drug Reports on two factors; firstly it reports on the relative use of the substances and secondly it tracks production, exportation and seizures. Figure 5.1 taken from the 2013 World Drug report, displays the global prevalence of use of the drug Ecstasy. It shows that the UK has amongst the highest prevalence of reported use of Ecstasy.

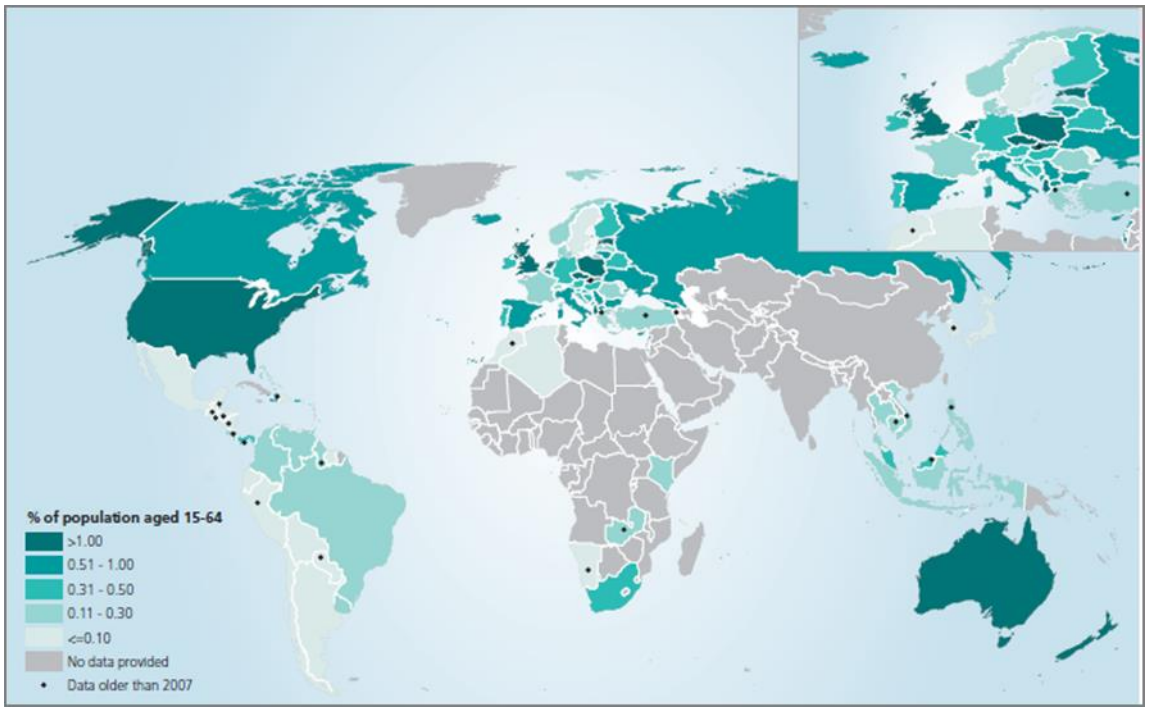


Figure 5.1: Estimated Global Ecstasy Use from the World Drug Report 2013 (UNODC, 2013)

The term Ecstasy is used by the UNODC to describe *'3, 4-Methylenedioxymethamphetamine (MDMA) and its analogues'* (UNODC, 2013 p. xvii). This description includes a wide range of potential substances, without the focus on just MDMA, when considering what the Ecstasy market is. Figure 5.1 demonstrates that Britain is one of the countries with the highest percentage of the population to have used this substance. This is supported by the responses given in Survey B question 1, which found that 33% of participants reported to have used Ecstasy and by the findings of the Global Drug Survey (2013) that reported 64% use of Ecstasy by participants.

The second part of the World Drug Report is the assessment of the relative size of the drug markets. This is done by comparing the reported seizure levels of the controlled substances by member states. As was mentioned in Chapter 2 section 2, in 2009 there was a crackdown in the production of the precursor safrole (UNODC, 2008). This led to an observed lack of availability of MDMA at a global level in the years proceeding, however some recovery was noted:

> *'Although many countries reported a continued low availability of MDMA in the "ecstasy" market in 2010 (often compensated by the increasing availability of new psychoactive substances), there are signs that the "ecstasy" market began to recover in the period 2010/2011'*
>
> (UNODC, 2012 p. 54)

An overall view of global seizures is dependent on the reporting of member states. This is further complicated by the individual social and political situations as well as the way the information is recorded. However the UNODC does provide an overview report of the global seizure levels as shown in Figure 5.2.

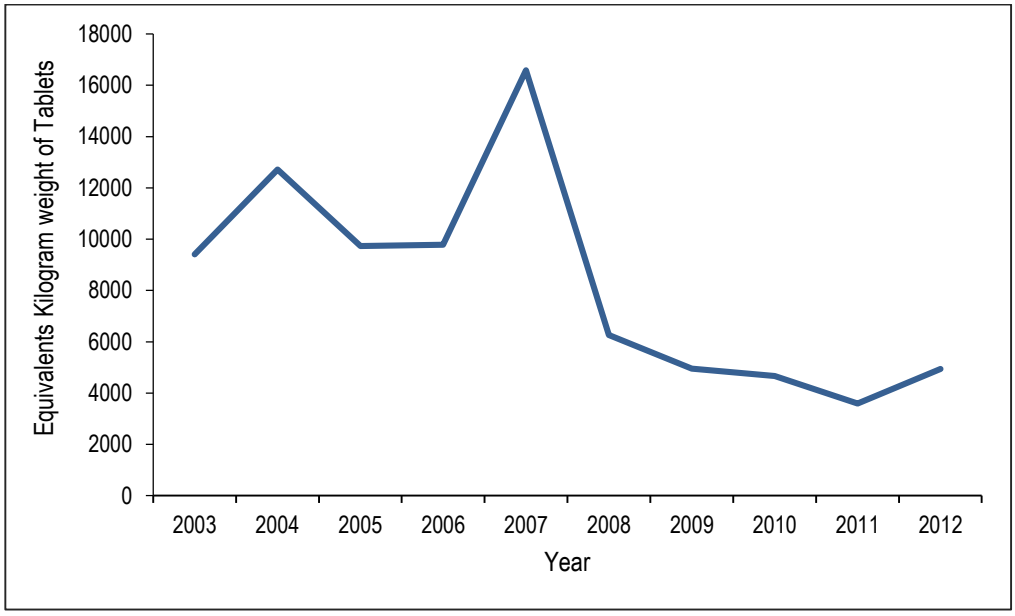


Figure 5.2: Global Seizure of Ecstasy-Type Substances as reported by the UNODC (2013)

The global level of seizures of Ecstasy type substances peaked in 2007, with the major decline observed from 2008, with the aforementioned recovery observed from 2011 onwards. The size of the yearly Ecstasy seizures, as provided by the UNODC, is calculated by converting the assumed bulk tablet weights into the equivalent kilograms based on information available. Thus the estimation on the size of the Ecstasy market is based solely on the seizures of tablets, with no reference to alternate forms. This is also reflected in the reported seizure levels specific to the United Kingdom, which also only accounts for tablet seizures as shown in Figure 5.3.

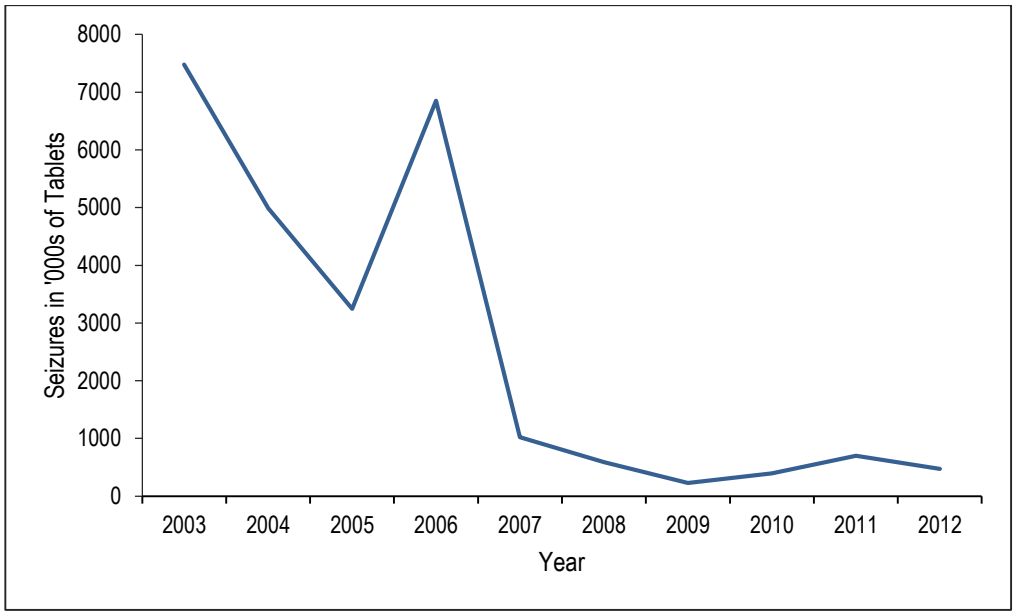


Figure 5.3: Reported seizure levels of Ecstasy type substance from the United Kingdom (UNODC, 2003-2012)

The seizures in the UK follow a similar trend to that observed at a global level; however the measure of the seizures is in number of tablets as opposed to an equivalent weight. As the two are measured by different parameters a direct comparison is not possible, but a number of observations can be made. Firstly in the UK the peak seizures occurred in 2006, followed by a sharp decline in 2007. This is compared to the peak of 2007 observed at a global level. The recovery also occurred a year earlier with reported seizures showing an increase in 2010. However the UNODC is just one of many organisations that tracks the trends around the ever changing drug markets, another that was assessed was the European Monitoring Council on Drugs and Drug Addiction, the EMCDDA.

5.1.2 European Monitoring Council for Drugs and Drug Addiction (EMCDDA)

The European Monitoring Council for Drugs and Drug Addiction (EMCDDA) monitors drug abuse within the European Union (EU), like the UNODC they are focused on identifying drug trends and providing advice to aid the development of drug policies. The EMCDDA collects data from each of the participatory countries within the EU and generates comparative reports (EMCDDA, 2013). The EMCDDA also reports on the estimated size of the 'Ecstasy' market based on the seizures of tablets, Figure 5.4 displays the comparison of the UK seizures to the findings from the EU.

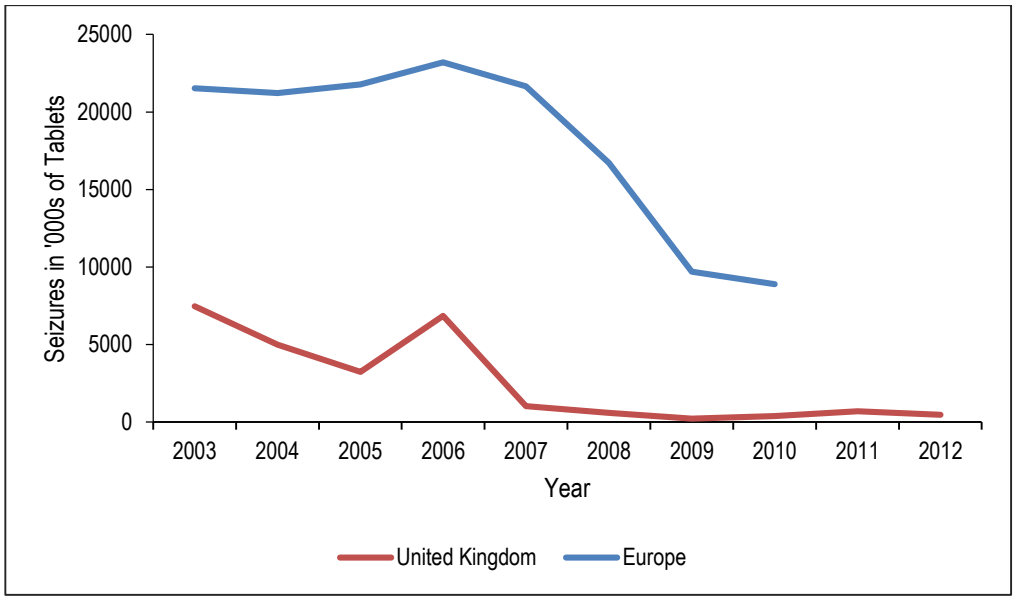


Figure 5.4: Comparison of reported seizure levels between the UK and the EU (EMCDDA, 2013)

The data from the EMCDDA is only available up to 2010 as not all member states produce regular statistics on their seizure levels. As can be seen from Figure 5.4, the decline in the level of seizures across Europe follows the same trend observed in both the global market and within the UK, with a decline in the lead up to 2009. However in Europe the decline is not as immediate, as was observed in the UK and Global trends, instead occurring over a number of years from 2007.

It is the findings from the World Drug Report, alongside EMCDDA reports that have impacted the perceived level of drug usage at the global, European and national stage. Yet both rely solely on the seizure of tablets to estimate the size of the 'Ecstasy' market. However as was shown in the responses to the questions in Survey B, more people are reporting to take an alternate form of MDMA, namely a powder or crystal product. This is further supported by the reports from the Global Drug Survey (2013). As estimations are made just on the level of tablets that are being seized, not including alternate forms, which are reportedly more popular. This could mean that the actual size of the market for MDMA is significantly underestimated.

This research sought to prove that the classification of what constitutes modern Ecstasy and MDMA consumption may be being undervalued by investigating to what extent the new crystal form of MDMA was being found on the streets. This was achieved by using a case example of examining the seizure levels found in the city of Cambridge, to establish what the prevalence of the different types of MDMA.

5.2 Seizure Data Collection Methodology

5.2.1 Introduction

Through a collaboration with Cambridge Police access was granted to the police record drug logbooks, with the help of a gatekeeper. From these log books data was collected from over a 10 year period. It was then examined for any possible changes in type of Ecstasy/MDMA being seized but also what impact the NPS has on seizure levels of the more established drugs.

5.2.2 Collaborations

Anglia Ruskin University is working in collaboration with the Cambridgeshire Constabulary working out of the Parkside Police station, situated in the city of Cambridge. This collaboration has allowed for the collection of primary seizure data of the drugs being seized in the vicinity of Cambridge. As well as providing access to the drug log books Cambridge Police are also providing seized street samples for analysis that are discussed in Chapters 7 and 8.

5.2.3 Data Collection Method from Drug Logbooks

A systematic review of the police logbooks was conducted, examining the time period between 2003 up to 2013. The number of books varied per year as did the total number of reported seizures per year. Upon examination of the drug record log books a number of variables were considered and recorded. Firstly, only samples that had a confirmed identity were included in the study, to ensure the accuracy of the data being recoded. Second, the seizures were counted per case rather than by the number or weight of the samples in each seizures. This was because the relative offence, either possession or supply were not considered and it was just the type that was of interest. There were also some substances that were excluded from the study namely; cannabis in any form, cocaine in any form, and heroin as they were not of interest to this research.

The final and most important variable was the type of sample recorded; this was the most subjective variable as the descriptions were dependant on the officer who logged the sample. There was a lack of uniformity in the recording of the description of substances; the

ramification of this is discussed later on in the results section. The layout of the information and the drug log books is shown as a diagram in Figure 5.5.

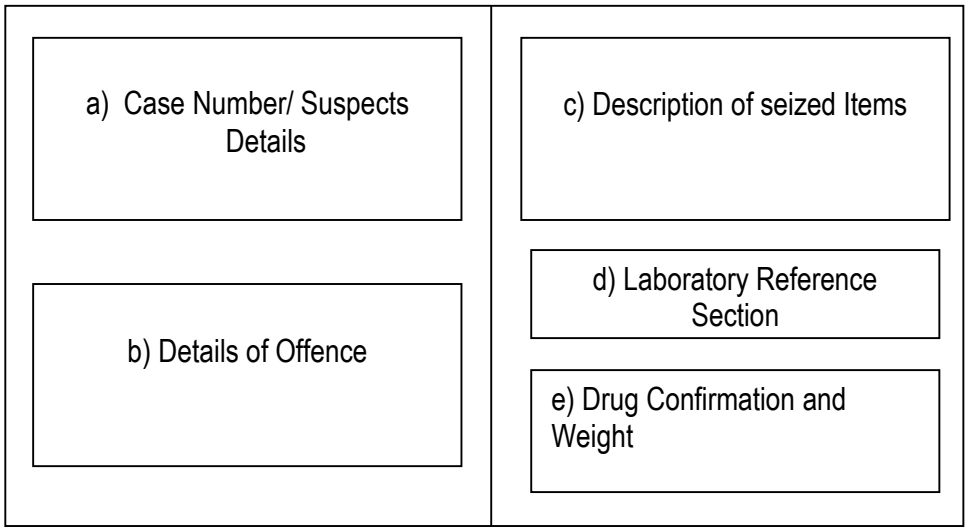


Figure 5.5: Layout of Cambridgeshire Police Seizure Logbook

Before data collection began certain data protection protocols were stipulated by the gatekeeper in relation to what was permissible to be recorded. It was made clear that only certain information was permitted to be included in this research, due to the sensitive nature of the information recorded in the logbooks. As mentioned previously the nature of the offence, either possession or possession with intent to supply was not recorded, neither were any personal details about the suspect or the case the samples related to. The information was that accessible to be recorded for this research included descriptions of the seizures and the confirmation of seizures chemical identity. To collect the data from the log books a form was generated, this was printed out and the data was collected and recorded by hand. For each seized sample the following was recorded; the confirmed substance identity and form as recorded.

The data collected was analysed in two ways; firstly to establish the prevalence of the type of MDMA being seized in Cambridge, looking specifically at when the powder first began to emerge and whether it has gained greater prevalence than the traditional pills. It was also analysed to look the impact that the emergence of NPS had on drug market of Cambridge, with a focus specifically on the impact of Mephedrone, its prevalence and whether it has it managed to persist in the market.

Chapter 6 Results of Seizure Data for Drugs

6.1 Cambridge Seizures between 2003 and 2013

The data that was collected for this project looked at seizures in the period between 2003 and 2013 in the city of Cambridge. The data was collected to answer two questions; firstly what was the prevalence of the compound MDMA compared to competing compounds. Secondly in which form was MDMA the most prevalent. The data collected from the drug logbooks has been summarised in Table 6.1.

Similar to the description used by the UNODC, the Cambridge police use the term 'Ecstasy' to cover any substance that contains MDMA or its analogues. This is because these substances are all classed under the same section of the MoDA 1971. Therefore when analysing the data the term 'Ecstasy' has been used consistently in this section when discussing either form. There were also some substances that occurred infrequently in the records, these were grouped together into their respective class of drugs, the piperazines and cathinone substances. There was also variability in which compounds appeared from these classes year to year. Table 6.2 shows the different compounds found in each year; separated into either the piperazines or the cathinones, as described in the record books. Some samples were recorded as containing mixtures of more than one compound; in this case each compound was recorded individually.

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Table 6.1: Number of cases confirmed to contain chosen substances seized by Cambridge Police 2003-2013

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Average	Range	Variance
Ecstasy (MDMA)	23	17	21	26	17	28	7	7	18	30	14	19	23	54
Amphetamine	15	11	28	24	14	17	23	15	26	20	18	19	17	27
Ketamine	0	1	2	5	14	20	24	9	11	9	5	9	20	55
Piperazines	0	0	0	1	1	7	22	22	1	4	0	5	22	66
Cathinones	0	0	0	0	0	0	2	21	4	4	9	4	21	38
n	*38*	*29*	*51*	*56*	*46*	*72*	*78*	*74*	*60*	*67*	*46*	56	49	225

Table 6.2: Individual compounds from the Piperazine and Cathinone classes as reported each year in the Cambridge drug log books

	2006	2007	2008	2009	2010	2011	2012	2013
Piperazines	BZP	Piperazine	BZP 'Piperazines'	BZP 'Piperazines'	BZP TFMPP	TFMPP	TFMPP	TFMPP
Cathinones	None	None	None	Khat Mephedrone (4-MMC)	Mephedrone (4-MMC) Naphryone Flephedrone	Mephedrone (4-MMC) MEC	Mephedrone (4-MMC)	Mephedrone (4-MMC) Methylone MEC Cathinone

6.2 Analysis of the seizures of Ecstasy reported in Cambridge

The level of seizures of confirmed samples of 'Ecstasy' recorded by Cambridge police is displayed Figure 6.1, this figure shows the changing trend over the time period.

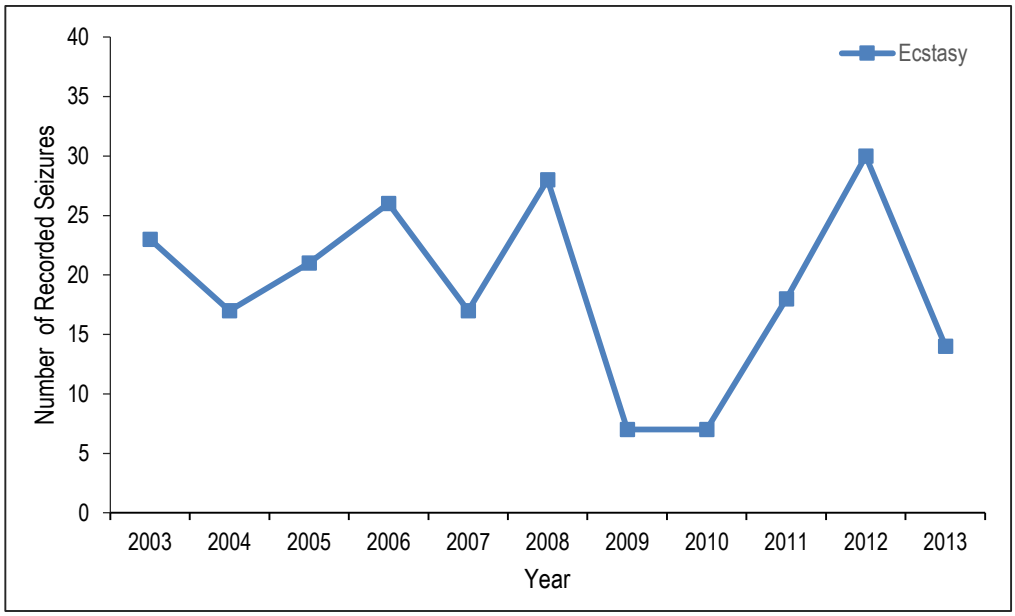


Figure 6.1: Number of seizures of Ecstasy (MDMA) as recorded by Cambridge Police between 2003 and 2013

A key observation from this data is what occurred between 2009 and 2010. As has already been stated there was a specific crackdown on the production of safrole in 2008, which led to a major decrease in the availability of MDMA (UNODC, 2008). The effect of this is observed in the seizures found in Cambridge the following year. However the levels of Ecstasy/MDMA began to increase again past 2010. This correlates with the findings reported at a global level by the UNODC (2013) as shown in section 5.1.1. The relevance of the lack of availability of MDMA at this time becomes apparent when examining the emergence of the NPS into the British recreational market, looking specifically at what occurred in Cambridge.

6.3 The analysis of Ecstasy seizures in comparison to Amphetamine seizures

From the data it was observed that amphetamine was present most consistently of the selected drugs reported over the time period examined as it had the lowest range and variance of the substances examined, as shown in Table 6.1. In the time period examined, the seizures of amphetamine also did not show the same decline in availability as was observed for Ecstasy in 2009. A direct comparison between the seizure levels of these two compounds is shown in Figure 6.2.

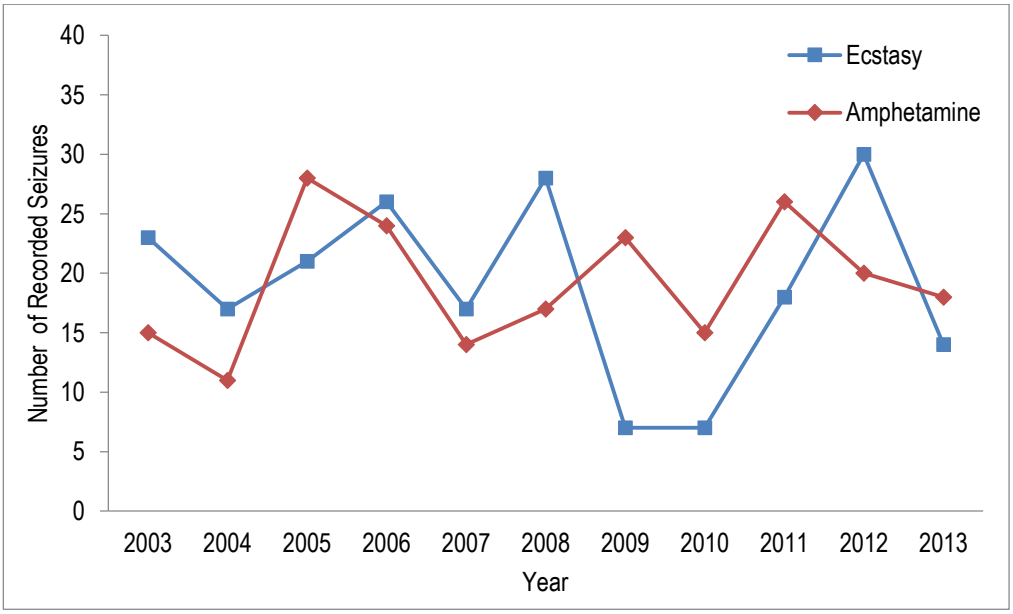


Figure 6.2: The number of seizures of Ecstasy/MDMA compared to Amphetamine as found in Cambridge (2003-2013)

The data shows is that while there was a decline in the seizures of Ecstasy in the years 2009/2010 as a result of the crackdown of safrole production, the level of amphetamine seized in Cambridge was unaffected. The observed trend suggests that the level of seizures for amphetamine appears to increase over the time period examined.

6.4 Seizures of Ecstasy in comparison to newly emerging NPS

This research not only sough to discover the prevalence of the drug Ecstasy, but also the substances that were considered to be 'replacements' or 'competitor' compounds, namely the piperazine compounds and the substituted cathinones such as Mephedrone and ketamine, which were assessed in Survey B. Figure 6.3, depicts the emergence of these compounds, in comparison to the seizure levels recorded for Ecstasy.

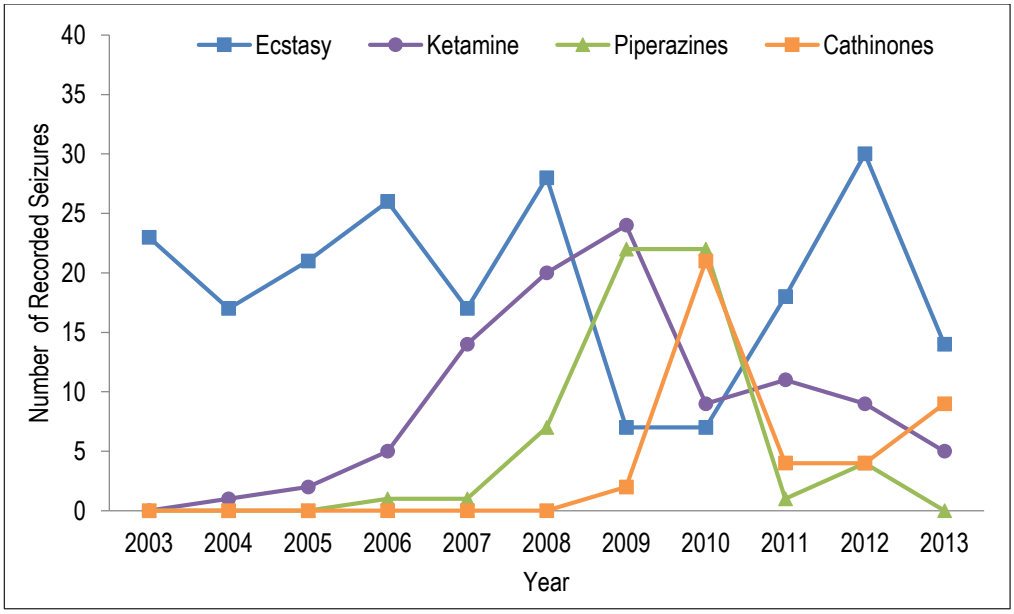


Figure 6.3: Seizures of Ecstasy/MDMA compared to the newly emerging NPS as found in Cambridge (2003-2013)

The compounds and their impact will be discussed briefly by order of their emergence in Cambridge. However the use of the word emergence is perhaps not entirely fitting. The increase in the prevalence of these substances in the seizure records can be identified to when each of the substances were controlled under new legislature.

The earliest of the NPS substances that was recorded in the log books was ketamine, which was controlled by an amendment to the MoDA 1971 in 2006. However there were records of it being seized before this in Cambridge, with the first recorded seizure in 2004. There was a sharp increase in the number of seizures of this substance being recorded post 2006. The reported numbers of seizures then increased year on year until 2009 when something else entered the market. As ketamine was only controlled in 2006 there was no requirement to record seizures before this date, even though some were, the actual scale of seizures pre-2006 is unquantifiable by this project as only confirmed samples were assessed.

Next to enter the Cambridge drug records were the piperazine class of substances in 2009. The first of these to be identified was BZP but was subsequently followed by a generalised term of 'piperazines' and then TFMPP as shown in Table 6.2. It is important to note that these compounds were relatively unknown as recreational drugs towards the middle of the 2000s, being sold like Ecstasy tablets (Staack, 2007, Wood *et al., 2007*). Again the 'emergence' of these compounds in the Cambridge market coincides with the legislation brought in to control them in 2009. Until this point any discoveries and seizures of these compounds would have gone unreported as they were treated as an unknown/uncontrolled substance and not confirmed as controlled substances.

The final group of substances that appeared in the Cambridge data were the cathinone derivatives. As with the piperazines it is impossible to discover the prevalence or emergence of these compounds pre-legislation in 2010. However Table 6.2 gives an indication based on the types of cathinones reported. There is a substantial increase in the seizures of cathinones, mostly the compound Mephedrone in 2010. This was at the peak of its media hype that was discussed in section 2.6.3 (Alexandrescu, 2014).

Post-2010 saw the re-emergence and increased prevalence of the seizures Ecstasy in Cambridge, which correlates with the findings reported by the UNODC (2013), who also noted a recovery to the market for this drug in the same time period (Section 5.1.1). This can also be linked to the observed decline in the levels of both piperazine and cathinone groups of compounds. Both these groups of substances were introduced as alternatives to the Ecstasy group of substances. However the findings from Survey B suggests that given an option the preference is for MDMA over these compounds. This could explain why the sudden decline of cathinones and piperazines coincides with the re-emergence of Ecstasy/MDMA products. As Ecstasy became more available there was less of a need for these products.

This finding indicates that certain NPS markets are driven by availability of compounds in question. However there is an argument to be made for consumer choice, specifically related to the Ecstasy market. This poses an interesting question; if the UNODC had not cracked down on the production of safrole, thus leading to the mass unavailability of arguably one of the most popular recreational drugs, would there have been the sudden explosion of NPS substances into the market to fill the MDMA void?

The answer to this question is most likely to be yes as there are still new NPS compounds entering the UK market (Home Office, 2014) despite the apparent re-emergence and availability of MDMA. However whether the drug Mephedrone would have become as prevalent could potentially be argued based on the user reports from survey B, and that its prevalence in the Cambridge market was so short lived. This raises a second question about how prevalent NPS products really are in relation to previous 'traditional' compounds. Has there been anything to emerge in the last 5 years that can actively compete with Amphetamine, Ecstasy and Cocaine? The data collected for this research, both the seizure records and social responses would suggest not.

6.5 Comparison of the Type of Ecstasy seized

To answer the second research question, whether tablets or pills were more prevalent, information was collected on the Cambridge seizures. This information was provided in the descriptive section in the log book. The descriptions were variable as there was no uniform description method and was solely dependent on the officer who was logging in the sample. However there was a clear distinction between the forms that were being reported. These types fell into two categories as either tablets or powders/crystals; the change in the prevalence of these two types is displayed in Table 6.3.

Table 6.3: Ecstasy Seizures in Cambridge city between 2003 and 2013 by type

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Tablet	23	*17*	18	22	*12*	13	4	1	1	5	0
	100%	*100%*	*86%*	*85%*	*71%*	*46%*	*57%*	*14%*	*5.50%*	*13%*	*0*
Powder/ Crystal	0	0	3	4	5	15	3	6	16	25	14
	0	*0*	*14%*	*15%*	*29%*	*54%*	*43%*	*86%*	*89%*	*87%*	*100%*
Unknown	0	0	0	0	0	0	0	0	1	0	0
	0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*5.50%*	*0*	*0*
n	*23*	*17*	*21*	*26*	*17*	*28*	*7*	*7*	*18*	*30*	*14*

The data shows a clear and definite shift has occurred in the type of MDMA being found in Cambridge, visualised graphically in Figure 6.4. There is a distinct cross-over period observed between 2008 and 2010. There was one sample in 2011 for which a clear identification was not possible, this sample was not included in the figure below.

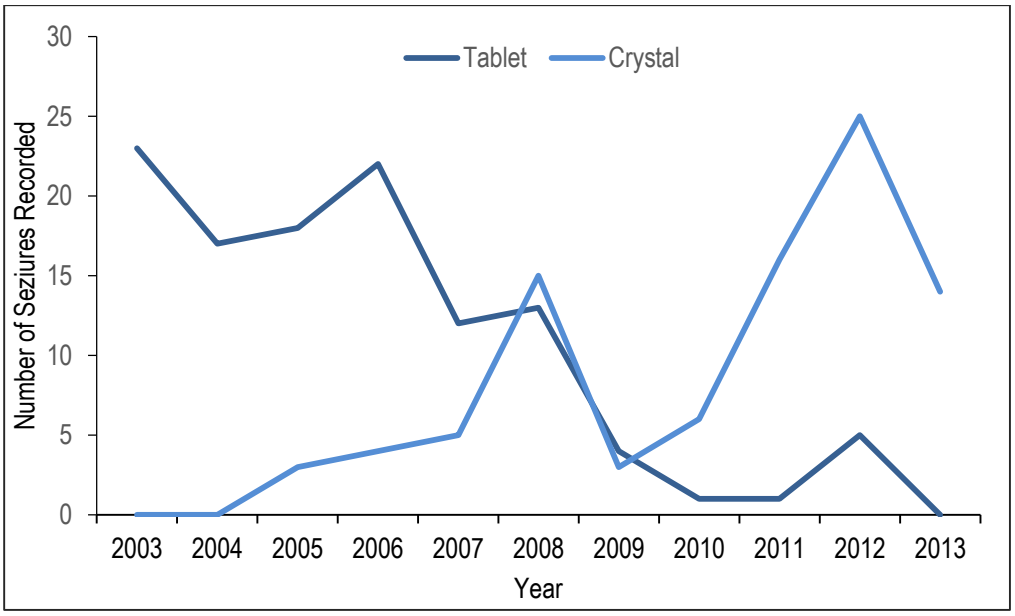


Figure 6.4: The changing trend of Ecstasy recorded by type as found in Cambridge (2003-2013)

The changing trend observed in the Cambridge seizure records correlates with the findings reported in a paper on the changing use of the terms Ecstasy and MDMA (Turner *et al.,* 2014). The significance of the change in seizures of tabletted material over time was tested using a spearman's rank correlation co-efficient. The test returned an r value of -0.898 and a P value of <0.001. Thus the change in seizures of the tablets form is a significant decline over the time period examined. Conversely the trend in seizures of the crystal samples was also tested using a Spearman's rank correlation co-efficient, this returned an r value of 0.836 and a P value of 0.001. This shows that the increase in crystal samples was significant over the time period examined.

The findings in this section has provide clear evidence that there is now effectively two 'products' in the recreational drug market that both use MDMA (the chemical), as their key psychoactive ingredient. The issues that arise from this were highlighted in the social research, that the public and potentially the users not recognising the two as being one and the same. This is further compounded by the belief that one product, namely the powdered form is purer, a hypothesis that will be analysed in the subsequent analytical section.

The second issue that was discussed in the evaluation of the UNODC and the EMCDDA's estimation of the Global and European markets is the reliance on tablet seizures to estimate the size of the market. Yet as can be seen in the data collected from Cambridge and supported by the users own statements in the qualitative questions from the social surveys, tablets are not the most dominant and prevalent form which is being used or seized. This means the actual size of the MDMA market is being under estimated and its impact understated.

6.6 Key Findings from analysis of Seizure Data from Cambridge

The seizure data collected from the Cambridge show that the availability of MDMA in the city was impacted by the sanctions by the UN in 2008, with less Ecstasy being found on the streets in 2009 and 2010. This also coincided with the emergence and identification of NPS's entering the Cambridge drug market. However neither the piperazines nor the cathinones have had the same level of prevalence of MDMA, and any increase in seizures of these substances was short lived once MDMA returned to the market. What is also apparent is the definite shift away from tableted material to the form of powders and crystals, which as of 2013 were the most prevalent form of MDMA being seized in Cambridge. These findings support the second social survey data in which the participants stated a categorical preference for the product identified as MDMA powder. With more powder available in Cambridge the fourth research question which sought to discover the relative purities of the two forms is answered in the next section, the chemical analysis of the seized samples.

Chapter 7 Chemical Analysis of Street Drugs

In previous chapters there has been a critical examination of how social surveys on usage and seizure data have been used in other research before comparing this to the data procured in this research. The following chapter discusses the method used to identify and quantify seized street samples of powder MDMA. This cannot be critically compared to previous data as there is no other study that has published comparable data. Therefore the following section will instead outline the approach taken in examining controlled substances, including an overview of the instrumentation that was employed in this research and why.

7.1 Process of Identification

Throughout this thesis it has been taken for granted that when discussing drugs, the substances are what they are believed to be. This is specific to the reports from the users of the substances they have taken. However how does a user know exactly what the substance they are taking is? As reported in Question 19 of Survey B 27% of the participants (*n =252)* reported to have tried something without knowing exactly what it was. The truth is that without thorough chemical analysis no user can be 100% sure that the drug they are taking contains the substance they think it does.

One way to determine what is in a sample is to send it for analytical testing. This is provided through forensic science laboratories to the police forces in relation to criminal cases. As the substances of interest are controlled under the MoDA 1971, accurate identification is important to be able to correctly prosecute. However due to the criminal nature of the control status of the substances, users have no legitimate way to gain access to the analytical techniques required for thorough identification. The seizures examined in the previous chapter had already gone through the identification in forensic laboratories to confirm the identities of the substances at the request of Cambridgeshire police.

After samples have been seized by the police or border agency they are sent to be examined by forensic laboratories for identification, quantification and any other testing that can provide information to help with the case. A general overview of the procedure the samples undergo is shown in Figure 7.1.

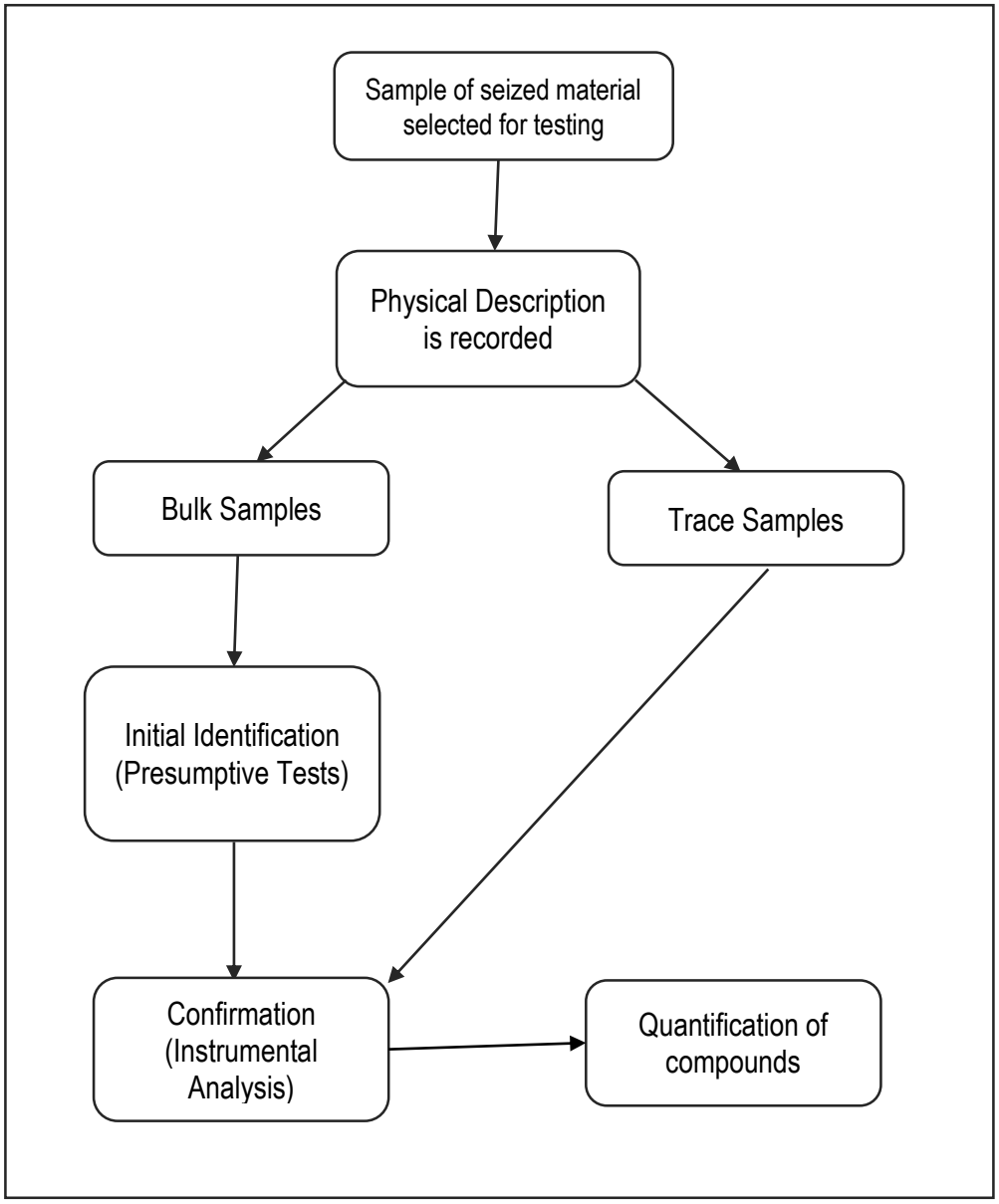


Figure 7.1: Flow Diagram of a generalised procedure for identifying street samples of drugs (Cole, 2003)

Once submitted to the laboratory, the first stage of identification is sample selection; this determines what needs to be tested and in what quantities. The second stage is a thorough and accurate record of every pertinent detail of the physical description of the sample, including any details of the packaging. This stage is especially important for tablets that have unique identifying markers that can link batches to producers, this has occurred most recently in the case of the yellow UPS tablets connected to group located in the Netherlands (Power, 2015). In a forensic context it is important to record an accurate starting weight of the sample before anything has been removed as then an accurate dosage amount can be calculated (Cole,2003). Any distinctive odours should also be noted as this can give a preliminary indication of what might be present (Cole, 2003).

The third step determines what course of action to follow, this is achieved by determining whether the sample is considered bulk or trace. Trace samples may include items that have been submitted that are believed to have minute amounts of a controlled substance, such as weighing scales and other paraphernalia (Cole, 2003). Bulk samples in relation to drugs are not necessarily significantly large quantities, as the analytical tests that will be described later on require milligram quantities for identification. Trace items are directly analysed by instrumental analysis (Cole, 2003). When dealing with large numbers of bulk samples a quick and cost effective method of eliminating samples is required. There are a number of presumptive tests that can provide preliminary identifications of select substances. Once a sample has indicated that it may contain a controlled substance it can then be analysed by a variety of analytical techniques. The technique that was used in this research was Gas Chromatography – Mass Spectrometry (GC-MS), a technique that can be used for the confirmation and quantification of controlled substances.

7.2 Acquisition of Samples

As mentioned in the section 5.2.2, the Forensic Science and Chemistry Research Group (FSCRG) at Anglia Ruskin University have an on-going collaboration with the Cambridge police based at the Parkside Police station. This collaboration provides seized samples of illicit substances for analysis to support the research projects conducted by the academics and PhD researchers of Anglia Ruskin. To date the number of samples provided by the Cambridge police stands at a total of 80 samples, these samples are allocated unique identifying numbers from A1 to A80. However not all these samples were of relevance to this research project, the choice of sample inclusion and exclusion is explained in the following section.

7.3 Sample Selection

Over the course of the project there were three stages of sample selection. The first stage was the initial test group made up of 19 samples. The first nine samples were specifically chosen at Parkside in March 2013 by the researcher as potentially containing the compounds of interest. Of these samples; four were in the tablet form with the other five were crystalline or powdered samples. The next ten samples were chosen using a random number generator from the samples labelled A1 to A44. These samples had been previously collected and were

also being analysed as part of other projects within the FSCRG. It was through these other projects that a further nine samples containing the target compounds were identified and so included into this project to make a second stage of samples.

The last stage of sample selection were samples collected from Parkside in February 2014. This stage included 20 samples, 2 tablets and the rest powders or crystals. This correlates to the findings from the seizure records as in the time period of sample collection 2012/2013 as only 13% of 'Ecstasy' samples seized in this year were in a tablet form. Samples A63, A70, A71, A72 and A73 were made up of a series of individually wrapped samples, with samples A63, A70 and A73 containing what are known in the drug using community as 'bombs' (Measham *et al.*, 2010). Each 'bomb' was separated to create individual samples bringing the total number of samples for the third stage to 28. Pictures of the different packaging types are included in Chapter 8. The total number of samples assessed was 56, however not all of these contained substances of interest. To identify samples of interest the identification process followed the same method outlined in Figure 7.1, with primary identification using presumptive tests and confirmation and quantification using analytical techniques.

7.4 Presumptive Tests

The first stage of analysis was to determine if the samples could possibly contain the substances of interest. The quickest and most cost effective method was through the use of presumptive tests (UNODC, 2006). There are a series of presumptive tests specifically developed for the primary identification of illicit compounds, these tests can indicate whether a sample contains a specific group of compounds and can differentiate to some extent between compounds (O'Neal, Crouch and Fatah, 2000). All of the samples were subjected to the same presumptive tests, with the two tests chosen being the Marquis and the Mandelin tests. These two tests can identify and distinguish between amphetamine type stimulants and other psychoactive compounds (Johns, Wist and Najam, 1979; O'Neal, Crouch and Fatah, 2000; UNODC, 2006; Velapoldi and Wicks, 1974*)*. The expected results for each tests is described in the following sections.

Marquis Test

There are a number of different ways of producing the Marquis Test reagent (O'Neal*,* Crouch and Fatah*,* 2000; UNODC, 2006). The method followed to produce the reagent used in this project follows the method outlined by O'Neal, Crouch and Fatah (2000). The solution was made by the addition of 100mL of concentrated sulphuric acid to 5mL of 40% formaldehyde (formaldehyde: water v/v). The Marquis test can be used to differentiate between amphetamine and the ring-substituted substances such as MDMA, as shown in Table 7.1.

Table 7.1: The positive colour reaction responses for Marquis Test as recorded in the literature

Compound	Velapoldi and Wicks (1974)	Johns, Wist and Najam (1979)	O'Neal, Crouch and Fatah (2000)	UNODC (2006)
Amphetamine	Orange – Brown	Orange – Brown	Reddish Brown	Orange – turn slowly to brown
Methamphetamine	Orange – Brown	Orange – Brown	Reddish Brown	Orange – Brown
MDA	Purple	Black	Black	Dark Blue – Black
MDMA	No Data	Blue – Purple – Black	No data	Dark Blue – Black

The Marquis test cannot be used to differentiate between amphetamine and methamphetamine nor between the methylenedioxy compounds, hence why it is only a presumptive test.

Mandelin Test

The Mandelin test can differentiate to some degree between amphetamine and methamphetamine. However it cannot differentiate between the methylenedioxy compounds as shown in Table 7.2. There are a number of self-test kits available on the market that rely on the Mandelin test reagent as proof of MDxx compounds, most notably the EZtestkit (EZtestkit, 2013). The Mandelin reagent was also produced in accordance to the method described by O'Neal, Crouch and Fatah (2000). To produce Mandelin reagent, 1.0g of ammonium vanadate was dissolved into 100mL of concentrated sulphuric acid. The varieties of colours which are produced when Mandelin reagent is added to the different compounds are due to oxidation of the vanadium ions in solution (*ibid.*).

Table 7.2: The positive colour reaction responses for the Mandelin test as recorded in the literature

Compound	Velapoldi and Wicks (1974)	Johns, Wist and Najam (1979)	O'Neal, Crouch and Fatah (2000)
Amphetamine	Bluish green	Green	Bluish Green
Methamphetamine	Yellowish green	Light Green	Dark Yellowish Green
MDA	Purple – Black	Red – Purple	Bluish Black
MDMA	No Data	Blue- Dark Purple – Black	No Data

Presumptive tests cannot be used as confirmation of a sample as there are number of factors that can impact how a presumptive test is interpreted. Firstly, colour is subjective, as demonstrated in the variation reported by the different papers published on what colour should be expected (Table 7.2). Therefore it is imperative that a known control is used at the same time as any unknown compound for a direct comparison (UNODC, 2006). There are also other factors that can affect the colour produced; the concentration of the compound and whether that drug is found as a salt or free base, whether there are any diluents, contaminants or dyes that could mask the colour change (O'Neal, Crouch and Fatah, 2000). Therefore confirmation of the sample requires further analysis by chromatographic and mass spectrometric techniques.

7.5 Chemical Analysis by Gas Chromatography- Mass Spectrometry (GC-MS)

The analytical technique that was employed in this research was GC-MS, which is a well-documented technique that is used in the identification and quantification of controlled and seized samples. In section 2.5 previous studies were discussed that specifically examined the content of ecstasy samples, these studies all made use of GC-MS to identify their samples (Baggott *et al., 2000;* Cole *et al., 2002;* Milroy, Clark and Forrest, 1996; Ramsey *et al.*, 2001; Renfroe, 1986; Sherlock *et al.,* 1999; Tanner-Smith, 2006). The technique has also been applied to chemical profiling, which provides further information on the potential synthesis routes, discussed in section 2.1.3 (Cole, 2003; Gimeno *et al.,* 2002; Swist *et al.*, 2005; van Deursen, Lock and Poortmen-van der Meer, 2006; Verweij, 1990).

The advantages of using GC include; '*the speed of analysis, high levels of resolution, ease of operation, excellent quantitative results and the moderate cost' (*McNair and Miller, 2009, p.156). The following section will provide a brief overview of how GC-MS works and how it was effectively applied to identify and quantify the compounds of interest to this research.

7.5.1 Gas chromatography – Mass Spectrometry

Gas Chromatography

The basic principle of GC is that when a complex sample is introduced to the system, separation takes place (Carlin and Dean, 2013). The complex sample in this research refers to samples that may contain more than one compound. The components that make up a GC system are: carrier gas and flow control, a sampling device and a heated injection inlet/port, a column and oven, a detector and a data recording device. Figure 7.2 shows a simplified schematic of a basic GC system.

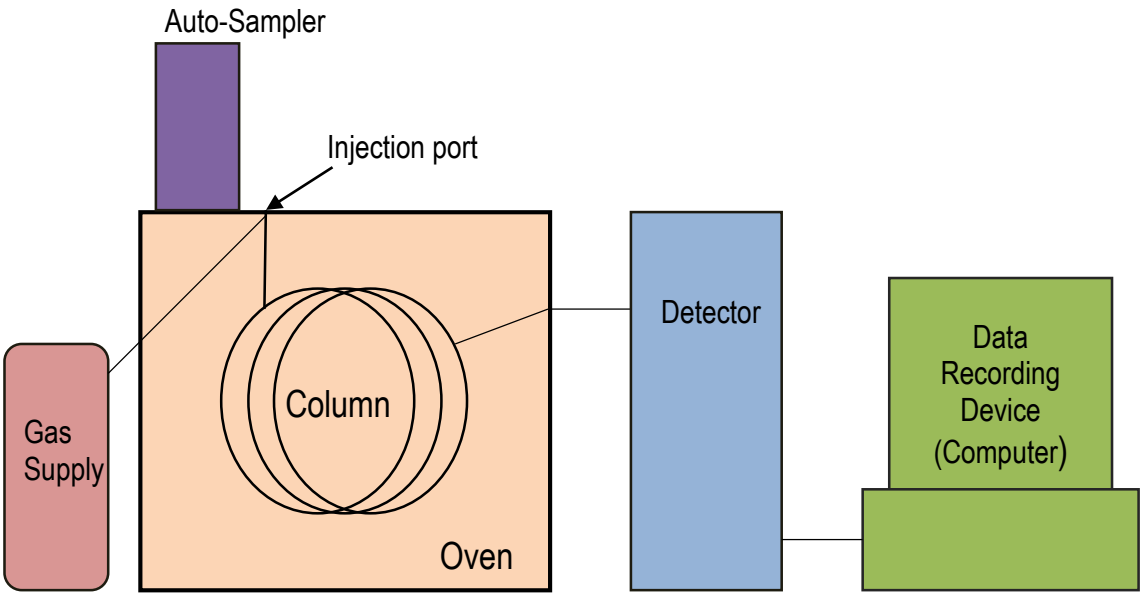


Figure 7.2: A basic schematic of a Gas Chromatographic system

Sampling

Firstly the sample is collected by the auto-sampler. The sample injection is controlled through an automatic sampling device with a micro-syringe to ensure the same amount is introduced onto the system with each injection (McNair and Miller, 2009). The sample is then injected through the heated injection port, where it is vaporised and carried onto the column by the carrier gas.

Mobile Phase

An inert carrier gas, such as helium flows through the injection port and along the column. It is the mobile phase that carries the sample through the system. The flow rate of the mobile phase is controlled to ensure reproducibility between samples (McNair and Miller, 2009).

Stationary Phase

The column is comprised of a fused silica tube coated with a thin film of stationary phase material. The stationary phase varies dependant on the type of analysis that is required, for the compounds of interest to this research namely MDMA and Mephedrone, there are two types of stationary phase that are recommended. These are either a 5% diphenyl/ 95% dimethylsiloxane composite or 100% dimethylpolysiloxane (UNODC, 2006). The oven runs a selected temperature programme to aid separation (McNair and Miller, 2009). As the sample passes along the column it partitions between the mobile phase and the stationary phase that causes the separation, illustrated in Figure 7.3.

Figure 7.3: Visual representation of the separation of compounds by GC

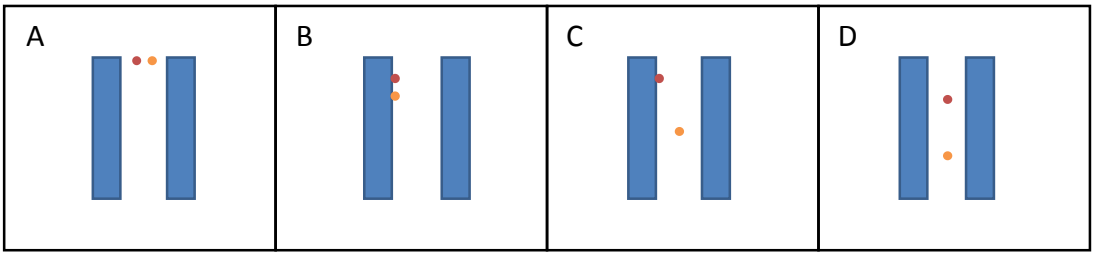


Image A above illustrates two compounds entering the column, both compounds then partition into the stationary phase. One compound then partitions back into the mobile phase and is moved further along the column. As the column temperature increases the second compound also repartitions back into the mobile phase. The separated molecules then pass into the detector. The detector then registers the presence of compounds as an electrical signal that can be picked up by the data recording device that then produces a chromatogram for interpretation (Carlin and Dean, 2013; McNair and Miller, 2009). Figure 7.4 displays an example of a chromatogram, how the data is presented for analysis. The example provided is a chromatogram that was generated for the analytical standard for MDMA.

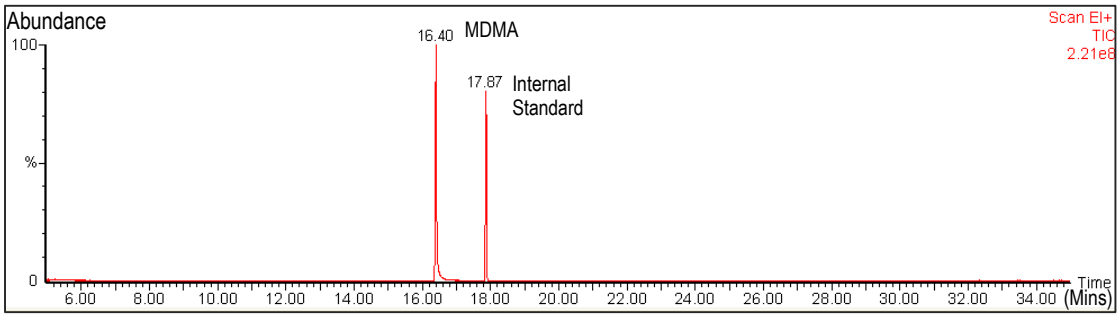


Figure 7.4: Exemplar chromatogram for MDMA Standard (RT 16.40 minutes) and the internal standard (RT 17.87 minutes)

The above chromatogram is an example of the report generated from the detection of compounds that have been separated using GC. It can provide two sets of information on the sample being analysed. The first is the time at which the peak was first detected, this is known as the retention time (RT). The RT for compounds can be collected by running known standards of the compounds before trying to identify any unknown samples. The second is quantitation of the compound, this is determined by how big the electrical signal is that is detected. The chromatogram above shows two peaks, the first was recorded at the time of

16.40 minutes and is the peak for a known standard of MDMA. The second peak, at 17.87 minutes was the Internal Standard (IS).

An internal standard is a known compound which is used as a reference point to verify that the instrument is processing each sample to the same standard and is used to verify that there is reproducibility and consistency between samples (Carlin and Dean, 2013). There are a number of qualities that determine a good internal standard that are; the IS must elute near the peaks of interest but not on top of any compounds of interest, as there must be clear resolution and separation between compound of interest and the IS as shown in Figure 7.3. The IS should also be chemically similar to the compounds of interest but should not interfere or react with any compounds analysed (McNair and Miller, 2009).The GC is just the first part of the analysis, once the sample has been separated on the column it then is passed into the MS, which completes the second stage of analysis.

Mass spectrometry

Mass spectrometry consists of ionisation source, mass analyser and the detector. In this research electron impact ionisation (EI) was used. The basic principle of EI is that the gaseous sample is bombarded with a stream of electrons to create ions that are then passed through a mass analyser and into the detector (Downard, 2004).

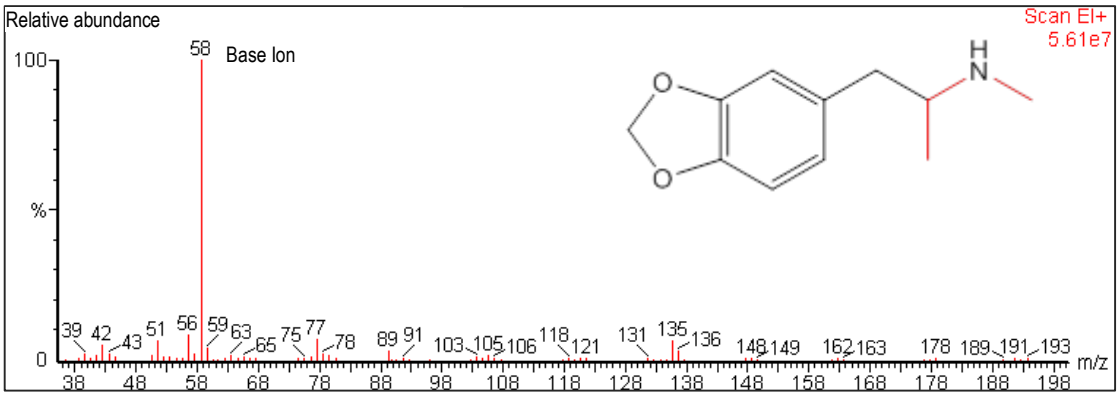
Firstly the gaseous sample, which was separated by the GC, is introduced into the ion source to fragment the molecule within a vacuum. The ion source produces a stream of electrons. As gaseous molecules pass through the stream they collide with the electrons, which leads to ionisation that causes the molecules to gain a charge (Downard, 2004*)*. If sufficient energy is conferred to the molecule during ionisation the molecule will fragment. Each primary product ion derived from the molecular ion will then also fragment into smaller ions (de Hoffmann and Stroobant, 2007). Once ionised the fragment ions are then accelerated into the mass analyser, in this research a quadrupole mass analyser (QMS) was used. A QMS separates the ions according to their mass-to-charge ratio (*ibid.)*. The mass to charge ratio is indicated as m/z, where m represents the mass of the ion over z the charge. As most ions lose only one electron the charge is +1, which means the m/z value of the ion is often considered to be the mass (Shimadzu, 2015). Once the ions have been separated by the QMS they pass into the detector, which registers the ions in proportion to their abundance. The most abundant ion is

labelled the base ion, with all other ions represented as a proportion against the value of the base ion (de Hoffmann and Stroobant, 2007). The resulting data produces what is known as the mass spectrum for the molecule and is plotted as ion abundance versus the m/z. An example of a mass spectrum is shown in Figure 7.5.

Figure 7.5: Exemplar Mass Spectrum for the compound MDMA (Base ion indicated on structure in red)

Relative Abundance %

The spectrum above shows the fragment ions that were recorded for a standard of MDMA. The heaviest ion recorded relates to the molecular ion ($M^{\cdot+}$), in the above spectrum this is the ion at m/z 193 the molecular weight of MDMA. The base ion (the most abundant i M+ MDMA is m/z 58, the other ions recorded are fragments of varying sizes. The confirmation of the identity of a sample can be assessed in a number of ways. As this spectrum was collected from a sample made from a known analytical standard it is logical to state that it is a spectrum for that compound, the fragmentation pattern and the relative abundance of selected ions is



unique to each molecule and thus provides a confirmed identity for the substance. However, if a sample is unknown there are also library databases, such as NIST (NIST, 2006), which are installed in the recording software. These databases provide a comparison to the collected spectra of known samples that can provide a preliminary identification, which can then be confirmed with a known standard once an identity is suspected.

Another way in which the spectra can be analysed to provide identity is to look at the specific fragment ions, which can give an indication of the structure of the sample being analysed if there is not a known standard or a library match. This is sometimes the case in the field of drug analysis when assessing NPS compounds. As new unknown compounds are entering the market, the databases and analytical standards for comparison are not always readily available, so interpretation of spectra can give an indication of the functional groups and type

of compound present though further confirmation of elemental composition would require the use of NMR (Cole, 2003). For this research NMR was not required as known analytical standards were available and the comparable spectra were available in the library.

Compounds can also be quantified using the mass spectrum, by using the abundance ratio of the base ion of unknown sample to the internal standard against different concentrations of the standard.

7.5.2 Choosing an appropriate method

The use of a GC-MS to identify and quantify illicit compounds is widely used within the field of drug analysis. There is a profusion of methods that have been used and are cited throughout the literature, which are specific to the analysis of MDMA using a GC-MS (Bonadio *et al.*, 2009; Gimeno *et al.*, 2002; Swist *et al.,* 2005; van Deursen, Lock and Poortmen-van der Meer, 2006). In 2006 the UNODC released its manual to be used by the national drug testing laboratories:

'Recommended Methods for the Identification and Analysis of Amphetamine, Methamphetamine and their ring-substituted analogues in seized materials'

(ST/NAR/34)

The document produced by the UNODC provides step by step instructions for tested and validated methods for the identification of compounds of interest to this project, and so was adopted as the method of choice for this research. However, at the time of completing the analysis in this research little had been published on the analysis of the compound Mephedrone, the second compound of interest in this research (Maheux, Copeland and Pollard, 2010; Santali *et al.*, 2011). Yet the methods that are reported are comparable to ones published for the analysis of MDMA. As Mephedrone and its analogue cathinones share structural similarities to the phenethylamine compounds that are covered in the UNODC manual the analysis was adapted to cover Mephedrone as well.

Once the samples were identified through the presumptive tests they were then prepared, extracted, analysed and quantified using the validated method outlined by the UNODC (2006, p. 34-35).

7.5.3 Sample preparation

The sample preparation method adopted from the UNODC report (2006), was scaled down, to reflect the level of material available. In the UNODC report it is suggested that 1000mg of active compound was to be made up into 1000mL of water, this was scaled to 10mg in 10mL, for cost and environmental purposes. The sample preparation method was employed for both the analytical standards and the unknown street samples.

Preparation of the Internal Standard (IS)

An internal standard is used as an internal reference controls for injection and instrument variability. The UNODC method suggests a number of possible internal standards; 'n-tetradecane*, other n-alkanes, diphenylamine or any structurally similar ATS*' (2006, p.34). For this project the internal standard that was chosen was n-hexadecane. The concentration of the IS used in each sample at injection was 0.48mg/mL as this was within the same concentration range used for the samples.

Preparation of Analytical Standards

Before the street samples could be examined the method needed to be verified using analytical standards. This was done to collect the retention times and mass spectra for each compound so identification could take place. The analytical standards were made to a concentration of approximately 2mg/mL and made with deionised water. The standards were stored at below 5˚C; as the standards are stable under these conditions for up to one year (UNODC, 2006 p. 65). The analytical standards that were chosen were based on the possibility of encountering them in the street samples. The standards included were either analogue compounds such as MDMA and MDA or competitor compounds that are found in the same format, such as piperazines, which have been previously misidentified as 'Ecstasy' tablets (Staack, 2007, Wood *et al.,* 2007*).*

The list of 16 standards chosen in the research fell into 4 categories: amphetamine type stimulants, cathinone derivatives, piperazine derivatives and caffeine as shown in Table 7.2.3.

Table 7.2.3: List of analytical standards

Group	Compound
Amphetamine Type Stimulants (ATS)	Amphetamine
	Methamphetamine
	3,4-Methylenedioxyamphetamine (MDA)

	3,4-Metheylenedioxymethamphetamine (MDMA)
	3,4-Metheylenedioxyethylamphetamine (MDEA)
	para-Methoxyamphetamine (PMA)
	para-Methoxymethamphetamine (PMMA)
Cathinone Derivatives	Methcathinone (MCat)
	4-Methylmethcathinone (4-MMC/Mephedrone)
	4-Methylethcathinone (4-MEC)
	3,4-Methylenedioxymethcatinone (MDMC/Methylone)
Piperazine Derivatives	3-Trifluoromethylphenylpiperazine (TFMPP)
	1-Benzylpiparazine (BZP)
Adulterant	Caffeine
Internal Standard	n-hexadecane

Preparation of Street samples

Firstly the samples were weighed, with the tabletted samples being homogenised into a powder before being weighed out. The same protocol that was used for the analytical standards was then applied to the preparation of the street samples, with samples made up to a concentration of about 2mg/mL in water, the exact weights for each sample are recorded in Appendix VI Tables 8.viii and 8.ix.

7.5.4 Extraction of samples

Preparation of the samples for analysis required the compounds to be extracted, as directed in the method already mentioned (UNODC, 2006 p.65). This is due to the compounds being dissolved in their salt form. To be extracted and analysed the samples needed to be converted to their base form, this was achieved through the process of liquid-liquid extraction (*ibid.*).

An aliquot of the prepared sample solution was pipetted into a vial. The solution was then basified using concentrated ammonium hydroxide (NH_4OH). The pH was checked using universal litmus paper, indicated by a colour change reaction in the paper. Once the sample had been basified, chloroform ($CHCl_3$) was added to the vial, forming two layers. The sample was thoroughly mixed to ensure the maximum transfer of compound from the polar water layer to the non-polar chloroform layer. The sample was left to stand to allow the two layers to separate. Once the two layers were separated, the chloroform layer was removed. The chloroform layer was then passed through a layer of anhydrous sodium sulphite into a clean vial. The chloroform was filtered in this way to ensure that there is no transfer of any water that could damage the sensitivity of the GC-MS (UNODC, 2006 p.65). The final filtrate was then used for analysis and made up to a known concentration. This procedure was used for both the known standards and the street samples.

To check that 100% of the sample was extracted by the method discussed above, an experiment was run to check the efficiency of the extraction. Firstly, a sample of analytical standard MDMA was extracted using the method above with the chloroform extract collected for analysis. A second and third round of chloroform was then applied to the original water solution, to check whether there was any remaining drug in the water sample. The second and third chloroform washes were processed in the same way as the initial extract. All three chloroform extracts were then analysed by the GC-MS to see whether any MDMA was detected in the second or third chloroform extract, however none was detected and so the extraction process had removed all the sample in the first extract as shown in Figure 7.6.

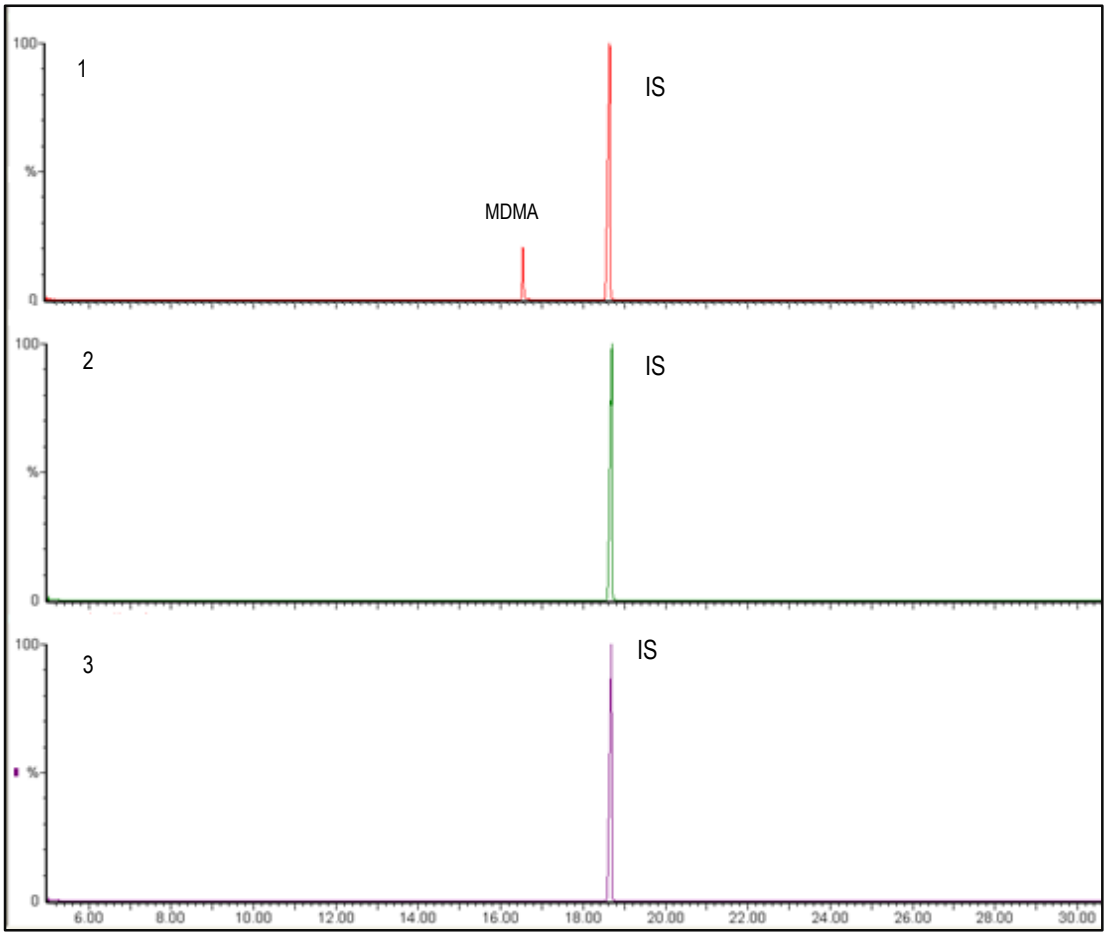


Figure 7.6: Chromatograms of multiple extractions of MDMA sample (1: first extraction, 2: second extraction, 3: third extraction)

7.5.5 Preparation of Calibration standards

The use of calibration standards provides a range of concentrations that can be used to quantify unknown samples. To quantify the street samples in this research an 11 point calibration was generated for the two compounds of interest, MDMA and Mephedrone. The samples were made up by the addition of a known volume of the extracted standard at a starting concentration of 2mg/mL in chloroform, a known volume of the IS solution at a starting concentration of 1.95mg/mL and made up to 100µl with chloroform to give the final concentrations used for analysis. The volumes required for each calibration point are shown in Table 7.2.4.

Table 7.2.4: Volumes used to generate 11-point calibration of analytical standards (Starting concentration of Standard = 2mg/mL, concentration of IS = 1.95mg/mL)

Calibration Point	Analyte Solution (mL)	IS (mL)	Solvent (Chloroform) (mL)	Final Volume (mL)	Final Concentration of Analyte (mg/mL)
1	0.0025	0.025	0.0725	0.100	0.05
2	0.005	0.025	0.070	0.100	0.10
3	0.010	0.025	0.065	0.100	0.20
4	0.015	0.025	0.060	0.100	0.30
5	0.020	0.025	0.055	0.100	0.40
6	0.025	0.025	0.050	0.100	0.50
7	0.030	0.025	0.045	0.100	0.60
8	0.035	0.025	0.040	0.100	0.70
9	0.040	0.025	0.035	0.100	0.80
10	0.045	0.025	0.030	0.100	0.90
11	0.050	0.025	0.025	0.100	1.00

The starting concentration of the analytical standard was 2mg/mL, to prepare a calibration standard with the final concentration of 1mg/mL the following calculation was used.

Calculation: starting concentration x volume 1/ volume 2 = final concentration
Example: 2 x 0.050/0.100 = 1mg/mL

Where by 2 is the starting concentration, 0.050 represents the volume of millilitres taken from the original solution (Volume 1) and 0.100mL is the final volume of the sample (Volume 2). This gives the final concentration of 1mg/mL. However as the initial concentration of the extracted standard depended on the initial weight of the samples in solution, the final

concentrations varied depending on how close to 2mg/mL the starting solution was, the actual concentrations used are shown in the section 8.5.

7.5.6 GC-MS Instrumental Method

The instrumental analysis was performed using a PerkinElmer Clarus 500 GC-MS. The column employed was an Equity-5, which has cross-linked poly 5% diphenyl/95% dimethylsiloxane stationary phase. The column parameters were 30m length by 0.32mm internal diameter and a 0.5µm film thickness. This column is comparable to the one used by the UNODC but also in other research looking at these compounds (Bonadio *et al.*, 2009; Gimeno *et al.*, 2002; Maheux, Copeland and Pollard, 2010; Santali *et al.*, 2011; Swist *et al.,* 2005).

The oven temperature programme was set at; 100˚C for the first 4 minutes, then ramped at a rate of 5˚C/min until 200˚C, then 10˚C/min to 270˚C, whereby it was held for a final 3 minutes. The injection port temperature was set at 190˚C and the transfer line temperature was 280˚C. The injection volume used was 1µl with a split ratio (20:1); the helium carrier gas flow rate was set at a rate of 1.2mL/min.

The Mass Spectrometer was tuned on electron impact ionisation (EI) operated at 70eV, with an ion source temperature of 230 ˚C. The samples were run in scan mode with a range of 35 to 450 m/z.

The data was collected and analysed using the compatible software TurboMass™ (PerkinElmer, 2006), the statistical analysis was also completed using SPSS.

Chapter 8 Results of the Chemical Analysis of Street Samples

This chapter examines the results obtained for the chemical analysis of the seized street samples using GC-MS, using the method outlined in section 7.5. The whole process of identification, from sample selection to initial presumptive testing through to the final quantitation of the samples will be reported in this chapter.

8.1 Descriptions of Samples

Part of the research was looking at the differentiation between tableted and powdered/crystalline samples that were seized by Cambridge police. The final count of samples assessed for this part of the research was 56. A description of each sample, its weight and defining characteristics can be found Appendix VI Table 8.i to iii. The samples were initially divided between tableted samples and powders or crystals. There were 11 tablets and 45 powder/crystal samples.

8.1.1 Visual depictions of different types of samples

As the samples are separated into two groups, tablets and powders, the descriptions for each group have been written up separately. There were a total of 11 tablets that were tested as part of this project for which there are photographs of 7, with an image taken from above and from a side view. These are shown in Table 8.1. The four remaining samples that were included into this study had been used by a separate research project and so had been ground into a powder before an image was taken. The powder and crystal samples fell into two distinct categories some were white and the rest displayed a pale brown or tan hue. The size and shape of the crystals varied, from some that resembled fine powders to large distinct crystals. Table 8.2 provides an example of the range of the types of crystallised samples examined.

Table 8.1: Images of selected tablets samples

Sample	Top view	Side View	Dimensions
A4			Unidentifiable imprint (possibly bulls head) - poor quality imprint Diameter: 9mm Depth: 3mm
A47			Pale blue circular tablet Mickey mouse imprint on one side, Fantasia hat on other Diameter: 8mm Depth: 3mm
A48			Teal heart shaped tablet with gold flecks Height: 1cm Width: 8mm Depth: 3mm
A49			Pale red circular tablet Cupid design on one side Blank on other side Diameter: 8mm Depth: 4mm
A50			Dark orange circular tablet Armani design Blank on other side Diameter: 9mm Depth: 3mm
A79b		None available	Red circular tablet No Design, rough top and Bottom Diameter: 8mm Depth: 4mm
A80			White Circular Tablet Star Design, blank other side Diameter: 1cm Depth: 4.5mm

Table 8.2: Types of Powder and Crystal samples

Sample	Type	Image

A61	Fine White Powder	
A51	Distinct White Crystals	
A77	Fine Brown Powder	
A70a	Small Brown Crystals	

Table 8.2: Types of Powder and Crystal samples (continued)

Sample	Description	Image

A54	Medium Brown Crystals	
A75	Large Brown Crystals	

8.1.2 Types of Packaging

When the samples were obtained they were collected as either a subsample of a larger seizure and were repackaged into clean polythene bags, or when possible were acquired in the original packaging that they were seized with. Most of the samples that came with the original packaging came in similar polythene bags to the ones that were used to repackage the bulk samples. Some samples needed to be placed in a second bag to prevent the risk of contamination between samples. There were a number of samples that were presented in the form of wraps and bombs. The images below depict the types of packaging found and to which samples the different packaging relates - Figures 8.1 to 8.7.

Figure 8.1: Sample A65 with original seized packaging and secondary packaging

Figure 8.2: Sample A65 original seized packaging

Figure 8.3: Sample A65 original packaging and secondary packaging side by side

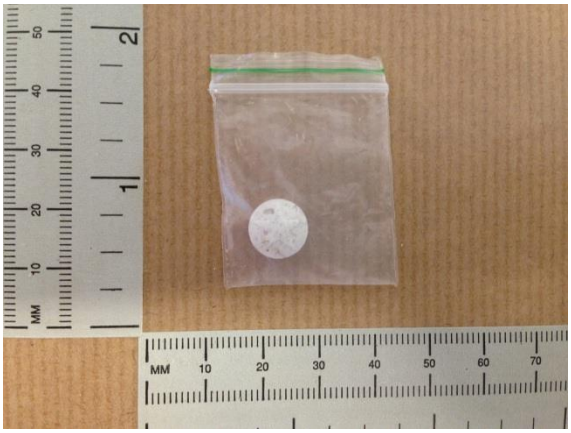


Figure 8.4: Sample A80 example of packaging used for tablets

Figure 8.5: Sample A64 packaged ‘bomb’s that were separated into samples A64a to e

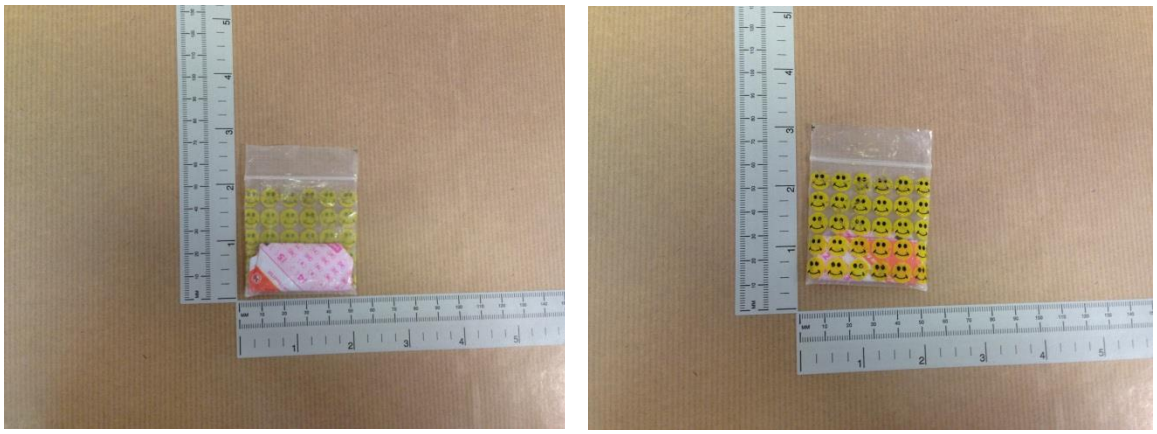


Figure 8.6: Sample A71, a wrap in original plastic bag (front and back view)

Figure 8.7: Sample A79 that contained a pill and crystal material that was separated and repackaged as A79a and A79b.

8.2 Presumptive Test Results

The first stage of analysis used to distinguish between the samples was presumptive testing. This was employed to give early indications of whether the samples included the desired compounds. The samples were tested using the Marquis and Mandelin reagents as described in section 7.4. There were a total of 56 samples tested, the results that indicated a positive for both tests is shown in Table 8.3.

Table 8.3: Results of the presumptive tests

	Positive colour test for MDxx compounds	Negative or no colour reaction
Samples	A3, A4, A7, A9, A11, A27, A28, A37, A44, A48, A50, A53, A54, A55, A63, A64a–e (5), A69, A71, A72, A73a-c (3), A74, A76, A77, A79a, A80	A12, A29, A30, A31, A32 A35, A40, A41, A42, A45, A47, A49, A51, A52, A61, A65, A66, A67, A68, A70a-c (3), A75, A78, A79b
Total	31	25

The presumptive test stage of identification of the street samples indicated that, out of the 56 samples tested with the Marquis and Mandelin reagents, 31 samples potentially contained an MDxx compound. Although the remaining samples gave a negative or non-reaction with the tests chosen they too were continued on for analytical identification as at time of analysis there was no published presumptive test for Mephedrone, the second compound that was being considered. The next stage of analysis was identification of the compounds using the GC-MS.

8.3 Primary Identification of Street Samples using GC-MS

Before the street samples were analysed using the GC-MS for identification, known analytical standards were run to collect the retention times and mass spectra for a range of possible compounds that may be present. This was done to be able to correctly identify the compounds that may appear in the street samples and to verify which substances were not present using the methods of identification outlined in section 7.5. By using the chosen method on analytical known standards first, this provided a way of verifying that the method being used could identify the substances of interest shown in Figure 8.8.

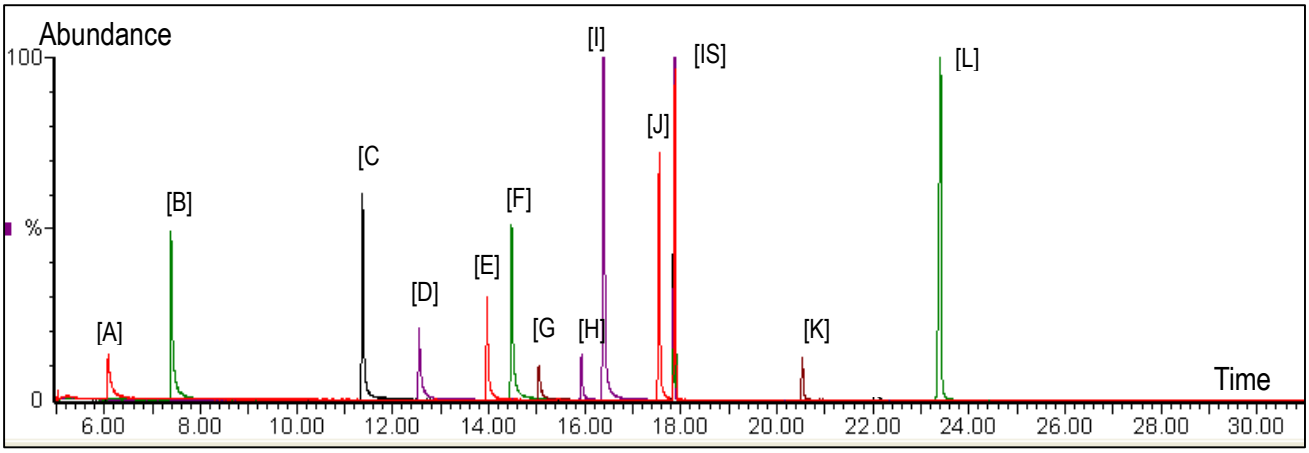


Figure 8.8: Chromatogram showing separated amphetamine and cathinone standards (A: amphetamine, B: methamphetamine, C: methcathinone, D: PMA, E: PMMA, F: Mephedrone, G: MDA, H: 4-methylethylcathinone, I: MDMA, J: MDEA, IS: n-hexadecane, K: Methylone, L: Caffeine)

The analytical data collected for the known standards used for identification including retention times can be found in Appendix VI Table 8.iv. This data was used to successfully identify the compounds in the 56 street samples. The samples were prepared in the manner as outlined in section 7.5, they were then analysed and the compounds present in each sample was identified. The focus of this research was on samples that contained the compounds MDMA or Mephedrone. Table 8.4 shows the samples that were confirmed as containing either of these two substances. It is these samples that were taken forward to the quantification stage.

Table 8.4: Samples that were identified as containing either MDMA or Mephedrone

Samples identified as contained MDMA	Samples identified as contained Mephedrone	Samples that did not contain compounds of interest
A3, A4, A7, A9, A11, A27, A28, A37, A44, A48, A50, A53*, A54, A55, A63, A64a – e, A69, A71, A72, A73a – c*, A74*, A76*, A77, A79a, A80	A12, A29, A40, A42, A51, A52*, A61	A30, A31, A32, A35, A41, A45, A47, A49, A65, A66, A67, A68, A70a – c, A75, A78, A79b
n = 31	n = 7	n = 18

Samples marked with an * indicate more than one compound was detected in this sample; the other compounds that were detected and are shown in Table 8.5.

Table 8.5: Samples that contained more than one compound

Sample	Primary compound	Secondary compound/s
A52	Mephedrone	4-Methylethcathinone (4-MEC)
A53	MDMA	Benzocaine
A73a – c	MDMA	TFMPP and BZP
A74	MDMA	Methylone
A76	MDMA	Methylone

Only 38 out of the 55 original samples contained compounds of interest to this research, the rest of the samples were therefore discarded after the initial identification stage. The individual identification of these samples can be found in Table 8.6. The most frequent compound that was found was methylone, a derivative cathinone similar in structure to MDMA and Mephedrone. The samples containing methylone were not assessed further, as this compound was not one of the key compounds identified for this research. However the presence and relevance of this compound will be discussed in Chapter 9.

Table 8.6: Identification of samples that did not contain either MDMA or Mephedrone

Sample	Compounds Identified
A30	Methylone
A31	Ketamine
A32	No Compound Detected
A35	Caffeine
A41	Benzocaine
A45	Cocaine
A47	TFMPP and Caffeine
A49	Caffeine
A65	Ketamine
A66	Ketamine
A67	Methylone
A68	Methylone
A70a – c	Methylone
A75	Methylone
A78	TFMPP
A79b	PMA
n	17

A point of interest is the identifications of samples A79a and A79b, which were seized and received to the project together. As one was crystal and one a tablet they were separated into two samples for analysis. The crystals of sample A79a were identified as containing MDMA, while the tablet contained PMA (para-Methoxyamphetamine). PMA was mentioned in Chapter 4.2, is a compound which has been sold under the guise of ecstasy tablets and caused a series of fatalities in the summer of 2013 (Saner, 2013).

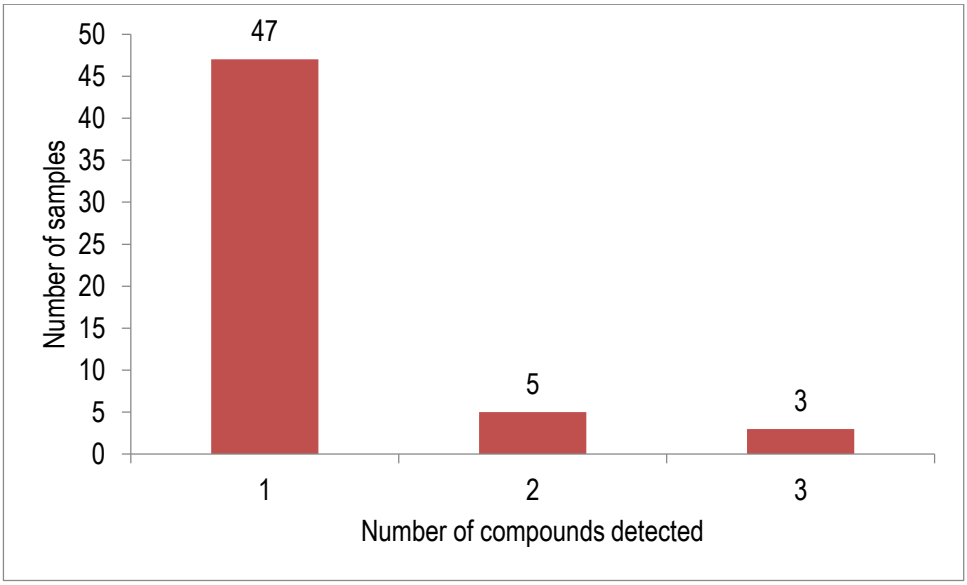


Figure 8.9: Number of samples and the number of compounds detected (*n = 55)*

There were very few samples that were identified as containing more than one psychoactive compound, the graph in Figure 8.9 shows that of the 55 samples only 8 samples contained more than one compound. However this only relates to compounds that can be extracted through the method and does not reflect any diluent compounds that would not appear using this method.

8.4 Calibration of standards for MDMA

Once the street samples had been identified as containing MDMA, standards of MDMA at different concentrations were analysed to produce calibration results, the standards were made using the method described in section 7.5.4. A calibration is used to quantify the levels of MDMA found within the street samples. The quantification of the samples will allow for the purity of the different forms of MDMA to be established.

Calculating Concentrations of Calibration points

Using the method described in section 7.5.4, an 11 point series of calibration samples were made. However the weight of the MDMA exceeded the desired 20mg and so an adjustment was calculated using the actual starting concentration of 2.044mg/mL. A further adjustment was taken into consideration as the original starting weight was in the salt form, which was converted through the extraction process to the free base form of the compound, shown in calculation 1.

Calculation 1:- concentration converted from salt form to base form

RMM of MDMA HCl. = 229.7
RMM of MDMA = 193.24
193.24/229.7 = 0.84

Therefore the free base concentration = starting concentration x 0.84
2.044*0.84 = 1.717

Using the above adjustment the actual concentration of free base MDMA that was in the calibration points was calculated as shown in Appendix VI Table 8.iv.

Calibration Results using integrated peak area

Once the calibration was completed the post-run analysis was accomplished using the TurboMass™ software (PerkinElmer, 2006). The peak area integration function was utilized to give peak area values for the MDMA peak. The value for MDMA was then divided by the internal standard to give the Peak Area Ratio (PAR), illustrated in Appendix VI Figure 8.i. This was repeated for each of the triplicated points per calibration point, with a mean calculated from the triplicate values. The mean and standard deviation of the triplicate values are shown in Table 8.7. The individual triplicate values are reported in Appendix VI Table 8.v.

Table 8.7: Calibration results table for MDMA standards

Concentration of MDMA free base (mg/mL)	Instrumental Response (PAR)	
	Mean response	Standard Deviation
0.043	0.027	0.010
0.086	0.068	0.027
0.172	0.185	0.025
0.258	0.335	0.016
0.343	0.492	0.008
0.429	0.774	0.007
0.515	1.100	0.097
0.601	1.354	0.055
0.687	1.584	0.078
0.773	1.882	0.097
0.858	2.085	0.021

The mean values were plotted on a scatter graph to check for a linear response as well as producing a linear regression equation that can be used in the calculation of the concentrations of the street samples. Figure 8.10 displays the calibration graph using the full range of calibration points.

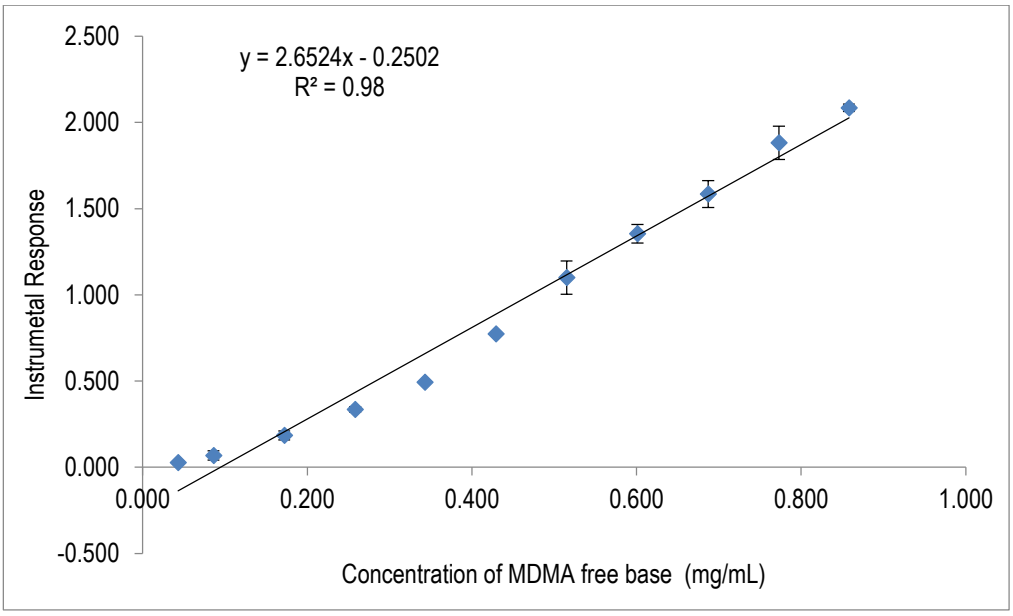


Figure 8.10: Calibration curve of the points calculated from the calibration standards (*n* = 3)

For predictions made from a calibration curve to have low uncertainties the R^2 values needs to be as close to 1 as possible, the closer to 1 the stronger the correlation between the variables. To be considered acceptable for linearity there can be 10% relative uncertainty, and so the R^2 value should be within 0.99 (Ellison, Barwick and Farrant, 2009). As can be seen in Figure 8.10 the R^2 value is 0.983, which is outside the limit for accepted linearity. However the linearity can be improved by excluding the lowest two calibration points to give the liner response seen in Figure 8.11 that produces an R^2 value of 0.994.

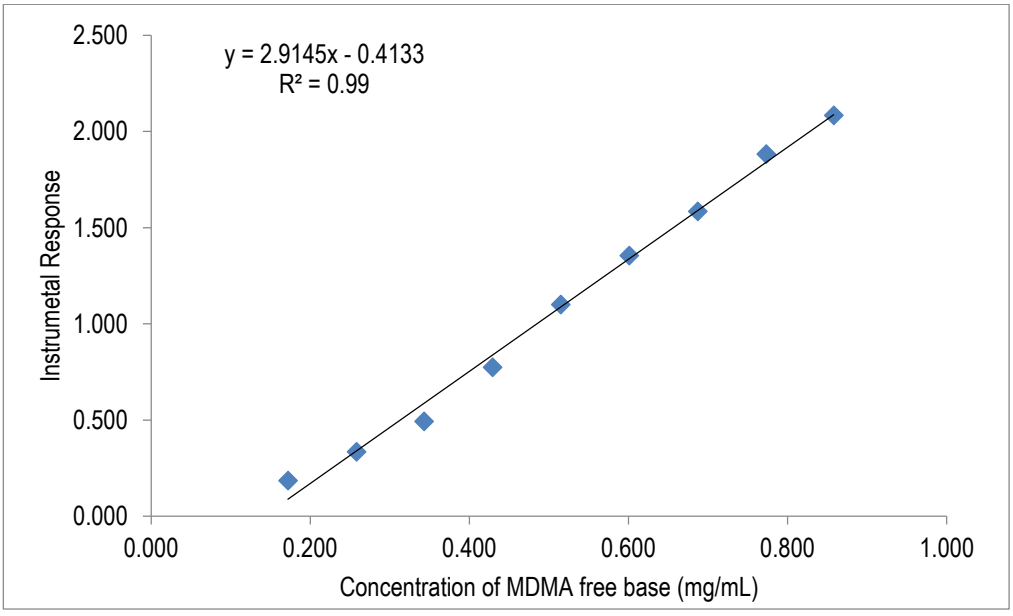


Figure 8.11: Adjusted scatter pot displaying linearity between concentration points 0.172 and 0.858mg/mL

As removing the lowest two points provided the best linear response, this was the range that was used for the analysis of the street samples. Using the regression equation in the above figure, the calculation can be rearranged to provide the concentrations of the street samples.

Validation of PAR Calibration Data

To check whether the calibration data was valid to be used for the quantification of the street samples, a number of statistical tests were employed. To confirm the validity of the calibration data the normality of the residuals and a runs test was completed using SPSS (IBM, 2011). The normality of the residuals checks whether the residuals (the difference between the actual value for the dependant variable and the estimated value from the regression equation) are normally distributed. Table 8.8 displays the concentration, the value obtained from the instrumental response designated as actual Y, the estimated dependant variable as calculated using the regression equation (y=2.9145x-0.4133) is designated as estimated Y and the residual is the difference between the actual Y and the estimated value.

Table 8.8: Calculated Residuals for PAR results for MDMA

Concentration (mg/mL)	PAR Value (Actual Y)	Estimated Y	Residuals
0.172	0.185	0.088	0.097
0.258	0.335	0.339	-0.004
0.343	0.492	0.586	-0.094
0.429	0.774	0.837	-0.063
0.515	1.1	1.088	0.012
0.601	1.354	1.338	0.016
0.687	1.584	1.589	-0.005
0.773	1.882	1.840	0.042
0.858	2.085	2.087	-0.002

The residuals calculated were tested using the Shapiro-Wilk test for normality in SPSS (IBM, 2011), with the null hypothesis stating that the distribution of the residuals is normal. The test returned a P value of 0.933. As this value exceeded the chosen significance level of 0.05 at a 95% confidence level the null hypothesis is retained, which means the residuals were normally distributed. The Runs test checks whether the data generated has been produced at random, whether the points along the regression line are distributed randomly (Walpole, Meyer and Meyer, 1998). Again the test was performed on the residuals and run in SPSS (IBM, 2011). The null hypothesis states that the sequence of values for the residuals is random. The test returned a significance of 1.000, which was greater than the significance level of 0.05 (95% confidence level) and so the null hypothesis is retained and the data has been shown to be random. These tests validate the data generated, allowing for it to be used to quantify the results for the street samples.

However if there is an issue with co-elution, whereby to samples are detected at the same time in the chromatogram the PAR cannot be used to accurately quantify those samples. This was an issue that arose with samples A73a, b and c, which contained a mixture of both MDMA and TFMPP. Both MDMA and TFMPP had overlapping retention times (16.34 mins and16.39 mins respectively) and so in analysis their peaks merged meaning that the method discussed above could not be used to quantify these samples.

This was addressed by using the mass spectra of that compounds, which can be used when chromatograms cannot. As both MDMA and TFMPP have distinct spectra as shown in Figure 8.12, the quantification of MDMA in these samples was achievable using the method of extracted ion chromatogram (EIC) by using the relative abundance of the base ion m/z 58.

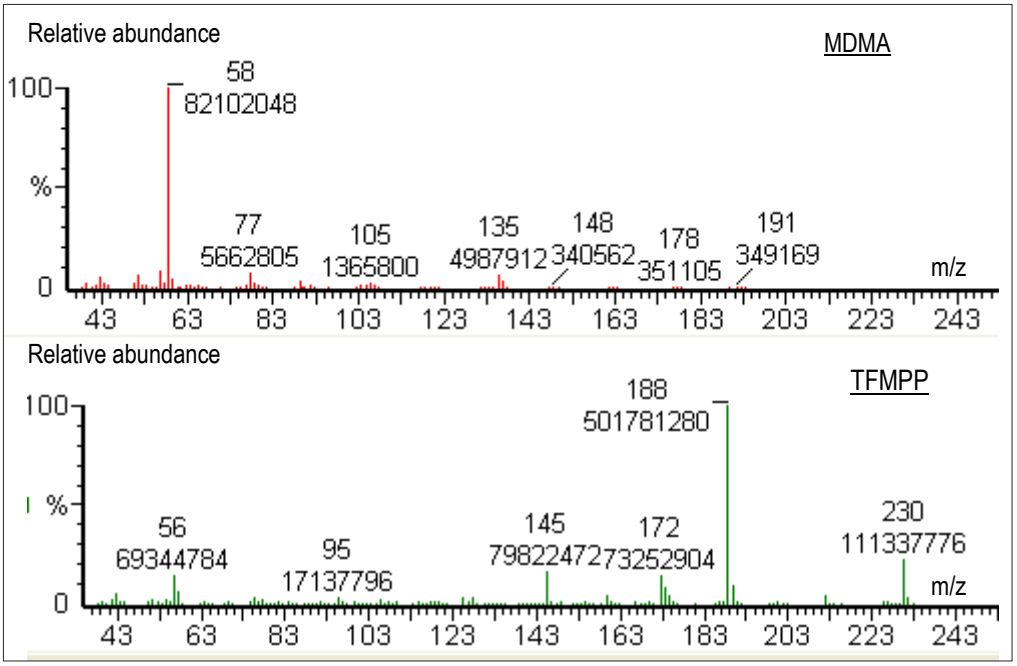


Figure 8.12: Mass spectra for MDMA and TFMPP

Calibration of MDMA (using EIC)

The quantification of the MDMA in samples A73a, b and c was not possible using the calibration already stated, however as the mass spectral data for MDMA and TFMPP are sufficiently different as shown in Figure 8.12, this allowed for quantitation from the spectra. The same data set that was used to produce the integrated peak area calibration was used for the mass spectral data analysis. The EIC was calculated by using the abundance level of the base ion (most abundant fragment ion) instead of the PAR. The response from the base ion of the compound, in this case the ion with an m/z of 58 for MDMA, is divided by the base ion for the IS (m/z 57). This provides the ratio that can be used to plot a calibration. Table 8.9 displays the mean values for the calculated EIC of MDMA divided by the IS. The individual triplicate values are reported in Appendix VI Table 8.vii. Figure 8.13 displays the calibration graph using the full range of calibration points.

Table 8.9: Calibration data for MDMA using selected ions (m/z 58 for MDMA divided by m/z 57 for the IS)

Concentration of free base MDMA (mg/mL)	Instrumental Response (PAR of m/z 58 / m/z 57)	
	Mean Response	Standard Deviation
0.043	0.078	0.071
0.086	0.115	0.022
0.172	0.406	0.086
0.258	0.737	0.112
0.343	1.049	0.075
0.429	2.022	0.112
0.515	2.541	0.264
0.601	3.572	0.101
0.687	3.861	0.767
0.773	4.743	0.223
0.858	5.320	0.164

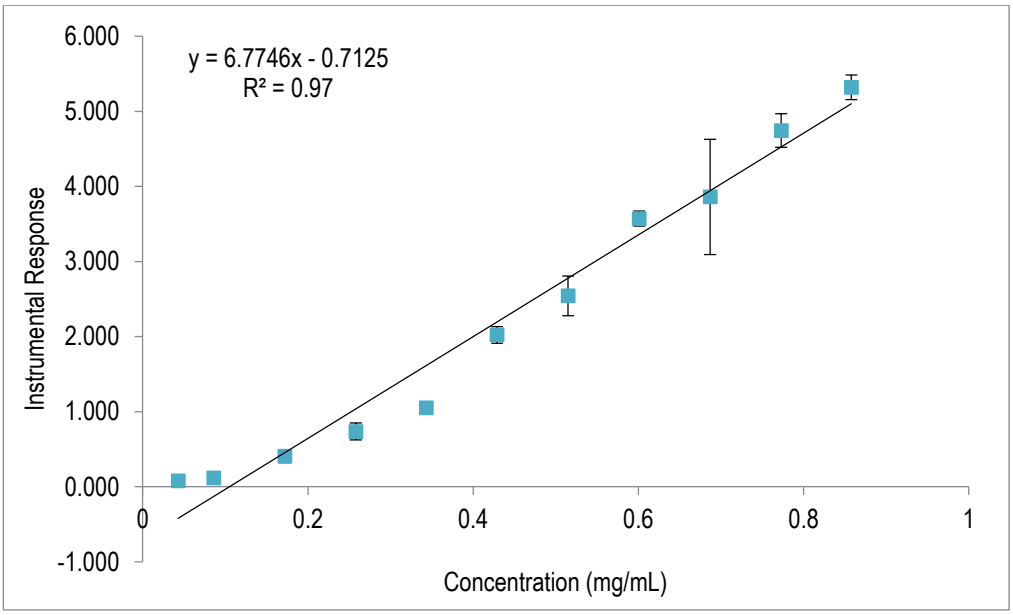


Figure 8.13: Calibration Graph using EIC data with standard deviation error bars plotted (*n* = 3)

As with the integrated peak area data from the total ion chromatogram shown in Figure 8.10 the best linearity achieved between points 0.2 and 1.0 as shown in Figure 8.14.

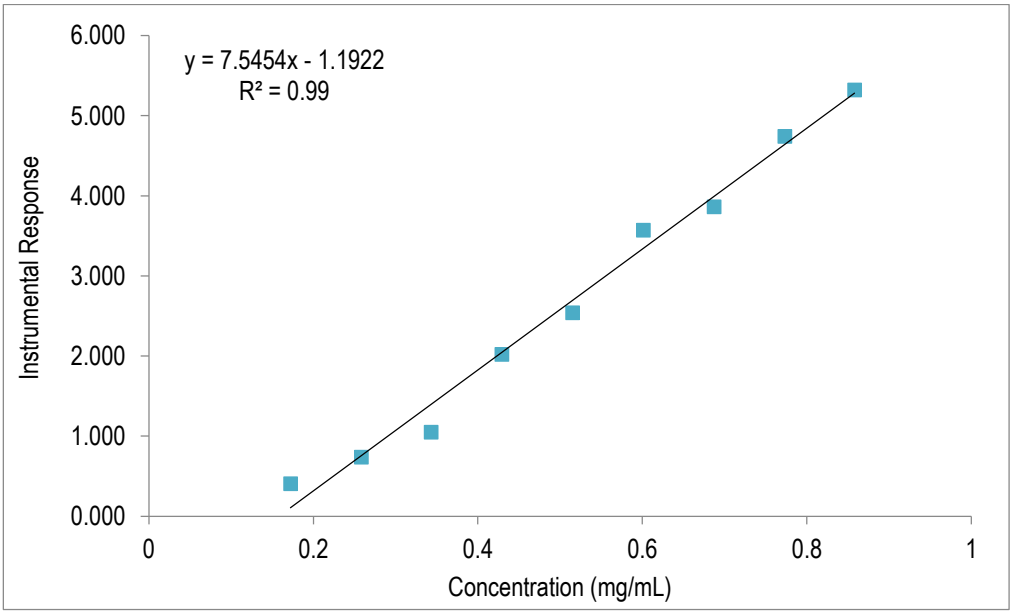


Figure 8.14: Calibration graph displaying linearity between concentration points 01.72 and 0.858 mg/mL

The regression equation from Figure 8.14 was used to calculate the concentrations of samples A73a, b and c as well as sample A53 to verify the accuracy of the two methods.

Validation of EIC Calibration Data

As the EIC method would be needed to quantify the mixed compound samples, it also required the same statistical analysis to check for validity. As with the PAR calibration graphs, the R^2 value was 0.99, which is within the correct linear range for quantification (Ellison, Barwick and Farrant, 2009). To confirm the validity of the EIC calibration data, the normality of the residuals and a runs test was again completed using SPSS (IBM, 2011). The values for the EIC calibration data using the regression equation from Figure 8.12 and the calculated residuals is located in Appendix VI Table 8.viii.

The residual data was again tested using the Shapiro-Wilk test, and generated a significance of 0.197, at a 95% confidence level. Again this value exceeds the stated significance The test statistics generated by SPSS for the Runs test on the EIC calibration residuals generates the same significance as the PAR calibration, with a significance value of 1.000. The runs test again proves that the calibration data is randomly distributed. As both sets of statistical tests on the two methods for quantification generated the same level of significance, this suggests that either method is suitable for quantifying the street samples.

8.5 Calculating purity of MDMA street samples

From the calibration data collected above, the concentrations and relative purities of the street samples containing MDMA were calculated. The samples were run in triplicate under the same method as the calibration standards. The concentrations of each sample and the instrumental response are reported in Appendix VI Tables 8.ix and 8.x. To calculate the relative purities of the samples a series of calculations were used, as shown in the example below using the data collected for sample A53.

Example using values from PAR of total ion chromatogram

The starting concentration for sample A53 was 0.67mg/mL (from Table 8.ix in Appendix VI) with an instrumental response of 0.928 (from Table 8.x in Appendix VI). These values can be used with the regression equation from Figure 8.10.

$Y=2.9145X-0.4133$

As Y, the instrumental response is known, the actual concentration of the sample can be established by rearranging the equation;

$X = (Y+0.4133) / 2.9145$

The values are then inputted into the equation to calculate the concentration of the sample

$X = (0.928+0.4133)/2.9145 = 0.460$

This shows that this sample contained 0.460mg/mL of MDMA free base, however this is different to the original concentration calculated based on the weight of the sample dissolved (0.670mg/mL). The relative purity of the sample was calculated by dividing the actual concentration by the initial sample to provide a percentage.

$(0.460/0.670) * 100 = 69\%$ MDMA

Table 8.10 lists the relative purities of the 29 samples that could be analysed using the PAR total ion chromatogram, as well as the form of the sample.

Table 8.10: Relative purities of street samples identified as MDMA (as a percentage of mass of sample represented as free base MDMA)

Sample	Type	Relative Purity of MDMA
A3	Tablet	39%
A4	Tablet	17%
A7	Tablet	46%
A9	Tablet	39%
A11	Tablet	45%
A27	Crystal	42%
A28	Crystal	58%
A37	Crystal	52%
A44	Crystal	52%
A48	Tablet	33%
A50	Tablet	37%
A53	Crystal	69%
A54	Crystal	70%
A55	Crystal	77%
A63	Crystal	75%
A64a	Crystal	87%
A64b	Crystal	73%
A64c	Crystal	85%
A64d	Crystal	72%
A64e	Crystal	65%
A69	Crystal	70%
A71	Crystal	51%
A72	Crystal	73%
A74	Crystal	78%
A76	Crystal	79%
A77	Crystal	76%
A79a	Crystal	61%
A80	Tablet	34%

As has been noted there were three samples (73a-c) for which using the PAR of the total ion chromatogram would not have given an accurate concentration due to the co-elution of a second compound so the EIC was used (Section 8.4). The same example of sample A53 has been used to illustrate that both methods are comparable.

To calculate the concentration using the EIC the same initial concentration for A53 was 0.670mg/mL. The instrumental response for A53 using EIC was 2.271 and the regression equation from Figure 8.14 was; Y = 7.5454X-1.1922. The regression equation was rearranged in the same manner as before to give the calculation

X= (2.271+1.1922)/7.5454 = 0.459

This gave the same relative percentage as was calculated when using the PAR, which was a relative purity of 69%. These calculations were then used on samples A73a through c, as shown in Table 8.11.

Table 8.11: Percentage of MDMA found in samples using EIC

Sample	Type	Relative Purity of MDMA
A73a	Crystal	48%
A73b	Crystal	47%
A73c	Crystal	50%
A53	Crystal	69%

8.6 Statistical analysis of significance of the results for MDMA

To assess the significance of the results, a series of statistical tests were performed on the relative purity percentages of the street samples to examine whether there is a significant difference between the two sample types, namely the tablets and the powders. This was done to answer the research question of whether the purity of the newly emerged MDMA powders is greater than that of the tableted form as was suggested in the analysis of the social survey data of this research. To answer the question; 'does MDMA powder live up to its reputation?'

The statistical tests of mean, median, range and standard deviation were applied to the data the results for these tests are shown in Table 8.12.

Table 8.12: Descriptive statistics for the MDMA street samples shown by type

	n	Mean (%)	Median (%)	Range (%)	Standard Deviation (%)
All	31	58	58	69	17.8
Tablets	8	36	38	28	8.7
Powders	23	66	70	45	13.3

The results above show a difference between the mean values for the tablets and the powdered samples. This is also true for the median and range values. The mode values were not included in the Table as the powdered samples had 4 sets of duplicate percentages; 47%, 52%, 70% and 73%. However the distribution of the samples percentage values was assessed through the use of the histogram displayed in Figure 8.15.

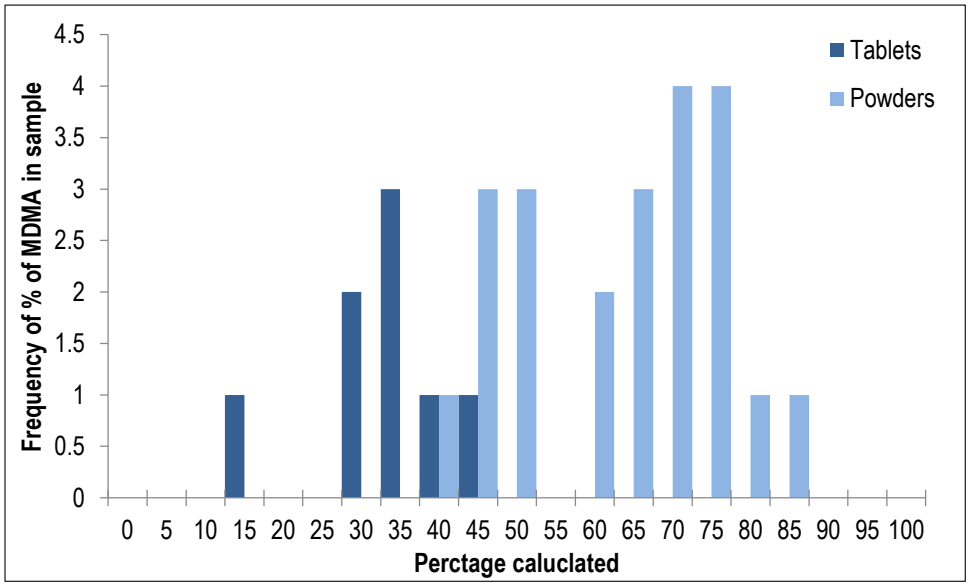


Figure 8.15: Distribution of the percentages of drug found for each type of sample

As suggested by the descriptive statistics in Table 8.15, the histogram shows that the distribution of the powdered samples are towards the higher end of the percentage scale and the tablets the lower. All of the tableted samples fell beneath the average for all the samples combined. There is an area of overlap between the two sample types, with the lowest percentage powders being less than the highest tablets. The distribution of the tablets appears to be normally distributed about the mean, whereas the powder samples display bimodal distribution, which was anticipated as the data set contained multiple modes. As the data is not normally distributed, a non-parametric test is needed to test the significant difference between the two types of MDMA, and so a Mann-Whitney U test was performed, an example is located in Appendix V. The Mann-Whitney U test returned a Z value of -4.06 as this less than -1.96 there is a significant difference at the critical confidence level of 0.05 in the percentage of MDMA found in the two types. With the powder form being significantly higher purity than the tablets for the samples tested. However further examination was conducted to assess whether the samples for which an accurate weight was gathered contained an active dose. As the powders had a high percentage of MDMA and the tablets a lower one, the weight of the full samples should be taken in to consideration. The next section examines the impact the weight of the sample had on the dose.

8.7 Dosage Level of MDMA Street Samples

Up to this point in this section the percentages have been calculated based on the weight of the sample analysed, approximately 20mg. Although the samples analysed represent the proportion of MDMA found within the sample, these calculations do not take into consideration whether the weight of the whole seizure represents an active dose. What is considered an active dose varies from source to source, it is also specific to the different individuals taking the substance, however for the purpose of this comparison an active dose is considered to be 75mg, as stated by the EMCDDA (2015).

To compare the dosage between the two types of sample, two factors were necessary. Firstly the proportional percentage from Tables 8.10 and 8.11, and secondly the known weight of the sample without any packaging. The weights of the samples varied and due to the relatively small amounts of the seized material it was not possible to separate all samples from their packaging to obtain a sample weight without risking significant loss of material and so a dose calculation is not possible for all samples. However of the samples that did have a sample weight, these were divided into two categories, bulk materials and bombs/individual doses. All tablets had a separate weight and so an accurate dosage level was obtained for all of the samples in this type, as shown in Table 8.13.

Table 8.13: Level of active doses available in Tablet samples (active dose = 75mg (EMCDDA, 2015))

Sample	Percentage	Tablet Weight (mg)	Weight of MDMA.HCl (mg)	Active Dose	Number of Doses
A3	39%	310	121	Yes	1.6
A4	17%	307	52	No	0.7
A7	46%	266	122	Yes	1.6
A9	39%	223	87	Yes	1.2
A11	45%	291	131	Yes	1.7
A48	33%	423	139	Yes	1.9
A50	37%	316	117	Yes	1.6
A80	34%	326	111	Yes	1.5

Only one out of the eight tablets did not contain the threshold level of MDMA considered to be an active dose. The other seven tablets did however contain an active dose, with six of the tablets containing over 110mg of MDMA, which according to the dosage guidelines by the EMCDDA constitute a ‘large’ dose (EMCDDA, 2015). How did the dosage levels found in the

tableted Ecstasy compare to the crystalline MDMA powder? The results for the powdered samples for which an initial weight was known are shown below in Table 8.14.

Table 8.14: Dosages available in powdered MDMA samples

Type	Samples	Percentage	Weight of sample (mg)	Weight of MDMA.HCl (mg)	Active Does	Number of Dose
Bulk powders	A53	69%	629	434	Yes	5.8
	A54	70%	2189	1533	Yes	20.4
Bombs/ Individual wraps	A64a	87%	83	72	No	<1.0
	A64b	73%	73	53	No	0.7
	A64c	85%	163	139	Yes	1.9
	A64d	72%	105	76	Yes	1.0
	A64e	65%	88	57	No	0.8
	A71	51%	75	38	No	0.5
	A72	73%	88	64	No	0.9
	A73a	47%	55	26	No	0.3
	A73b	47%	40	19	No	0.3
	A73c	49%	82	40	No	0.5

The first point of comparison is the starting weight of the individual/bombs, whereas the tablets are set at specific weight by the manufacturer, bombs were found to be more variable in their weight. An example of this was observed with sample A64, which was seized as a pack of 5 bombs. The lack of uniformity between the individual bomb weights and the homogeneity of the original product has impacted the individual dose level found in each of the bombs. In the case of A64 only 2 out of the 5 samples contained an active dose. However if the average percentage for sample A64 is taken as 76% when the weights are averaged to 102mg per sample, which provides an average dose of 79mg. It is important to consider whether the sample would be for single consumption by an individual or shared between multiple users. Personal communications on this subject suggests that an individual user may use between 3 and 5 bombs to themselves over the course of an evening (Anon. pers. com. May 2014).

The mean weight of MDMA hydrochloride across all individual bombs was 58%, which is below the threshold considered an active dose of 75mg. As has been previously stated this data cannot be compared to national averages as this has not yet been established. Though the variable content of pills has been tracked there are no comparisons for bomb weights or samples of MDMA powders. Also samples A73a-c should be considered separately to the rest of the MDMA seizures found, as they contained the adulterants BZP and TFMPP, two compounds that are considered to be MDMA substitutes (Staack, 2007; Wood *et al.,* 2007).

Though these samples did not contain the threshold amount of 75mg MDMA, which constitutes an active dose, the interaction between the compounds and the resulting psychoactive effects are as yet unreported in the academic literature. However on online forums discussing drug use there is the suggestion that the combination of these two classes of substances namely MDMA and substituted piperazines causes a greater negative 'comedown' than when the substances are taken individually (Futura2012 on Bluelight.com, 2012).

Interestingly two single samples, A71 and A72 that were packaged in paper wraps did not contain an active dose. However it is unknown what the circumstances under which these samples were seized. One obvious difference was that they were packaged differently, in paper parcels as shown in Figure 8.16, compared to the 'bomb' packaging shown in Figure 8.17, which is associated with the consumption of MDMA. One difficulty observed with the paper form of packaging was ensuring complete separation of the product from the paper; as the 'bomb' would be ingested whole (Measham *et al.*, 2010).

Figure 8.16: Image of A71 packaging

Figure 8.17: Image of A64d packaging

8.8 Calibration of standards of Mephedrone (4-MMC)

One of the research aims was to investigate what impact the new psychoactive substances have had on the use of MDMA. As has been previously reported throughout this document much has been made of the emergence and popularity of the drug 'Mephedrone'. This research has sought to examine one possible reason for the difference, looking at the relative purity of these two substances. The known purities of seized Mephedrone, as with MDMA powder has been under reported. Following the same method as outlined in section 7.5, a calibration for Mephedrone was run and the 7 street samples that were identified in the initial analytical stages as containing Mephedrone were quantified.

The same concentration points that were used for the MDMA calibration were used for the Mephedrone calibration. Using the same volumes illustrated in section 7.5, an 11 point calibration was run in triplicate with a starting stock solution of 1.97mg/mL.

The results displayed in Table 8.15 show the mean and standard deviation for each concentration of the integrated peak area of the TIC response for Mephedrone divided by the integrated peak area of the TIC response internal standard. The instrumental response reported in triplicate is located in Appendix VI Table 8.xii.

Table 8.15: The mean of the Calibration results for Mephedrone standards

Concentration (mg/mL)	Instrumental response	
	Mean Response	Standard Deviation
0.049	0.011	0.003
0.098	0.041	0.003
0.197	0.112	0.027
0.295	0.207	0.024
0.393	0.330	0.013
0.492	0.470	0.016
0.590	0.633	0.010
0.688	0.766	0.025
0.786	0.908	0.024
0.885	1.007	0.054
0.983	1.132	0.016

The linear regression is plotted on a scatter graph; Figure 8.18 displays the mean average value against the actual concentration. The Linear regression equation and the R^2 value are displayed below.

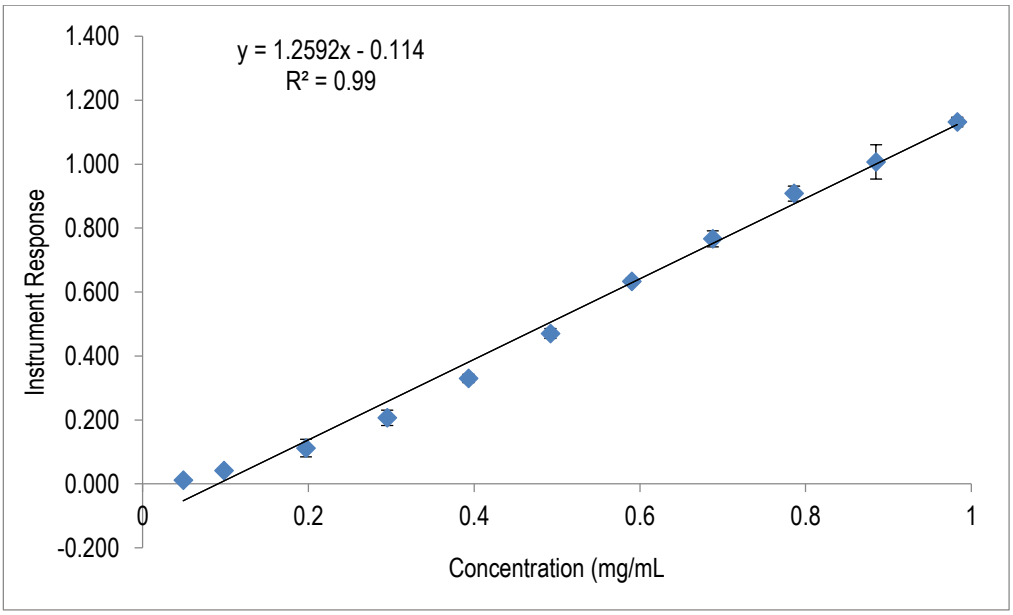


Figure 8.18: Calibration graph for Mephedrone displaying standard deviation error bars (*n* = 3)

The R^2 value displayed on the above graph demonstrates that linearity has been achieved, with a value of 0.99, which is within 10% relative uncertainty (Ellison, Barwick and Farrant, 2009). This means that the calibration can be used to calculate the unknown concentrations of the street samples.

Validation of Mephedrone Calibration Data

The validity of the Mephedrone data was assessed in the same manner as that of the MDMA calibration data. As shown in Figure 8.16 the R^2 value is within the linear range. The tests for the normality of the residuals and the runs test were also performed, using SPSS. The residuals calculated from the Mephedrone data are located in Appendix VI.xiii.

When the residual values were tested using the Shapiro-Wilk generated in SPSS the P value of 0.587 is given. As this value is greater than the chosen significance value of 0.05 the null hypothesis is retained and is therefore normally distributed. The data was then tested for randomness through the use of the Runs test, where a P value of 0.58 was obtained. As this value is greater than the significance level of 0.05 the null hypothesis is retained and the data is shown to be randomly distributed. The statistical tests prove that the data generated for the Mephedrone calibration is sufficiently valid to quantify the street samples identified as containing Mephedrone.

8.9 Quantification of Street Samples of Mephedrone

Using the linear regression equation calculated from the calibration data above the relative purities for the seven Mephedrone samples were calculated, the results from the instrumental data are reported in Appendix VI Tables 8.xiv and 8.xv. The values calculated from the instrumental data were then compared to the original concentrations to provide the relative purity of the Mephedrone street samples, shown in Table 8.16.

Table 8.16: Relative purity of Mephedrone found in seized street samples from Cambridge

Sample	Calculated concentration (mg/mL)	Original sample concentration (mg/mL)	Relative purity (%)
A12	0.696	0.886	78%
A29	0.966	1.473	66%
A40	0.572	0.825	69%
A42	0.589	0.795	74%
A51	0.635	0.821	77%
A52	0.340	0.677	50%
A61	0.781	0.781	100%

The percentage was calculated by dividing the instrumental response by the concentration calculated from the actual weighed value. The mean of the Mephedrone samples was 74%. This will be compared to the values for both the Ecstasy Tablets and MDMA powders in the following section. As noted in previous sections sample A52 was a mix of both the 4-MMC compound found in Mephedrone and an analogue 4-MEC. The quantification suggests that the sample maybe equal parts of both compounds, however a calibration of the 4-MEC compound was not completed as it was not one of the compounds perceived to be relevant to this research. None of the other Mephedrone samples contained any other chemically active substances that would have been identified through this analytical method. The mean and median values for the Mephedrone samples returned the same value of 74%, with the range giving a value of 50%, the same as the lowest reported sample value. The sample that reported the lowest percentage of Mephedrone (4-MMC) was also the only sample to contain another compound, 4-MEC a structural homologue to Mephedrone. As with the MDMA samples that contained TFMPP, the effect of the combination of 4-MMC and 4-MEC on the user is unreported.

8.10 Comparison of the purity of Ecstasy Tablets, MDMA powder and Mephedrone

One of the questions this research sought answers was whether there is a difference in the purities of the street level seizures of Ecstasy Tablets, MDMA powers and the newly emerged Mephedrone, and whether this difference reflects the relative popularity and usage that was examined in section 4.2 on the second research survey.

Before this question can start to be answered a statistical comparison between the results discussed above is needed. As the data is not normally distributed a non-parametric test is required, as in section 8.6 a Mann-Whitney U test was used to test the difference between the results for Tablets, Powders and Mephedrone samples. The following analyses compare the mean results of all MDMA samples against the mean value for the Mephedrone samples, the mean value for just the powders in comparison to the Mephedrone samples and the mean of the tableted samples against Mephedrone. All of the tests were run using the SPSS Software to generate the results, the below sections contain a summary of the results.

Mann-Whitney U test to determine whether there was a significance between all MDMA samples and the Mephedrone samples

The first test compared both samples sets to determine whether there was a significant difference between the relative purities of the two substances. The test returned a z value of -1.827, which is greater than -1.96 and so is not significant at the critical significance level of 0.05. This shows that there is not a significant difference in the percentage purity between the samples of MDMA and Mephedrone that have been tested.

However as the mean value of the tableted Ecstasy samples were significantly different the test was repeated to compare Mephedrone to the 'Ecstasy' Samples and the MDMA powder samples.

Mann-Whitney U test to determine whether there was a significance between powdered MDMA samples and the Mephedrone samples

This test compared the MDMA powder sample with the Mephedrone samples to determine whether there was a significant difference between the relative purities of the two substances. The test returned a z value of -1.006, which is less than -1.96 and so is not significant at the critical significance level of 0.05. This shows that there was no significant difference in the percentage purity between the samples of MDMA powder and Mephedrone that have been tested.

Mann-Whitney U test to determine whether there was a significance between Tableted MDMA samples and the Mephedrone samples

The third test was compared the tableted Ecstasy sample with the Mephedrone samples to determine whether there was a significant difference between the relative purities of the two substances. The test returned a z value of -3.243, which is greater than -1.96 and is therefore significant at the critical significance level of 0.05. There is a significant difference between the tableted samples and the Mephedrone samples analysed. The relevance of these tests are discussed in the following section.

8.11 Summary of the results of the chemical analysis of Street sample

The above sections detail the results for chemical analysis stage of this thesis. In starting this research a number of hypotheses were discussed as to what would be found when street level MDMA powder was to be analysed. As had been stated throughout this document very little has been published on its purity, or whether it was being adulterated and diluted. Though the last statement was not examined thoroughly as part of this research, the findings from the results of what was assessed allow for certain conclusions to be drawn. There were two questions that the chemical analysis of the street samples hoped to address, the first examined the difference in purity between the types of MDMA. The second looked at the difference in the purity between MDMA and Mephedrone.

Question 1

H^1: There will be a significant difference in the purity between the two forms of MDMA street samples

H^0: There is no significant difference between the reported purities of the different types of MDMA street samples

The first hypothesis relates to the responses reported in the second research survey, taken from the responses to Question 11b: Describe the reasons for your preference between MDMA Powder and Ecstasy tablets, the majority of respondents mentioned purity as the major factor in their choice between the two MDMA products when the powder type was chosen. These results suggested that there was a perception of purity relating to the new powdered product. This perception was unsupported as there had been no publications to date on the relative purity of other forms of MDMA aside from tablets.

The results of the chemical analysis of the street samples proved that there was a significant difference in the relative purity of MDMA being found between the two types. The powder samples had a greater average value of 66% MDMA compared to the 36% for the tablets. To contextualise these figures, consider a hypothetical 1g of each type of sample. Within the 1g of 66% MDMA powder there would be 660mg, the equivalence of just over 8 active doses of MDMA, using the dosage level of 75mg (EMCDDA, 2015). This is compared to the 360mg that would be in the tableted form, which would provide only 4.8 doses, it would seem that the powders are almost twice as pure as tablets. Though it would appear that the powders contain the greater quantity of MDMA, the dosage comparison in section 8.7 proved that this was not always the case when assessing street samples. As a tablet is pressed into a set form there is a set level of MDMA but also a relatively set weight. All bar one of the tableted samples included in this project contained an active dose of MDMA, yet this was not the case when considering the seized 'bombs'. The number of tablets analysed within this project are at the higher end of tablet market when compared to the data by the EMCDDA for 2014. The sample size is also not large enough to determine whether this is true across the breadth of tablets available within the UK, this is due to the fact that in the data collected on the seizures of MDMA within Cambridge there were no recorded tablets seized for the year 2013 when the analysis was taking place as reported in Chapter 6.

Question 2

H^1: There will be a significant difference in the purity between the MDMA samples and the Mephedrone samples

H^0: There will be no significant difference in the purity between the MDMA samples and the Mephedrone street samples

This hypothesis was assessed statistically in three ways; by comparing the purities of all MDMA samples to the Mephedrone samples, then be comparing each type of MDMA individually to the Mephedrone samples. As was shown with the Mann-Whitney U results for all MDMA samples versus Mephedrone samples there was not a significant difference between the average purities. However when type of samples was considered there was a difference found between Mephedrone and the Ecstasy tablets. To answer this question it should be considered in the context of the results from the other sections of this project, namely the seizure records and the social response from the surveys. When the seizure records are considered that looked at the relative abundance of the two types of MDMA available in Cambridge over the course of the research project it is clear that the comparison should be drawn between the powdered MDMA samples and the Mephedrone. As of 2010 the majority of MDMA samples being seized in Cambridge were powdered, with no tablets at all in 2013. So if the comparison to just the powder samples are taken as the responses to the above hypothesis it is therefore the null hypothesis that is accepted. Between MDMA powder and Mephedrone there was no significant difference in purity observed. The ramifications of this statement with regards to popularity and the use of both substances are examined in detail in the discussion section. It will take into consideration the responses from the social survey as well as the trends established from the seizure data and the host of literature already discussed in previous sections.

Chapter 9 Discussion

The discussion section of this thesis has been broken down into three sections, to answer the four research questions set at the start of the thesis. The first section discusses the changing identity of Ecstasy in modern Britain. The second correlates the findings around the two types of street drug, namely Ecstasy tablets and MDMA powders with regards to the seizure findings and the participant's preference. The final part examines the impact of NPS substances, what can be learned from their emergence and their impact on Ecstasy use.

9.1 What is in a Name?

'The changing social identity of the drug Ecstasy in 21st century Britain'

Throughout this research what has become apparent is the importance of names. The compound MDMA has, over the century since it was first patented, been recognised under a number of different chemical names. First mentioned under the title of 'Methylsafrylamine' in the German patent, it was later referred to as either 'Safryl-methyl-amine' or '1-(2-methylaminpropyl)-3, 4-methylenedioxybenzol' (Freudenmann, Öxler and Bernshreider-Reif, 2007). The first widely accepted use of the term 3, 4-methylenedioxymethamphetamine can be attributed to the 'Godfather of Ecstasy' Alexander Shulgin, in his collaborative paper with David Nicholls on the effects of ingesting the substance published in 1968 (Shulgin and Nicholls, 1968). Even in this paper the authors point out that MDMA was also known as either 'N-methyl-3, 4-methylenedioxyphenylisoproylamine' or 1-(3, 4-methylenedioxyphenyl)-2-(methylamino)-propane. Shulgin provides a clear explanation for the variety in the naming conventions applied to this substance;

'MDMA has a number of correct chemical names based on one portion or another of the chemical structure. With that defining portion named as the stem word, the full chemical name is apparent by the addition to this base fragment.'

(Shulgin, 1986, p. 291)

Even today, though the most common chemical name attributed to the compound remains as 3, 4-methylenedioxymethyamphetamine, current systematic naming conventions as set out by the International Union for Pure and Applied Chemistry (IUPAC) who determine the

nomenclature of chemicals, uses the name 1-(1,3-benzodioxol-5-yl)-n-methyl-2-propanaime. Although 'MDMA' is controlled under the MoDA 1971 in the amendment in 1977, its chemical name or any other affiliated terms are not mentioned. It is instead captured in an all-encompassing paragraph that covers any substituted phenethylamines. The passage that governs the control of this compound states;

'Any compound (not being methoxyphenamine or a compound for the time being specified in sub-paragraph (a) above) structurally derived from phenethylamine, an N-alkylphenethylamine, a-methylphenethylamine, an N-alkyl-a-methylphenethylamine, a-ethylphenethylamine, or an N-alkyl-a-ethylphenethylamine by substitution in the ring to any extent with alkyl, alkoxy, alkylenedioxy or halide substituents, whether or not further substituted in the ring by one or more other univalent substituents."

(MoDA 1971 modification 1977, Paragraph 1)

The use of the same encompassing terminology was also utilized in the control of the substituted cathinones (MoDA 1971, Amendment 1207, 2010). However control has done little to stop the spread of these recreational substances, with the use of MDMA emerging as part of the first wave of what would be known as 'designer drugs' (UNODC, 2013).

It was not the term MDMA that initially permeated the market or the social conscious, rather a catchy moniker attributed to an unknown dealer in the 1980s who labelled this drug 'Ecstasy' (Pilcher, 2008 p.24). It was Ecstasy, sold as tablets, which became the third most used drug in the UK (Home Office, 2013; Karch, 2011; Sedghi, 2013), and with it the changing social phenomenon (Measham and Shiner, 2009; Rushkoff, 2001; Shapiro, 1999). Ecstasy was a status symbol, evocative of the style icons it plagiarised on the tablets themselves. However as shown in section 2.5, there was a decline not only in the use but the trust of the product available (Measham, 2004). As Ecstasy grew in popularity the content of the active compound MDMA began to decrease, with tablets being mixed with a range of substances (Cole *et al.*, 2002; Ramsey *et al.,* 2001; Sherlock *et al.,* 1999*)*. Ecstasy lost its status symbol to become a cheap high, with tablets being sold for as little as a few pounds apiece (Binney, 2013).

After the crackdown of the production of the key precursor material in 2008, which led to a global decline in the availability of the compound (UNODC, 2008a), a new form began to emerge. A 2009 paper noted the issue of the undocumented emergence of a new form of Ecstasy known as MDMA powder or crystal (Smith, Moore and Measham, 2009). This was also an issue highlighted in the 2009 ACMD report on MDMA under recommendation 5, which stated that more information was needed on alternate forms of this substance (ACMD, 2009).

This new form of an old compound appeared to have undergone a 'rebranding', with a new street name and a new reputation. Though MDMA was now being used as a term in its own right, there were no publications examining its emergence as separate name or how it related to what was described as Ecstasy until a paper published from this research examined how the use of these two terms, Ecstasy and MDMA has changed over the last decade (Turner *et al.*, 2014).

Using metadata analysis from a number of different sources, academic usage, media usage and public usage of both terms were examined. The first analysis looked at the usage of the terms Ecstasy and MDMA as key words in journal articles from the UK between 2004 and 2013. The requirement of limiting to UK based authors was necessary as terminology can vary even between English speaking countries. The results of the data analysis are shown in Figure 9.1.

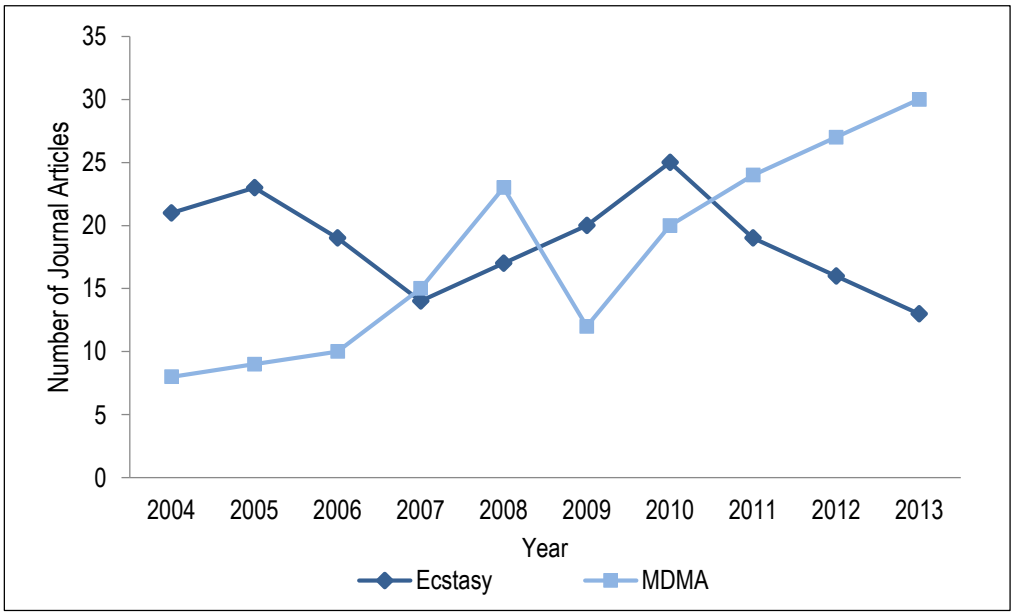


Figure 9.1: The frequency with which each word appears individually as a keyword found in journal articles from the UK in the academic databases Elsevier and Sage (Turner *et a.l*, 2014)

A changed was observed in the use of these terms as key words in the journals and databases as shown in Figure 9.1. Pre-2007 the most frequent term was 'Ecstasy', however in 2008 MDMA was more prevalent. This could relate to focus on MDMA at this time and crackdown by the UNODC on the production of MDMA, which can then be observed with the drop in usage in 2009 that relates to findings from the current research on the availability of

MDMA at this time, as shown in the seizure records of the Cambridge police reported in section 6.5, Figure 6.4. From 2010 onwards the use of MDMA starts to be used more frequently than Ecstasy. Therefore there has been a shift observed in the academic literature towards the use of the term MDMA over that of Ecstasy. This trend was then explored by examining the use of the terms by the BBC in their news stories. Using the same time period the number of times stories mentioned either terms was counted. The results from this count are shown in Figure 9.2.

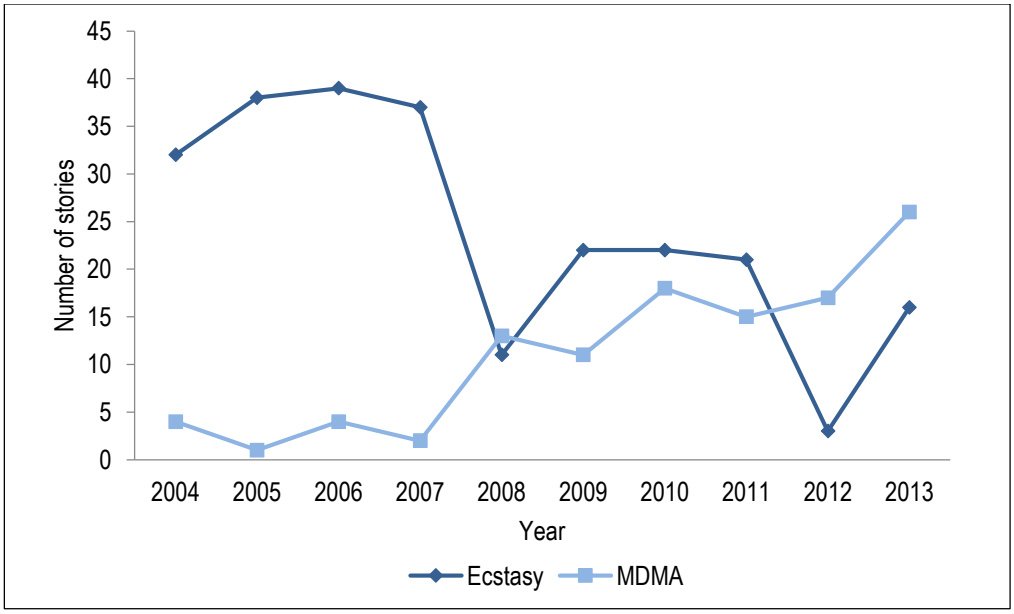


Figure 9.2: Number of news stories referencing Ecstasy and MDMA as reported by the BBC News Corporation (Turner *et al.*, 2014)

Again 'Ecstasy' is shown to be the most dominant term used up until 2008, when it was briefly overtaken by MDMA. Ecstasy remained the most dominant term, however the use of MDMA increased year on year until 2012 when it overtook the use of the term Ecstasy. This data supports the idea of a shift in usage, which was also found with the academic database results. This suggests that within the UK at least, MDMA is now the most common term that is being used. However the differentiation between what the two terms are actually describing required further definition, as both technically refer to the same compound.

One issue noted with the media's use of the term Ecstasy is in the imprecise application of the term. A recent example of this is in a recent case of 'contaminated' Ecstasy pills. In January 2015 there were reports of dangerous Ecstasy pills that were responsible for a number of fatalities. The pink superman embossed tablets were described in the media as 'rogue'

Ecstasy pills (Sabin, 2015). These pills were found to contain the compound PMMA, there was no evidence to suggest that the pills contained MDMA, which would mean that these are not in fact 'contaminated' pills, but rather they were PMMA tablets labelled as 'Ecstasy'.

The final aspect covered in the paper looked at how the general public in the UK were using these terms. This was explored utilizing a function of the Google software 'Google Trends'. This web based application records the frequency with which users search for terms, which can then be limited by location and time. The results for the use of the terms Ecstasy and MDMA over the same time period and limited to UK searches is shown in Figure 9.3.

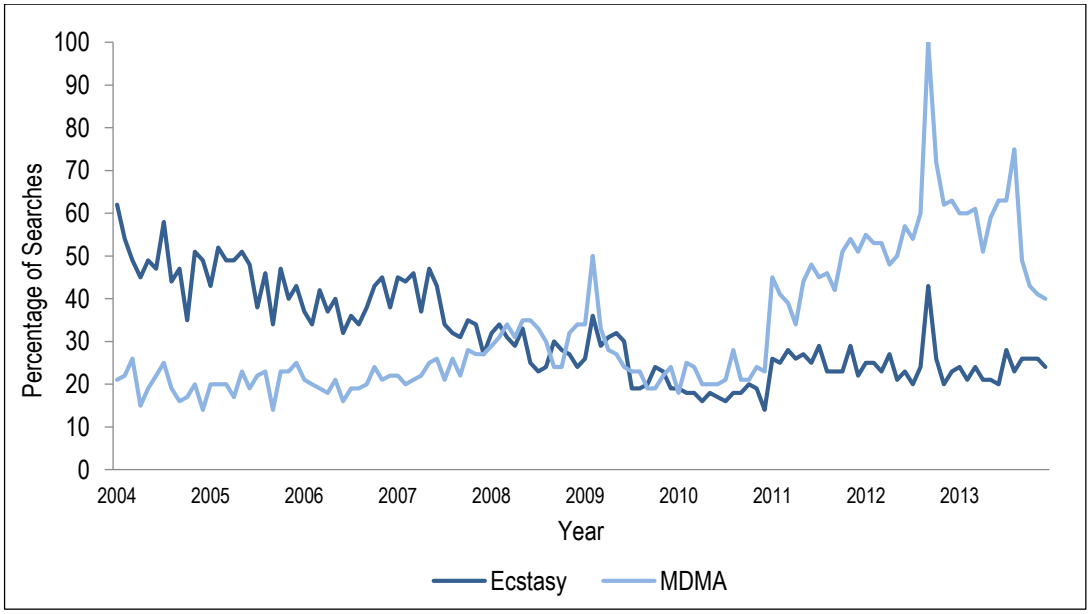


Figure 9.3: Frequency of searches for both search terms entered into Google Inc. (Turner *et al.*, 2014)

The results of the Google Trends search displayed a similar pattern that was observed with both the results from the academic and media searches. With Ecstasy being the most dominant term used until 2010 when MDMA starts to overtake the number of searchers for Ecstasy. There is also a similar cross over period between 2008 and 2010. The large peak observed at the start of 2013 relates to the broadcast of the Channel 4 show 'Ecstasy drug trial Live', which shone a spotlight on this substance and made use of both terms interchangeably (Channel 4, 2013). The results found from the meta-data analysis highlighted a clear change in the use of the two terms. In the last five years there has been a shift away from using the term Ecstasy towards MDMA. The reason behind this could be due to the emergence of the new crystal form that was being found. This supports the idea that Ecstasy

and MDMA are now being viewed as separate products, each with its own social identity and reputation.

This hypothesis was further explored through the use of the social research surveys. Analysis of the responses from both social research survey found that there is a distinct disassociation in the understanding of what the terms Ecstasy and MDMA represent. This was highlighted throughout both surveys, with the two terms obtaining separate scores across the range of questions. The first question that identified this difference was the first question from Survey A, which asked the participants which drugs they had heard of. It was found that the majority of the participants had heard of the term Ecstasy (99%), with 78.2% reported to have heard of MDMA. This was proven to be a significant difference when tested with the two way chi square (χ^2 = 89.92, P = <0.001). Ecstasy was the better known term, with no participants reporting to have heard of MDMA but not Ecstasy.

The hypothesis that Ecstasy and MDMA are not synonymous was further supported with the findings from the second question from Survey A, which found that 68% of the participants correctly identified the classification of Ecstasy while only 48% correctly identified MDMA. This is despite both being controlled under the same paragraph in the legislation (*MoDA1971 modification 1977, Paragraph 1)*. The amount of people who were able to correctly identify both as being a Class A was only 42%, which meant that of the total population 58% were unable to correctly identify both of these terms. This supports the theory that the public has not formed a synonymous association between the two terms. The theory of separate identities is further reinforced by the 13% who correctly identified Ecstasy but claimed that they 'did not know' what MDMA's classification was.

Building on this concept of a separate identity of the terms Ecstasy and MDMA in the social consciousness was the third question which asked the participant about colloquial name association of a number of drugs, again with the key focus on Ecstasy. In this question instead of having the two terms as separate items the term MDMA was included into the list of possible synonyms the participant could choose from for Ecstasy. This question reinforced the concept of two identities of the terms Ecstasy and MDMA as only 44% of the participants identified the latter as being an alternative name for the former. A further point of interest is the low association with the term Ecstasy and the term Crystal at only 6%. As the term Crystal relates to the form in which the compound is found, there appears to be a strong association

between Ecstasy and the pill/tableted form, whereas crystal has a greater association with the term MDMA. This is further supported by the alternative names suggested by the public, of which the form terms tabs and pills were mentioned.

The final question from the first survey that established the difference in perception between the two terms examined the participants own perception of their knowledge of these terms. Again the findings from this question supported the idea that there are two separate products that are being identified by the public, as Ecstasy obtained a mode of 4 the second highest possible value on the scale whereas MDMA obtained a mode of 1, the lowest. The fact that the majority of people feel highly informed about Ecstasy but gave the lowest possible value for MDMA suggests that these are separate in the public perception.

This theory was also supported by the results for the second research survey into use of these substances with the terms representing different forms, Ecstasy pills and MDMA powder. Across the range of questions asked on use the two received different responses, supported by the qualitative responses that there was a definite perception that these two represent different and separate products on the recreational drug market, with MDMA being reported to be '*purer*'.

The results from the survey data not only supports the idea that MDMA and Ecstasy are now considered separate products, it also highlights a definite gap in the awareness and understanding of MDMA as a term and what it actually represents. The origin of this gap may be linked to the inconsistent reporting of these terms and this drug in general, not only by the media as already discussed but also by the organisations that publish information on these substances for educational purposes. Information sources was another aspect that was examined as a part of this research, and are discussed in the paper on the use of language (Turner *et al.,* 2014). The inconsistency can be identified in the descriptions of Ecstasy used by the different organisations that report on this substance.

The UNODC has been cited throughout this work and could be considered the pinnacle of organisations who report on drug use. In their annual publications The World Drug report, they state *'Ecstasy is a subgroup of drugs which contains MDMA and its analogues'* (UNODC, 2013 p.xvii). The UNODC do not distinguish between the street name and the chemical component.

This is also reflected in the use of Ecstasy by the EMCDDA it its annual reports, which considers the term 'Ecstasy' to be inclusive of the range of analogues potentially found in the street samples. There is however one discrepancy in how the EMCDDA report on this substance. As part of the EMCDDA's web based information page they provide profiles of a number of substances which are stated as being *'scientifically sound descriptions of drugs'* (EMCDDA, n.d.). Instead of there being a profile dedicated to the drug 'Ecstasy' there is in its place one for MDMA. On the profile page, the description is given as;

'*A synthetic substance commonly known as Ecstasy, although the latter term has now been generalised to cover a wide range of other substances.'*

(EMCDDA, n.d.)

Though acknowledging that Ecstasy is an umbrella term, the fact that the focus of the page is on the term MDMA is of interest, suggesting that in terms of educating on this subject the EMCDDA has shifted the focus onto the chemical rather than the brand or form in which it may be found. However both the UNODC and the EMCDDA are not UK-centric, and must use language and terms that are applicable to the widest possible audience. As part of the paper published, three UK based sources were examined on how they used these terms. These were the ACMD, the TalktoFrank webpage and the charity Drugscope (Turner *et al.*, 2014).

In 2009 the ACMD released its review into MDMA, not 'Ecstasy'. In the opening paragraph of the introduction the report states that the focus of the review was MDMA because it was the most commonly seized compound associated with the term Ecstasy being found in the UK (ACMD, 2009, p.9). Conversely the TalktoFrank website has stuck with the term Ecstasy as the chosen term, with the option for MDMA being redirected to the Ecstasy page (TalktoFrank n.d.). As a part of the profile a description of Ecstasy's appearance is given as;

'Pure ecstasy is a powder made of white crystals, known to chemists as MDMA. Ecstasy is usually sold on the street as tablets, although it's getting more common to see it sold as powder and called by its chemical name, MDMA, or 'crystal'.'

(TalktoFrank n.d.)

The importance of this statement is that the form in which the drug is found dictates the name that it is given; Ecstasy to tablets and MDMA to crystal or powder. Yet the description is

problematic as it suggests that the newer powdered form is 'pure', which to date, the relative purity has yet to be established or published. This message about purity is reiterated by the drugs educational charity DrugScope, whose own web based information portal states that;

'Ecstasy is an illegally manufactured drug that usually comes in tablet or capsule form. The chemical name of pure ecstasy is 3, 4-Methylenedioxymethamphetamine or MDMA for short'

*(*Drugscope, 2015*)*

Both of these resources provide an explanation that could be misleading to the general public they are informing. The perception being promoted is that the term MDMA means "pure". From a purely chemical sense this is true, as it is the abbreviation of the longer chemical name. However as the term MDMA has been used to effectively rebrand the new powdered and crystal form of the recreational drug found on the street, of which the relative purity is still unknown. The perception that MDMA is pure has permeated the social conscious, as shown in the responses to the second research survey. This is without any substantial evidence into the chemical composition of the powdered form having been published.

The inconsistent and potentially inaccurate information provided by the sources examined may have an impact on how the public perceives this compound and the two names it is associated with. The second half of Survey A examined where people went for information and who they trusted to supply it. Question 6 asked the participants where they would look for information about drugs. For both parts of this question the results were unanimous in the top three options, the most popular answers being; the internet, friends and drug forums. The governmental sources were outside the top 3 choices and doctors received less than a quarter of participants citing them as a source they would use. This was in stark contrast to the results for question 7, which found that doctors were the source that elicited the highest level of trust, closely followed by independent scientists. These findings correlate with a recent poll by Ipsos Mori (Duffy, 2015) on which professions the public trusted to tell the truth. The most trusted profession as reported were doctors, followed by teachers and then scientists. The lowest ranking professions in the poll were journalists and politicians.

The outcome of this section of the research has proven that there is a definite difference not only in how the terms Ecstasy and MDMA are being used but also in how they are being perceived. They now represent different identities with regards to what is seen in the recreational drug market, something that has yet to be adopted by the media and the governmental organisations. This research has also highlighted the inconsistency in the reporting on this topic and discussed the relevant information sources in relation to how the public perceive the accuracy of the information they provide. The next section will examine the responses found in this research in the context of the second research question. So far the emergence and knowledge of the new form of MDMA has been established but not its prevalence or whether perception matches reality.

9.2 Prevalence, Perception and Purity

The previous section established that there has been a shift in the terms used to describe the compound MDMA, with the identification of terms referring to specific forms of the drug as it is found on the street. Ecstasy can be said to describe any illicit compound that is presented in a tabletted form that may or may not contain MDMA as the active component. Whereas the designation of MDMA has been introduced to cover the newly emerged powders and crystalline material, which has suffused the British recreational market. Prevalence of use was examined in two ways in this research, firstly by examining user based reports of substances (Section 4.2) and secondly by examining seizure records (Section 6.5).

Prevalence

In the 2012/13 edition of 'Drug Misuse Declared', which published the responses to the CSEW, it was noted that the proportion of participants reporting to have taken 'Ecstasy' was at its lowest since records began in 1996 (Home Office, 2013). Yet a number of criticisms of the methodology employed in this survey were highlighted in section 3.3, concerning issues of sampling and participant bias. As discovered in the review of pervious drug use surveys in section 2.7, the profile of an Ecstasy user was a male in his twenties (Gross *et al.,* 2002; Hammersley *et al.,* 1999; Handy, Pates and Barrowcliff, 1998; McCambridge *et al.* 2005; Ogeil, Rajaratnam and Broadbear, 2013; Sherlock and Conner, 1999; Solowij *et al.,* 1992) yet this group is under represented in the CSEW survey as was shown in section 4.2.1. In addition there is the issue of including only the term Ecstasy in the questions set for the CSEW.

As discussed there has been a change in the terminology to describe what is being used, as there are now two products with separate identities for the same compound. As the results of the analysis of Social Survey A there was a distinct disassociation between what is understood about the two terms, therefore if participants are not identifying the drug they have taken as Ecstasy but rather as MDMA then the usage of this substance is not accurately being recorded by the CSEW.

This is further supported when comparing how the Global Drug Survey has responded to the shift. Over the last 5 years the language used to describe the substance MDMA in this survey has changed. In 2010 participants were asked if they had tried Ecstasy or MDMA powder, with both answers being displayed as separate (Mixmag, 2010). In the 2011 survey the option Ecstasy (pills or powders) was deployed (Mixmag, 2011). However since 2012 the Global Drug Survey has just used the term MDMA, omitting the use of the term Ecstasy (Mixmag, 2012). This change, alongside the methodology and rationale of the Global Drug Survey, also described in section 3.3, may explain why MDMA has remained one of the most popular substances recorded by the Global Drug Survey (2013).

In the 2014 survey 45.2% of participants reporting to have taken MDMA (in any form), which was more than the number who reported to have taken a caffeinated drink (44.7%) (Sedghi, 2014). The level reported by the GDS is a stark contrast to the 1.3% reported in the CSEW. This was also evident when compared to the findings from Survey B. The findings of this research show a distinct difference in the level of reported use between the three surveys as shown in Figure 9.4

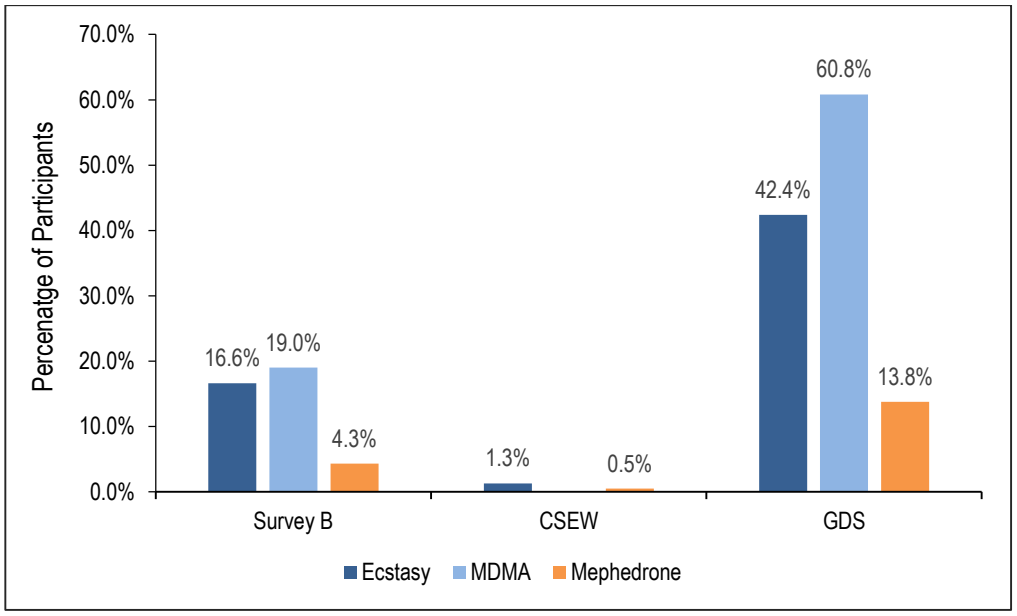


Figure 9.4: Comparison of percentage of participant responses to substances taken in the last year

There is difference observed between the percentage of participants reporting to have taken MDMA and Ecstasy in the last year from Survey B and what was reported by the CSEW. Proportionally the responses from Survey B reflect a similar pattern of use identified in the Global Drug Survey, though none of the substances are as prevalent. This again can be explained by the eliminatory questions employed by the Global Drug Survey to remove non-drug users, something that was not applied to the findings of this research. In removing the responses from non-drug users the relative proportion of use cannot be contextualised to society as a whole.

One clear point that can be drawn from the above findings is that the CSEW, in not utilizing or recognising the term MDMA as being separate to that of Ecstasy, is potentially missing a large proportion of the MDMA using community and so is under reporting the relative prevalence of the use of this substance. So to refer to the early statement made in section 2.3.3 , that Ecstasy use is at an all-time low is disingenuous.

Under estimating the size and prevalence of the MDMA market is not just an issue that is apparent in survey based research. This research also examined how the market was assessed at a global, continental and national level through the use of seizure data analysis. In looking at how the UNODC, the EMCDDA and the UK government classify the size of the 'Ecstasy' market it is apparent that there is the potential for underestimation of the market.

The level of ecstasy seizures and the prevalence of the market is calculated in relation to the number of tablets seized. This was logical when the tabletted form was the most dominant, however in reviewing the data collected from Cambridge police, reported in section 6.5, this no longer is the case. As of 2010 the most dominant from that was being found in Cambridge was reported to be powders. The findings from the seizure records alongside the responses to Survey B clearly indicate that alternate forms of MDMA need to be considered to accurately estimate the size of the market. This is a change which has yet to occur within the way that governmental and international organisations report and record the seizures of this substance.

Perception and preference

The second research question that was posed at the start of this research wanted to examine how the perception of the types of Ecstasy and MDMA differed. The literature on this subject, reviewed in section 2.5, was conflicting with the scope of the survey information variable to when and where it was conducted (Hammersley *et al.*, 1999; Handy, Pates and Barrowcliff, 1998; Parrott, 2004; Peroutka *et al.*, 1988; Solowij *et al.*, 1992). The only consistent evaluation on the subject of the perception around Ecstasy specific to the UK was the Mixmag/GIobal Drug Survey, which reported on the user perception of the quality of the products they were using (Winstock *et al.*, 2001). There has been very little qualitative research into the preference of specific substances, this has subsequently been addressed in this research.

The analysis of responses from Survey A found that there was a definite difference in what the participants thought about the two terms Ecstasy and MDMA , while Survey B provided a qualitative context to the question by asking both user and non-users to compare their perceptions of the two types. Some of the most interesting points that arose from this survey came from the qualitative responses of the users, who provided erudite discourses on the topics discussed.

The first point of interest was the user perspective on the physical and emotional effects experienced under the influence of 'Ecstasy' and MDMA powder. The effects of this chemical is well documented (Curran and Travill, 1997; Downing, 1986; Freese, Miotto and Reback, 2002; Greer and Tolbert, 1986; Harris *et al*., 2002, Kirkpatrick *et al.*, 2015; Peroutka *et al., 1988;* Sumnall, Cole and Jerome, 2006; Vollenweider *et al.,* 1998). However as discussed, there is a difficulty in measuring and quantifying the subjective effects (Sumnall, Cole and Jerome, 2006), which was also highlighted by the participants in their qualitative responses. In this research the participants were asked to rate their physical experience of the drugs, with both Ecstasy and MDMA being rated as significantly positive. What was interesting from this question was the number of users who ranked the terms as 'indistinct', with double the number of users stating that Ecstasy produced indistinct physical effects compared to that for MDMA. The participants were also asked to rate their emotional experience, again both rated significantly positive each achieving over 90% of the respective users rating the experience as positive. This follows the well documented evidence that MDMA as a compound is an empathogen that causes euphoria and a positive mental state (Harris *et al.*, 2002).

When participants were asked whether they had ever had a 'bad experience' on the drugs, 6% responded 'Yes' for Ecstasy compared to 3.6% for MDMA. There were significantly more participants who did not report ever having a bad experience on this drug. The participants were next asked if they knew of someone else that had had a bad experience, relating to the reputation of the drug as opposed to purely first-hand experience. There was a significant difference between the participants reporting to know someone who had had a bad experience with Ecstasy (33.3%) compared to who had for MDMA (24.6%). For both substances significantly more users reported to have known someone with a bad experience than non-users. However when asked about whether their own knowledge or the knowledge of someone else's bad experience had changed their usage, the majority reported that neither, the knowledge of or their own first hand bad experience had had an effect in changing their behaviour.

These questions lead into the first of the qualitative questions where participants provided detail responses for their reasons behind their choices. There were three themes that emerged from the 'Yes' responses; with bad experiences, negative side effects and the risk and fear of dependence being highlighted as key factors. In this question both MDMA and Ecstasy were discussed in a negative context, though not to the extent of other substances included in the questions. Of the reasons given by the users who stated that their usage had not changed based on the knowledge of others experiences was summed up in the response by participant 23;

'The experiences of others are always laced in hyperbole to make the storyteller in question sound preposterously cool and unbeatable. I never trust humanity, not even myself; which can often be a problem.'

Participant 23

This comment is consistent with the criticism of subjective user reports mentioned previously (Sumnall, Cole and Jerome, 2006). There was also a critical tone observed within some on the user based responses, with a few of the participants judging other drug users, stating that their negative experience are based on ignorance. However considering the criticisms this research has raised regarding the inconsistent information that is being distributed on these drugs, ignorance or lack of understanding is bound to emerge. Though some may try to self-educate

the mixed messages and inaccurate information available on this substance in particular may be dangerous as people are not sure of what it is they may be taking. Participant 238 commented succinctly on the issue around what they noted as '*the notoriously impure 'Ecstasy' market';*

'I prefer to base my usage on what I know to be true. The notoriously impure 'Ecstasy' market often results in user's obtain cut MDMA and/or a drug that is not actually MDMA, but is labelled as so. As a result, they have a bad experience and attribute that to MDMA. When in fact it was a result of a combination or different drug entirely. Thus, when I take MDMA I ensure my product and base my usage on my own experiences.'

Participant 238

This relates back to how the two terms are perceived, where 'Ecstasy' is connotative of the tablet form that may contain any number of substances that then get attributed to MDMA. The final question that assed the differences between the perception of Ecstasy and MDMA powder provided the hypothetical choice between the two. In this question the significant choice was MDMA with 31.1% of the participants choosing it over Ecstasy (11.6%), the rest of the participants choose the neither option. When asked the reason behind the choice there was one resounding reason given – MDMA powder was 'purer'. One participant stated that tablets were only '30-40%' MDMA in content. Whether this is the case or not is something discussed in detail section 9.3. The preference for MDMA was further reinforced in the findings from question 15, where the participants were asked to rank the drugs selected based on their own preference. The analysis of this question found that MDMA was not just the most preferred substance by both Ecstasy and MDMA users, of which there was overlap, but across all groups examined.

One final noteworthy finding from social survey B was the impact of the gender ratio on the findings. As discussed, the profile generated from previous user surveys suggested that the Ecstasy user was male and in his twenties (Gross *et al.,* 2002; Hammersley *et al.,* 1999; Handy, Pates and Barrowcliff, 1998; McCambridge *et al.* 2005; Ogeil, Rajaratnam and Broadbear, 2013; Sherlock and Conner, 1999; Solowij *et al.,* 1992). The surveys generated for this research both obtained gender ratios more dominant in female participants, which is unique. However when the gender ratio of the users was analysed there was no significant difference between the number of male and female who had ever used Ecstasy or MDMA. The only difference that was observed was within usage of Ecstasy in the last month. The

difference in the perception and choices of the two genders was assessed throughout the analysis of the second survey (Section 4.2). The main finding being that there was no significant difference in how the genders perceived or reported their experiences. The majority of the users, whether male or female did fall within the same age range as observed in previous surveys, specifically when examining the responses to the question of usage in the last year and last month, as shown in Appendix IVb.

A key finding from this research is the unequivocal preference for MDMA powder stated by the participants of this survey, which is supported by a perception that the product in the powder form is of better quality and higher purity. This could be the driving force behind the shift in type of MDMA being found on the street as shown in the seizures from Cambridge, with people actively choosing to buy crystal/powder over 'unreliable' tablets. However whether the perception is supported by reality is the focus of the final part of this section.

The truth behind the perception of purity

As has been stated in section 2.5.3, there is a host of published literature on the quality and prevalence of the Ecstasy tablet (Baggott *et al.,* 2000; Cole *et* al., 2002; Milroy, Clark and Forrest, 1996; Ramsey *et al.*, 2001; Refroe, 1986; Sherlock *et al.*, 1999; Spruit, 2001; Tanner-Smith, 2006), which supports the user perception highlighted by Participant 238 on the '*the notoriously impure 'Ecstasy' market'*. There is however very little published or confirmative literature on the comparable purity of the powdered form of the street drug. The only reference found to date is located in the footnotes of the EMCDDAs' website page on the purity of selected drugs. The EMCDDA report that of the 487 samples examined, the average content of MDMA found in the crystal form was 81.1%. The median is given as 88% and the mode is 92% suggesting that it is indeed '*purer'.* The number of samples of powder recorded by the ECMDDAs page is also more than four times as many tablets that were analysed, suggesting powders were more dominant and yet the focus of the page remains on tablets (EMCDDA, 2014).

The truth of the perception of purity was tested by this research through the quantitative chemical analysis of seized samples from Cambridge. The results from the street samples proved that there was a significant difference in the relative purity of MDMA being found in the

two types, with the powders having a greater average value of MDMA at 66% compared to the 36% that was found for the tablets. This finding correlates with the statement made by participant 21, who claimed Ecstasy tablets contained between '30-40%'.

Though it appears that the powders contain the greater quantity of MDMA, the dosage comparison in section 8.7 proved that this was not always the case when assessing street samples. As a tablet is pressed it is in a set form, with a set level of MDMA but also a relatively set weight. All bar one of the tableted samples included in this project contained an active dose of MDMA. This correlates with the qualitative responses from the users who stated they would choose tablets over the powder form, who stated that the relative ease of administration and does control a key factor in their choice.

However the relative dosage varied when considering the powder forms. Two types of seizure were assessed as a part of this project, bulk and individual 'bombs'. Although all powders had a comparatively high purity, the weights registered for the individual 'bombs recovered did not necessarily relate to what would be considered an 'active' dose. The sample size is also not large enough to determine whether this is true across the breadth of tablets available within the UK, this is due to the fact that in the data collected on the seizures of MDMA within Cambridge there were no recorded tablets seized for the year 2013 when the analysis was taking place.

The overall finding from the chemical analysis completed in this research supports the perception reported by the user groups from the second survey, that the powder form of MDMA is 'purer' when the relative percentage is taken into account. One reason for the high purity of the products being found on the street may be related to the competitive market into which MDMA powder emerged. There is now a broader choice of substances to choose from than ever before, the impact of which is assessed in section 9.3.

The aim of the second question of this research was to discover whether there was a difference in how the two forms are perceived but also whether this perception had any basis in fact. In reviewing the data collected it is apparent that Ecstasy has had an effective re-branding, shaking off its reputation as an impure product and emerging under the new banner as MDMA powder. This new product also appears to live up to its reputation of being a 'purer' product when considering the relative purities of the samples examined in this project. However MDMA powder has only just entered the market and whether producers follow the

pattern of adulteration further down the line has yet to be seen. With such a saturated recreational drug markets, producers now have more competition. This is examined in the final aspect of this research, which summarises the impact NPS have had on the use of Ecstasy and MDMA.

9.3 The deal with Mephedrone

As previously reported in Chapter 2 of this thesis, recent years has seen the emergence of numerous new psychoactive products entering the market under the banner of 'Legal Highs' (APPGDPR, 2013; EMCDDA and Europol, 2013; EMCDDA, 2011; UNODC, 2013b). With some sources claiming these new compounds are replacing the use of conventional or traditional drugs (BBC, 2013; McElrath and Van Hout, 2011; Measham, Moore, Newcombe and Welch, 2010; Measham, Wood, Dargan and Moore, 2011). This final section of the thesis seeks to examine to what extent this statement was true. This research has focused on the drug known as Mephedrone and the impact it has had on the use of Ecstasy/MDMA.

It is difficult to establish when Mephedrone exactly emerged onto the recreational drug market before it became prevalent and before it was controlled under the MoDA 1971. This is due to the nature of recording practices of seizures, and issue that was also observed in the analysis of the seizure data at Cambridge. As substance can only be recorded once it has been identified and if it is not controlled it is unlikely to be recorded. It is believed that Mephedrone first emerged in the late 2000's (Measham *et al.*, 2010), but it was not until 2010 when it became a national 'moral panic' (Alexandrescu, 2014) that it was controlled under the MoDA 1971, Amendment 1207 (2010). There was much speculation at the time as to whether Mephedrone would replace Ecstasy as the party drug of choice (BBC, 2013). This was the final question evaluated in this research. To answer this question a comparison between Mephedrone and MDMA in any form was assessed throughout the three projects.

The comparison was first assessed in Survey A, which compared the participants' awareness of the two substances. The first question examined whether people were aware of Mephedrone. The analysis of this question found that in comparison to Ecstasy that obtained 98% of the participant population reporting to have heard of it, only 72% reported having heard of Mephedrone. This was high in comparison to other drugs asked in this question, namely the piperazines and 2CB that obtained 14% and 22% of participants reporting to have heard of them. One reason why such a large proportion reported to have heard of Mephedrone may relate to the media presence of this drug (Alexandrescu, 2014). However though people reported to have heard of Mephedrone, the responses on the knowledge based questions in the rest of Survey A suggested that there was a lack of knowledge about what Mephedrone is and what it does beyond a name for new synthetic substance.

In the question that asked participants what classification Mephedrone belonged to, the majority of participants stated that they did not know (40%). Only 27% were able to correctly identify the substance as a Class B, compared to 69% that correctly identified the classification of 'Ecstasy' and the 48% that classified MDMA correctly. The low level of knowledge was also reflected in the response to the question on what other names the participants associated with the drug, 56% identified it with the name meow-meow, and variations thereof. Coincidentally, as was seen in the case of Ecstasy and MDMA, the abbreviation of the chemical name also had less recognition than the slang term. Only 12% of participant's identifying the term 4-MMC, the abbreviation for 4-methylmethcathinone as being related to the drug.

The lack of awareness and knowledge around this substance was further reinforced by the responses to the ranked question that asked participants to rate their knowledge of the effects of a selection of substances on a Likert scale, where 1 represented low and 5 represented high. The most frequent score that was selected by the participants for Mephedrone was the lowest possible on the scale. The overall mean reported for Mephedrone was 2.12, this was the lowest score given by the participants on their knowledge of the selected substances. This suggests that though people may have heard the term Mephedrone there remains a gap in the knowledge about this drug. A reason for this lack of knowledge is perhaps that the use of Mephedrone has not proliferated and it has not become as prevalent in the recreational drug market post control as was suggested it might when it first emerged (BBC, 2013; McElrath and Van Hout, 2011; Measham, Moore, Newcombe and Welch, 2010; Measham, Wood, Dargan and Moore, 2011).

There are a number of possible explanations as to why Mephedrone may not have been as prevalent post control, though the published literatures suggests that the legislative control alone of new psychoactives has not shown to reduce use (Dargan et al., 2011; Wood *et al.*, 2011; Wood, Measham and Dargan, 2012). Therefore there may be alternative reasons as to why this drug appears to not be as popular, with the responses to Survey B providing an insight through the qualitative and quantitative responses of the users.

In Survey B only 37 participants reported to having ever tried Mephedrone, this equalled 15% of the total participant population. Only 4% reported to have used it within the last year,

relating to the period of 2012/13. By comparison the Global Drug Survey for the same year recorded participant usage who had ever tried Mephedrone at 36%, and at 14% for having tried in the last year (Mixmag, 2013). These figures are significantly smaller than the level reported for Ecstasy or MDMA in either survey. As with the comparison between Ecstasy and MDMA that has previously been discussed, the user perception of Mephedrone was also assessed. What was reported was a negative reputation that Mephedrone has gained in the short time that it has been available.

The first of the perception questions in Survey B asked users about the effects of Mephedrone. As reported in section 2.6.3 Mephedrone reportedly mimics the effects of MDMA and other ATS drugs (Coppola and Mandola, 2012; Measham *et al.*, 2010; Winstock *et al.*, 2011a). The participants' responses in these questions indicated that the physical and the emotional effects of both Ecstasy and MDMA were positive. Therefore if the effects of Mephedrone are designed to mimic MDMA the participant responses should also have been positive. This however was not what was reported, as the participants' response to physical effects indicated that there was no significant difference between the numbers of participants who stated their experience was positive, negative or indistinct. There was significant difference in the responses reported for the emotional experience, with more participants reporting positive experiences over either of the other two options.

The impact of the effects and the reputation of Mephedrone was also examined in questions 6, 7 and 8. In question 6 the participants were asked whether they had or if they knew someone who had had a bad experience with the substance. 38% of the people who reported to have used Mephedrone stated that they had had a bad experience, this is compared to 18% for Ecstasy and 12% for MDMA powder. Yet only 16% of all the participants reported to have known someone who had had a bad experience, compared to a third for Ecstasy and a quarter of participants reporting to know someone with a bad experience of MDMA powder. Significantly more participants from the user group were more likely to have known someone who had a bad experience of Mephedrone than a non-user. Question 7 asked whether the participant's experience of the drug had changed their usage, 60% claimed it had changed their use of Mephedrone, compared to 37% for Ecstasy and 40% for MDMA. When asked whether someone else's experience had changed their usage, 32% of users stated that it had compared to 14% for Ecstasy and 13% for MDMA powder. Mephedrone consistently reported more participants with a negative association with the drug than either Ecstasy or MDMA

powder as shown in Figure 9.5, which summarises the user group responses for Questions 4 through to 8.

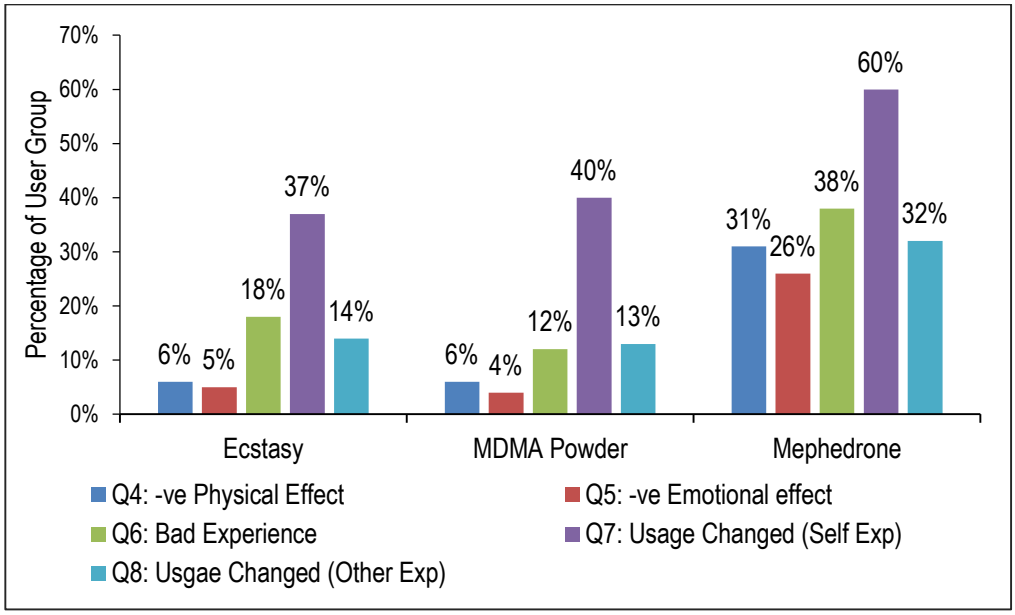


Figure 9.5: Summary of User group responses for Questions 4 to 8 from Survey B (Ecstasy *n* = 86, MDMA Power *n* = 77, Mephedrone *n* = 37)

The effects and users perceptions were elaborated on in the responses to questions 9 and 10. The participants were asked to provide qualitative answers about the changes to their usage or knowledge of others negative experiences. In the analysis of these questions Mephedrone was the second most mentioned substance by name, tied with ketamine. The tone of the comments provided by the participants were very negative as shown in the following examples;

'Negative effects from Mephedrone resulted in no longer using. Don't think there's enough information regarding this drug available.'

Participant 20

'Drone – Found it to be very addictive with horrendous comedowns. Eventually there was no nice feeling coming from taking it so the thought of it now makes me sick.'

Participant 63

I think Mephedrone is a very unpredictable substance. I would never take it again. My experience wasn't terrible – just lots of memory loss which made me realize how dangerous the drug could be, I felt very out of control.

Participant 192

The comments from the users indicated that the side effects were a key reason in why they had moved on from its use. Not a single participant referred to in the context of its control status or whether their use of the experience had changed based on the change in legislation, supporting the findings from published literature (Dargan et al., 2011; Wood *et al.*, 2011; Wood, Measham and Dargan, 2012). One further insight into the prevalence of Mephedrone can be obtained from the results to question 12, which asked participants to choose between MDMA and Mephedrone and provide reasons for their choice. When given the choice between these two comparable substances 34% chose MDMA while only 3% chose Mephedrone, with the rest choosing the neither option. In providing a reasons behind the choice, the majority of participants who chose MDMA stated the fact that there is less known about Mephedrone. That the participants had heard *'bad things'* about its use and again reiterated the negative effects. Of the few people that did choose Mephedrone, their reasons were that is was cheaper and less effective than the other choice.

A review of the user response from all parts of the second survey suggest that though it was speculated that this drug was set to replace MDMA (BBC, 2013; McElrath and Van Hout, 2011; Measham, Moore, Newcombe and Welch, 2010; Measham, Wood, Dargan and Moore, 2011), this has been proven not to be the case. This is supported throughout by the numerous participants referencing negative side effects and a poor reputation for this substance.

The lack of proliferation by Mephedrone into the recreational drug market was further reflected in the seizure data collected from Cambridge police. The analysis of the record books at Cambridge police station highlighted a number of trends, which correlated to the findings from the literature and the social research surveys. Firstly was the emergence of cathinone derivatives in Cambridge, Mephedrone was the first of a variety of substances that was recorded in the logbooks, with the first confirmed sample appearing in 2009. This correlates to the suspected time of emergence reported in the literature (Measham *et al.*, 2010). There are limitations to this data however as the police only have to record substance that are controlled under the MoDA 1971, with substituted cathinones only being controlled in 2010. This therefor accounts for the observed trend in the Cambridge data that saw a spike in the seizures of Cathinones and Mephedrone in particular in 2010 shown in Figure 9.6, a revised copy of Figure 6.3 that shows the seizure of Cathinones and MDMA.

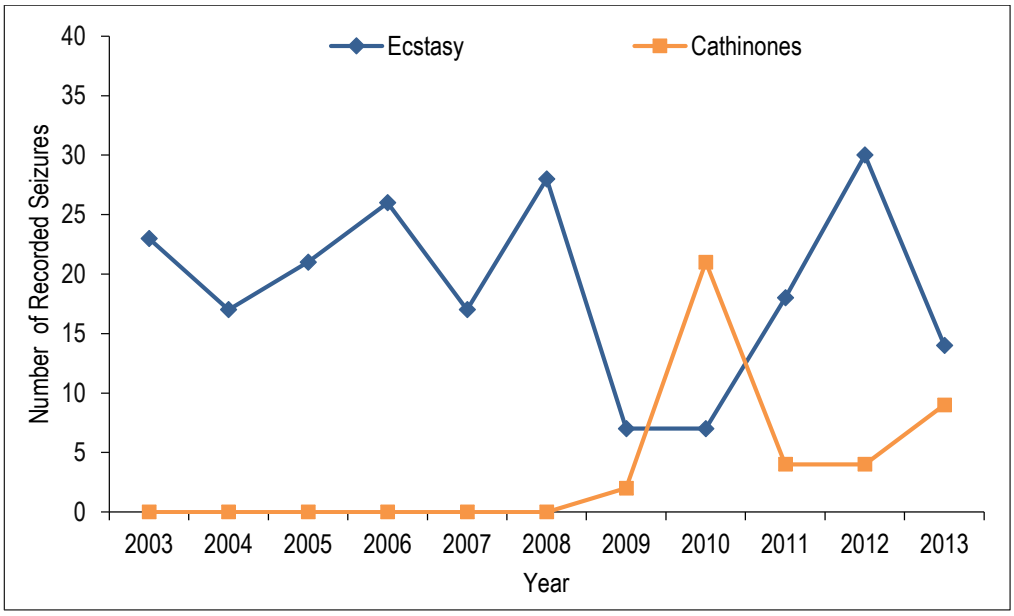


Figure 9.6: Seizures of Cathinones and Ecstasy recorded in Cambridge between 2003 and 2013

The seizure trend observed in Cambridge for cathinones is interesting as there was a spike in 2010 when the blanket ban came into effect (MoDA, 1971 amendment 2010), with very few being found between 2011 and 2012. This trend also coincides with when there was a noted shortage of MDMA available, which has previously been discussed. There was a noted increase in 2013, which related to a number of seizures of the compound Methylone (3, 4-methylenedioxymethcathinone). Methylone was also found in some of the samples that were tested as a part of the chemical analysis of the street samples. Interestingly the seized Methylone samples bore a visual similarity to the MDMA crystals rather than the samples that tested positive for other cathinones. The Methylone samples were light brown irregular shaped crystals, compared to the samples positive for Mephedrone that were all white or colourless as shown in Figure 9.7.

		
Sample A51: Mephedrone	Sample A75: Methylone	Sample A54: MDMA

Figure 9.7: Visual comparison of Mephedrone sample with Methylone and MDMA.

The use of Methylone was also documented in Survey B, with 10 participants (4%) claiming to have ever taken it and 2 participants stating they had taken it in the last year. However the use of Methylone was not considered in the development of the later survey questions and the records of its seizures were discovered after the majority of the data collection had been completed, and so the use of Methylone as an alternative was not examined as a part of this research.

The question of what was prevalent has already been addressed with regards to the terms Ecstasy and MDMA. In answering that question the use of the Google Trends application provided an interesting insight into the search patterns of the UK public, with the data for Ecstasy and MDMA correlating to the pattern observed with the seizures in Cambridge. The use of Google trends was also applied to the term Mephedrone so examine its search history within the UK, as shown in Figure 9.8.

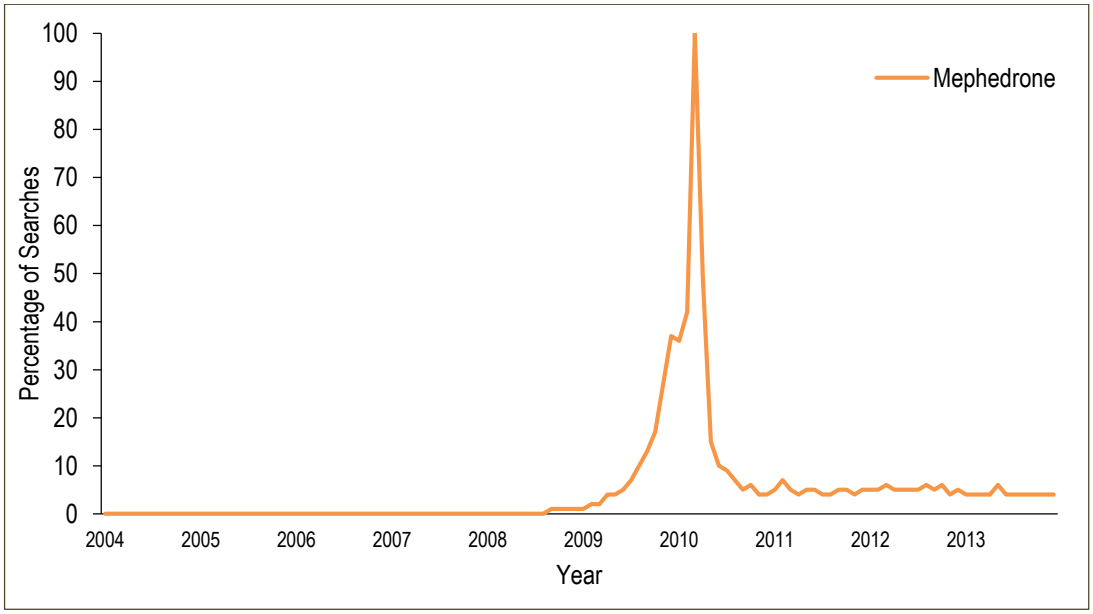


Figure 9.8: Searches recorded for the term 'Mephedrone' by Google Trends in the UK between 2004 and 2013.

As can be seen from the Google trends data there was a surge in the number of people who were searching google for the term Mephedrone. This in itself is perhaps not that radical bearing in mind the media presence of this term and the changes in legislation that were occurring at the same time (Alexandrescu, 2014). Yet the fact that the search history of the UK correlates almost exactly the pattern observed for the seizures of this substance in Cambridge

is significant. The use of this method of data collection and analysis has a number of potential advantages. It could potentially be used to track the prevalence and use of specific substances in a way that seizure and self-report survey data cannot. The data captured in this method is not subject to the many forms of bias encountered in survey methodologies nor is it hindered by changes in reporting practices. One disadvantage would be the variety of names and potential misspellings by the public in their searches, however google has an autocorrect feature that mitigates this issue. The use of Google Trend could also help predict which substances are emerging and track the ever evolving recreational drug market in real time.

The final aspect that was examined was whether there was a difference in the relative purity of Mephedrone in comparison to MDMA in either form. The results from the street samples varied with the mean content of Mephedrone came out as 74%, with a range between 50 and 100%.

The fact that one sample returned a 100% purity, and that the purity of the samples examined was so high may be due to the methods of manufacture. Mephedrone, unlike MDMA, was not originally being manufactured in illicit clandestine factories but by corporations in China, which promised a high purity of product (Davidson, 2015). The samples of Mephedrone tested did not show a significant difference in the level of compound found in the samples compared to the MDMA samples. However the samples tested were from within a time frame close to when the original ban occurred, subsequent testing of later samples would be required to see whether the control had impacted the quality of this product. However in correlating the chemical data with the survey findings, the quality of the actual substance appears not to impact the preference when choosing between MDMA and Mephedrone, rather the actual experience of Mephedrone is reported to not be as positive.

In answering the final research question, this project sought to answer was whether Ecstasy/MDMA had been replaced by the newly emerged Mephedrone. On review of the data collected from the various different sources the answer to this question appears to be no. Though there was a drop in the recorded seizures of MDMA, it appears to have recovered its prevalence post the 2009/10 dip. It was in this time when Mephedrone shot to prevalence as a short term alternative due to its availability. However the long term prevalence and popularity of Mephedrone appeared to have waned in comparison to MDMA.

Chapter 10 Conclusions, Recommendations and Limitations

10.1 Conclusions

To conclude this thesis, the findings will be considered in relation to the four questions outlined at the beginning of this document. The first question that was posed at the start of this research was:

'Has there been a change in what is meant by the terms 'Ecstasy' and MDMA, and how are they being used in relation of the recreational drug in modern UK society?'

This research has shown that there is a definite gap in what the public know and perceive about these two terms, which are supposed to be affiliated with the same compound. What has been found is that these two terms now represent separate products to the public, and that the terms are no longer considered to be synonymous. What is known about Ecstasy has not translated into what is known about MDMA. There has been inconsistent reporting by organisations responsible for the dissemination of information on this subject and this research has discovered that there is a lack of trust in the information sources who produce the information. Through the social research surveys it was revealed that there is also a desire for more drugs information to be provided. The analysis of the questions into the trust and searching for information provides a potential opportunity to discuss how to engage the public and who would be the most effective in reporting accurate information. The overall outcome of this element of the research is that now the term Ecstasy is connotative of the tablet form rather than the chemical composition. Whereas MDMA has a dual meaning; primarily it represents an abbreviation of the chemical while its second meaning represents the new form that has emerged, the crystal and powders. It is important going forward that the new use of these terms is adopted and proliferated to aid in accurate dissemination of information.

The second question that this research sought to answer was:

What are the differences in the types of Ecstasy being seized on the streets of Cambridge, and how does this relate to user preference?

This question was answered by the research surveys, which established that there is a difference in perception around what the two terms Ecstasy and MDMA represent, and that there is a difference in how the two forms are perceived by the users themselves. There was also a unanimous preference described by the users for the new MDMA powder over that of the tabletted Ecstasy, with the perception that one was '*purer'* than the other. The preference for MDMA powder was also shown in the analysis of the seizure records, which found that as of 2011 the most prevalent form of MDMA being seized in Cambridge was either crystal or powder. Once the preference was identified, the perceptions about the quality of the products was tested using analytical chemistry on seized street samples. These results answered the third research question which asked:

Does the user perception around the difference types reflect what is found chemically?

This perception stated by the users in the responses to the second social research survey was supported by the findings from the chemical analysis of the street samples in Cambridge, which found that on average the powders contained a higher percentage of MDMA. However, the analysis of the street sample also found variability in the content and the relative dose forms of the drug. There were however limitations with the sample size and extrapolation to a wider population, which is discussed further in section 10.3.

The final question set out at the beginning of the research was:

What impact has the emergence of Mephedrone had on the popularity and prevalence of Ecstasy and MDMA?

The answer to this question was assessed throughout, in the results of both the social surveys and the seizure data. The results of the chemical analysis however showed no significant difference in the mean content of the street samples analysed as a part of this research. In the social surveys a number of key findings were observed, firstly that the participants felt that they were less aware of Mephedrone and its effects which suggests that this drug was still relatively obscure in 2013. The Second finding showed that those who did have first-hand knowledge/experience of Mephedrone consistently rated more negatively than that of Ecstasy/MDMA, with the word '*dirty'* frequently used by the participants when describing Mephedrone. Lastly, when participants were given the hypothetical choice between the two substances there was a categorical preference for MDMA by both the user and non-user participants.

Although it has been suggested that when Mephedrone was introduced it was being chosen over MDMA as the new party drug (BBC, 2013; McElrath and Van Hout, 2011; Measham, Moore, Newcombe and Welch, 2010; Measham, Wood, Dargan and Moore, 2011) this may not have been the case. On examining the evidence from this research it is plausible to suggest that Mephedrone only became popular as a response to the unavailability of MDMA caused by the UN crack down of safrole production (UNODC, 2008a), and once MDMA remerged into the market users switched back to the product they preferred. The answer to the above question would therefore be, that Mephedrone has had very little effect on the use of MDMA. As Mephedrone has appeared and subsequently disappeared in relation to the disappearance and re-emergence of MDMA.

Nevertheless the recreational drug market is ever evolving, with new products constantly being introduced and though this research has shown a popularity of MDMA in the future this may change. If the quality of powders declines, as was seen with the tablets at the turn of the millennium, there may be a shift to a new '*drug du jour'*.

10.2 Limitations

There are a number of limitations that have affected this survey, which will be considered in relation to each project separately. However there are two main limitations that impacted all three aspects, namely timeframe and geographic location.

All data collection relating to this project is a product of the time in which it was collected, as the recreational drug market is constantly evolving, the analysis is therefore retrospective. It is also limited by the geographic location, specifically the seizure and street samples that are representative only of Cambridge. However the findings from this research have been compared to national and international data when available.

When considering the limitations of the social surveys, many of them were highlighted in the critical analysis of other national surveys. It is incredibly difficult to accurately estimate the prevalence of use of a substance that is illicit and therefore covert in nature. There are methodological issues including representative sampling and participant bias, which impact any survey based studies. And although this research did not obtain a significantly large participant group size, the results collected have provided new insight into this subject.

The limitations of the seizure data relate to the recording practices, the records examined were not consistent in the descriptions of the samples being seized and were limited to identification only once a substance had been controlled. Without a control status there is no necessity to report. There may also be variation based on geographic location, however comparison to other locations was not available to the research at this time. The same limitations applied to the testing of the street samples, which were representative only of what was available in Cambridge at the time of the research. However as stated comparisons to published literature was completed when available.

10.3 Recommendations and Further Work

Throughout the development and analysis of this project a series of recommendations emerged that could impact and influence current understanding and policy making.

Recommendation One

The first recommendation that can be made on the basis of the findings from this research revolves around the clarification and consistent use of the terminology around these substances. A clear definition needs to be established concerning what is considered to be Ecstasy and what is now MDMA, the following are three examples of definitions that could be applied:-

Ecstasy – A tablet or pill that is believed to contain the substance 3, 4-Methylenedioxymethamphetamine but may in fact contain a range of substances.

MDMA – (Colloquial) the term given to crystalline or powdered products believed to contain the compound 3, 4-Methylenedioxymethamphetamine

MDMA – (Chemical) the abbreviation of the term 3, 4-Methylenedioxymethamphetamine

Though these definitions may not be adopted, what is clear from this research is the need for corresponding organisations to all use the same language, and language that is consistent with what the public understand.

Recommendation Two

The second recommendation that can be made from this research concerns the effectiveness of drugs education. In this research the majority of participants reported to have had some form of drugs education, yet there was no difference in the level of accurate knowledge between the educated and non-educated groups. This is further supported by the work of Fletcher, Bonell and Sorhaindo (2010) who found that drugs education in secondary schools, though a requirement under the current curriculum was minimal and varied greatly between institutions. Although this research focused on one aspect of drug use, specifically the changing perceptions around the drug Ecstasy. What it has highlighted is that there is a definite gap in what the public knows about illicit substances, how these substances are now being perceived and that there is also a desire for better education on this subject.

Through this research it became apparent that the traditional sources of information are either untrusted (i.e. the government) or underutilized (i.e. doctors). This can be attributed to the debate and controversy between experts, such as Professor Nutt, which has eroded confidence in governmental sources (Kasperson *et al*. 1988). This if further compounded by the conflicting information that is available on the internet, produced by factions with differing political agendas.

Therefore a recommendation from this research would be to instead of merely educating on what drugs are, to include critical analysis of the information that is available. This could be achieved with greater engagement with the using community as well with support from academia, which would provide a more holistic knowledge base that can communicate effectively the true risks associated with specific substances.

Recommendation Three

The third recommendation relates to re-evaluating the data collected from the social research surveys used to estimate drug use. Currently drug use is estimated from the reports to the CSEW, however this research has shown the inaccurate and conflicting data that is produced by social surveys, by comparing the CSEW, the Global Drug Survey as well as the data collected from this survey. There are a variety of alternative methods, as shown with seizure data and with the use of google trends that can and should be utilized to represent an accurate measure of the illicit market.

Recommendation Four

The final recommendation relates to the recording practices of the UK police forces and the British government. As with the use of terminology there is also the need for accurate and consistent reporting of the type and form of 'Ecstasy' that is being seized. As highlighted in this project the reliance on tablet seizures to estimate the size of this market is under estimating its size. Therefore there needs to be a change in what is recorded with tablets and powders being recorded separately.

Further Work

As this research has covered a number of different disciplines there are a multitude of possible opportunities for further study.

One aspect which could be explored further is an examination of the curriculum set out to provide drugs education. Who is responsible for providing it, where does this information come from and is it consistent across the country? A clear understanding of what is currently being taught and what is available post-secondary education could further aid in the development of a better drugs education system suggested in recommendation two. This would provide support for the debate around changing drug policy. If what people actually know and believe about drugs it is better understood, harm reduction can be targeted to disambiguate misinformation on the topic.

A second aspect which could also be explored could look at the diversity of drug use across the UK. This study was focused on the city of Cambridge, an affluent University town and so has a specific socioeconomic and social structure. The research could be developed to compare the differences in drug use reported in rural, urban and suburban communities. This could also then be compared to what is being seized in these areas to examine changing trends and also further develop the argument for whether the recreational drug market is consumer or product led. This could also be expanded to a continental or global comparison.

A third area of expansion could investigate how new drugs spread across the country. With new substances emerging their popularity and prevalence could be tracked by combination of social surveys and comparison to official seized data. If a new substance is found in Cambridge for the first time it would be interesting to see where else it has been found and when, to track the emergence across the country. This could have two benefits, the first would be the possibility of modelling possible distribution routes, the second could again help with information sharing. If there were a pattern of emergence, information could be disseminated for the purposes of reducing possible harm.

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Appendix I: Research Publications

Investigating the terminology used to describe Ecstasy

Drugs and Alcohol Today, VOL. 14 NO. 4 2014, pp. 235-244 DOI 10.1108/DAT-07-2014-0029

Introduction

In their paper Smith, Moore and Measham (2009) outlined an issue in the undocumented emergence of a new form of Ecstasy known as MDMA powder or crystal. It was noted that this new form could have ramifications not only on under reporting of drug use but also inhibit the work of healthcare professionals working towards harm reduction. The authors comment that the general understanding of the difference between the two terms had yet to be established. Five years on and this is still the case with the relative prevalence and consistency of use of both terms, Ecstasy and MDMA, unknown. A considerable body of literature across a range of disciplines has been written about 'Ecstasy'. However there has been no published articles which addresses the use of the nomenclature, Ecstasy and MDMA, or how these two terms are used. This paper addresses the issue through the use of metadata analysis of a selection of resources; from governmental organizations, academic publications and web-based information sources to establish the use and consistency of both terms.

In popular drug culture there is a unique and specific language which is associated with not only the substances themselves, but also how they are used and the societal context that surrounds them, for example their control status. For each individual compound and class of compounds there is a multitude of names and subsequent terminology or 'slang' with which they are associated. In regards to the terms 'Ecstasy' and MDMA, the term 'Ecstasy' is a colloquial generic brand name whereas the term MDMA is derived from the abbreviation of the chemical compound 3, 4-Methylenedioxymethamphetamine, the psychoactive compound which is found in Ecstasy. The diversity in terminology is not only limited to the language being used to describe the drugs but also to the groups and organisations who make use of this language when discussing drugs and drug use.

One group who actively utilizes the language surrounding drug and drug use is the academic community who study these compounds from a host of different disciplines. These studies range from establishing what effect these chemicals have on the individual to the effect they have on society as a whole. In the context of this paper the academic literature has been evaluated through the preference of the keywords chosen by examining the use of either Ecstasy or MDMA as key words. The second group who make use of the language are the

policy makers, governmental organisations and law enforcement agencies (e.g. the United Nations Office on Drugs and Crime), whose role it is to evaluate the literature produced by the academic community and then implement it into legislation and subsequently enforce it. The use of the two key terms, Ecstasy and MDMA, by these organisations has also been considered. The key organisation in the United Kingdom which oversees the evaluation of the academic output is the Advisory Council on the Misuse of Drugs (ACMD) whose own use of the two terms is evaluated. The dissemination of the academic and policy information is through a third group of sources who propagate the information about the substances. Included in this group are the healthcare professionals, educational programmes, the media and the internet/web-based resources whose purpose it is to provide information to the general public. It is the output of the last two groups which form the foundation of the comparison for this paper. The last and final group who make use of the language are the general public who rely on the information provided by the other three groups. Their use of language has been evaluated through the analysis of google trends, software which tracks the use of search terms.

What has yet to be established is whether there is cohesion in the language used by these different groups when it comes to reporting on and discussing Ecstasy and MDMA. Both terms have been used synonymously in the past. A thorough investigation of the literature will establish for the first time whether there has been a shift in the frequency with which the two terms are being used and if there has what implications this has with regards to the dissemination of accurate information.

Why the names of drugs are important

As with any taxonomy there are different classifications under which each substance may fall. The chemical MDMA is part of the Amphetamine-Type Stimulant (ATS) class of substances. This is due to its chemical structure and reported stimulating effects. MDMA's other noted effects mean that it is also a part of a class of substances known as 'empathogens' (Harris *et al.,* 2002).

Illicit drugs do not generally have just one name. In addition to their chemical name they have a number of colloquial synonyms which differ not only by geographical location and also over time. A number of issues can arise when there is a difference and/or overlap in names being

used. For example different names can be used for the same compound or the same name can be used for different compounds as is the case with the colloquial term 'Speed' which has been used to describe both amphetamine and methamphetamine as can be seen on the website Erowid (https://www.erowid.org).

In the case of the MDMA, it is reported to have gained its infamous moniker, Ecstasy, from an anonymous American dealer in the early 1980s, when it started coming into prevalence in the recreational drug scene;

'Ecstasy was chosen for obvious reasons, because it would sell better than calling it Empathy. Empathy would be more appropriate but how many people know what that means?'
(Pilcher, 2008 pg.24).

Subsequently the term Ecstasy has followed the spread of this substance around the globe until it finally made its way to the British dance scene towards the late 1980s (Karch, 2011). Aided by clear branding stolen from other famous designs the 'Ecstasy' tablet became the third most used drug in Britain (*ibid*).

Towards the end of the nineties and into the first decade of the new millennium the declining purity and quality of tablets found on the Ecstasy market led to an apparent decline in their use (Cole *et al*, 2001 and Smith, Moore & Measham, 2009). This is supported by seizure levels reported; primarily at a national level by the ACMD (2009), at European level as reported by the European Monitoring Council for Drugs and Drug Addiction (EMCDDA) (2004 - 2013), and lastly at a global level as reported by the United Nations Office on Drugs and Crime (UNODC) in their annual World Drug Reports (2004 - 2013). The decline in the use of Ecstasy tablets could have been a reason for the shift or 'rebranding' of the product back to the chemical designation MDMA. The extent of this change will be assessed through the analysis of the use of both terms throughout this paper.

An analysis of the use of language in publications by the UNODC & EMCDDA

An analysis was completed to determine the frequency with which the two terms Ecstasy and MDMA have been used within the annual reports from the EMCDDA and the UNODC. These were chosen because these are the two major organisations that report and assess the impact

of drugs on society at a global and continental level. The UNODC annually compiles data on global drug trends, trafficking, and reported usage which forms the basis of their World Drug Report.

The UNODC's definition of the term Ecstasy states that; *'Ecstasy is a subgroup of drugs which contains MDMA and its analogues'* (UNODC, 2013). This infers that the compound MDMA is not to be considered to be directly synonymous with the term Ecstasy, but rather 'Ecstasy' is used as an all encapsulating term for any of the ring-substituted phenethylamines.

The EMCDDA also produce annual reports on the prevalence and use of drugs available in a multitude of languages as pdf documents found on their website. They have two published definitions of Ecstasy. The first description that they use can be found in the annual reports which states:

> '*Ecstasy refers to synthetic substances that are chemically related to amphetamines…The best-known member of the Ecstasy group of drugs is 3, 4-methylenedioxy-methamphetamine (MDMA), but other analogues are also sometimes found in Ecstasy tablet'*
>
> (EMCDDA, 2013, pg51).

The definitions used by both the UNODC and the EMCDDA employ the term 'Ecstasy' as an umbrella term to cover a range of analogous substances. However there is a slight deviation in what definition is used when it comes to the second definition which can be found on the drug profile pages published on the EMCDDA homepage. As part of the EMCDDA's web based information page they provide profiles of a number of substances which are stated as being *'scientifically sound descriptions of drugs'* (http://www.emcdda.europa.eu/drug-profiles/mdma). Instead of there being a profile dedicated to the drug 'Ecstasy' there is in its place one for MDMA. On the profile page, the description is given as *'a synthetic substance commonly known as Ecstasy, although the latter term has now been generalised to cover a wide range of other substances'* (*ibid*). The page also states that the most prevalent form the drug is found in is white tablets yet also notes other forms of powders and capsules are found but less commonly. Although both definitions given by the EMCDDA refer to Ecstasy as an encapsulating term for a range of substances there is an apparent change in focus from the term Ecstasy to the term MDMA. This change in focus for the drug profile is of key importance

since it suggests that there has been a change in use of these two terms with the use of MDMA being more prominent.

This idea was further explored by analysing the frequency with which the two terms, Ecstasy and MDMA have been used by both organisations over a ten year period within their annual reports shown in Figure 1.

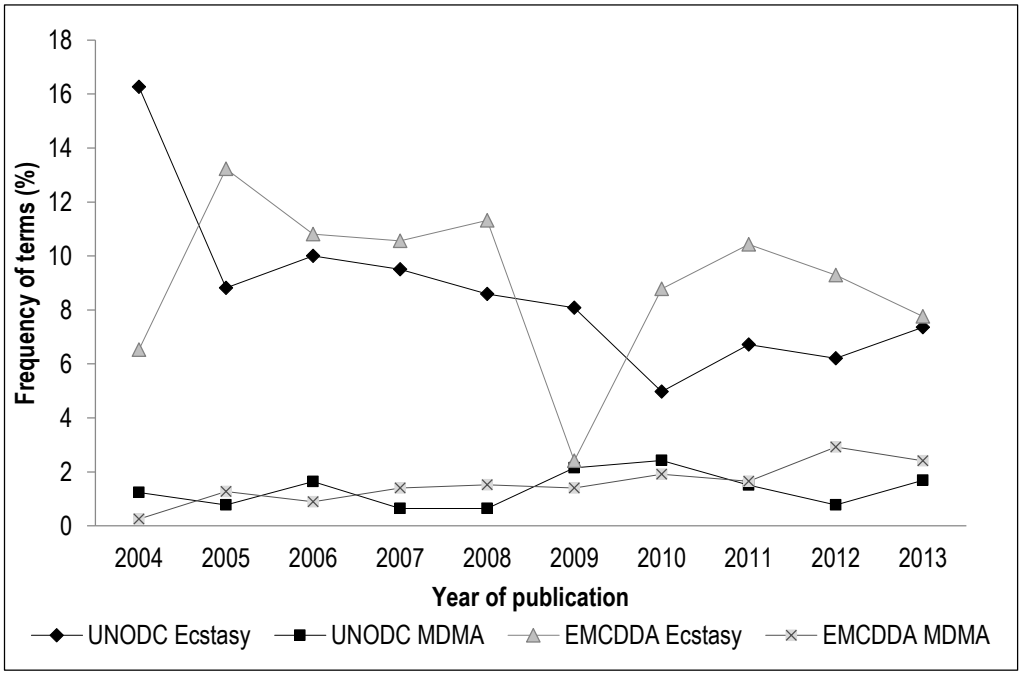

Figure. 1: The frequency of the terms Ecstasy and MDMA used in the annual reports produced by the UNODC World Drug Report and the EMCDDA Annual drug monitoring report.

The data shown in Figure 1 indicates the change over time in the frequency of each term found in the annual reports from both organisations. The frequency was calculated by recording the number of incidences with which both search terms occurred throughout the documents using the Nvivo software. This was then converted to a percentage by dividing the frequency of each term by the total number of times Ecstasy and MDMA appeared within each set of documents, with each set of documents considered as individual data sets. The total number of occurrences is 2189 for the UNODC reports and 868 for the EMCDDA reports.

Up to 2013, there is a clear preference for the term Ecstasy being used by both organisations. This is not unexpected when considering their official descriptions and use of Ecstasy to represent more than merely MDMA in terms of seizures, usage and trafficking.

One point of interest is the marked decline in the use of the term Ecstasy in the 2009 EMCDDA report and then in 2010 UNODC report. This can be correlated to the lack of availability of MDMA found globally at this time. This deficit was due to the increase focus on the control of safrole which is one of the main precursors for the manufacture of MDMA (UNODC, 2008 available at http://www.unodc.org/unodc/en/frontpage/cambodia-tackles-safrole-oil-production.html).

Though Ecstasy is the more prevalent term used by the UNODC the frequency with which it is found per report has declined over the last decade. Meanwhile the use of the term MDMA has remained consistent in the World Drug Report. The focus of the EMCDDA's report has varied depending on the prevalence of the drugs found in Europe year on year. As both sets of reports reflect changes in overall drug trends different drugs have become the focus dependant on their relative prevalence and the political focus. The relevance of this data becomes apparent when it is compared to the use of the terms in academic literature and by the web based information sources.

An Academic Perspective

The study of drugs is of interest to a variety of parties and disciplines and it is important when looking at these substances to differentiate between research on the pure compound and what it is found on the street. A literature search was conducted on two databases of academic journals relating specifically to the study of drugs (Elsevier – https://www.elsevier.com/advanced-search and Sage - http://onlne.sagepub.com/). These databases were chosen as both make use of similar online search parameters for their archives which proved advantageous when compiling comparable data. Other databases were investigated but did not contain the same level of discriminative search parameters for the purpose of comparison, namely not being able to limit the data by location. Through the use of databases and restricted search terms a count was conducted of the number of times Ecstasy, MDMA and both terms together were used in the keywords of journal articles.

The keywords are one of the most important factors when searching for and evaluating academic literature. In choosing a key word the author is focusing what the impact and relevance of the article is about into a limited number of words. In choosing to examine the

use of Ecstasy and MDMA as key words it filters the journals and articles that mention these specific terms without them being the focus of the article in question. Figure 2 illustrates the change over time in the use of the two terms, comparing when they have both been used as keywords and when they have been used separately. Figure 3 shows the difference between when each term has been used individually as a keyword alone.

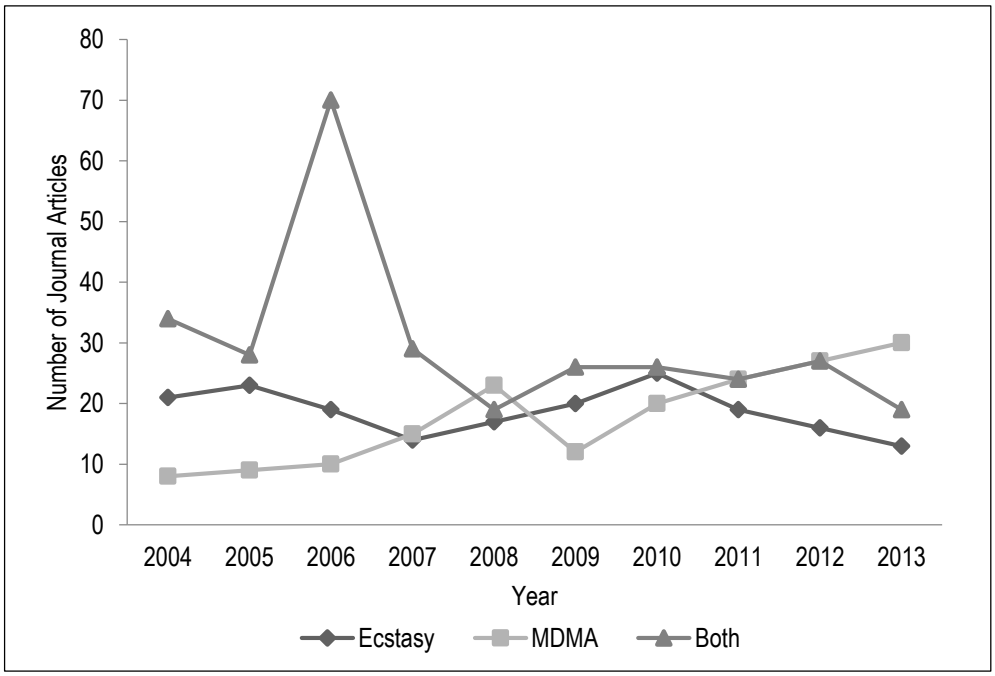

Figure 2:- The frequency of the terms appearing as keywords, together and individually in journal articles from the UK in the academic databases Elsevier & Sage

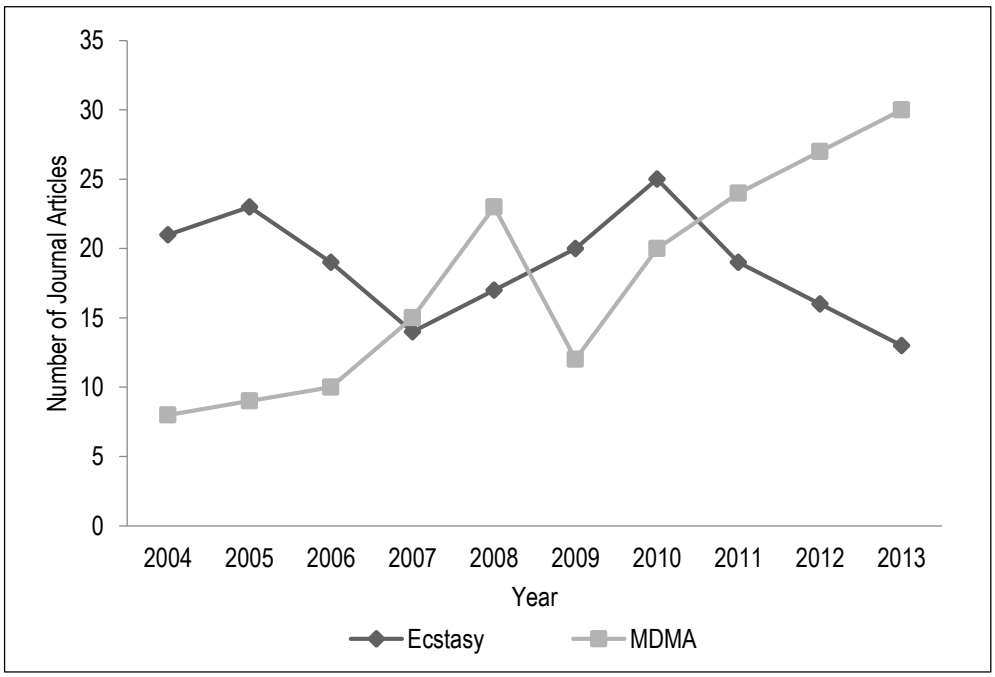

Figure 3:- The frequency with which each word appears individually as a keyword found in journal articles from the UK in the academic databases Elsevier & Sage

Figure 2 shows that there was a marked increase in journals which used both terms as key words in 2006; the impact of this is evident in the policy making of the United Kingdom as demonstrated in the correspondences between the Science and Technology Committee (STC) and ACMD. The response published by the ACMD to the STC report states that;

> '*In view of the high-profile nature of the drug and its apparent widespread usage amongst certain groups, it is surprising and disappointing that the ACMD has never chosen to review the evidence for ecstasy's Class A status…We recommend the ACMD carries out an urgent review of the classification of ecstasy.'*
>
> *(*Rawlins, 2006 pg12)

The recommendation was accepted and the ACMD went on to publish their review in 2009. They acknowledged that MDMA was the most prevalent compound found in Ecstasy. When examining the prevalence of the language used in the review report the authors use the term MDMA 1.5 times more often than that of Ecstasy. This relates to the findings displayed in Figure 3, when the individual use of both terms is considered, as in 2008 the term MDMA is recorded as being used as a keyword more frequently than Ecstasy for the first time.

After the increase in use of the term in 2008, the frequency of the use of the term MDMA falls in 2009. This reflects the findings shown earlier in Figure 1, from the UNODC and the EMCDDA Reports, reflecting the lack of MDMA available globally at this time. However, post 2011 the most prevalent term being used as a keyword in the journals and databases examined is MDMA. There has also been an apparent decline in the number of journals that used both terms as key words as shown in Figure 2.

The findings from this study suggest that that MDMA has replaced the term Ecstasy in the academic vocabulary. This also supports the idea that there may have been a shift in type of Ecstasy being found on the street as suggested by Smith, Moore and Measham (2009). However these findings are contradictory to the conclusions found in Figure 1, which described the usage by both the UNODC and the EMCDDA which maintained the use of the term Ecstasy. The difference between the two can be attributed to the necessity for the global organisations to reflect the use of the term in its broadest sense.

The review of the academic literature could be considered reductionist as it merely reflects the literature from the UK; however this data is further supported by the analysis of the media, online information sources and search terms stored by Google. To further explore whether there has been a definitive shift in the use of the two terms in the UK a third database was assessed. This was explored by examining the response by the British media, with a specific examination of news stories published by the BBCnews archive.

Ecstasy, MDMA and the Media

To examine the impact and change of language in the media the frequency with which each term appears in the news stories reported on the BBC news website (www.bbc.co.uk/search/news) was selected as an example to compare to the other sources. The BBC website was chosen due to the similarity in the search function of its archive to that of the journal databases. With the same search parameters being employed allowing for comparable data the findings are shown in Figure 4.

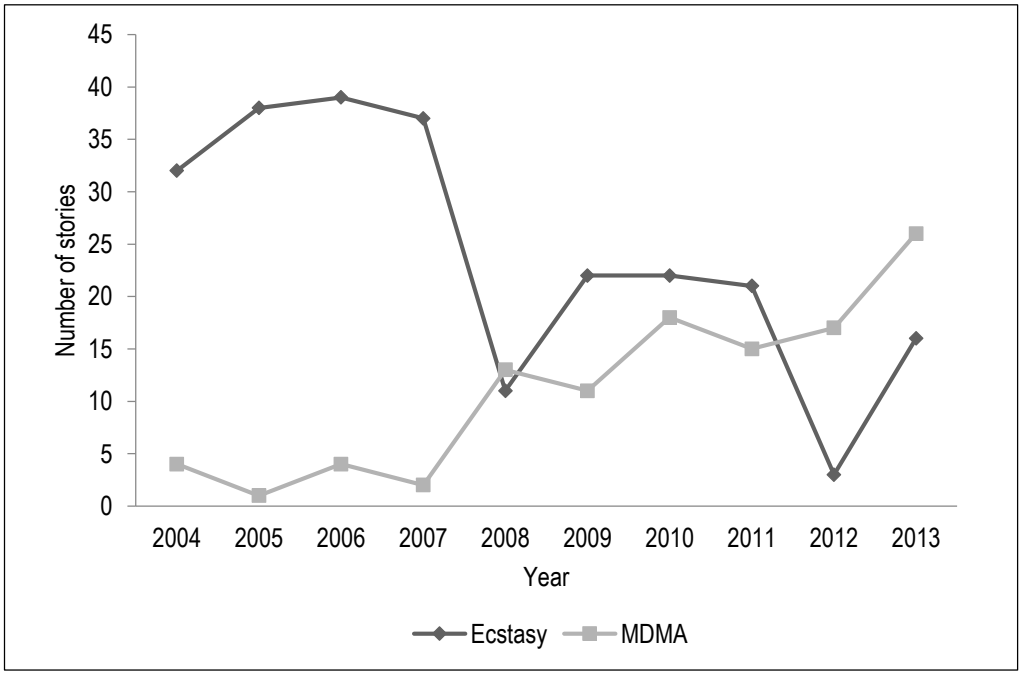

Figure 4: Number of news stories referencing Ecstasy and MDMA as reported by the BBC News Corporation

As with the findings from the academic literature search the data above shows that there has been a definite change in the use of the two terms in the period between 2008 and 2011.

There is the same drop in use of the term Ecstasy in 2008 with further usage mirroring the findings reported above. However the term MDMA has increased year on year, until finally surpassing the term Ecstasy in 2012, to become the more frequently used term in the subsequent year. This data supports the dominance of the term MDMA over Ecstasy, as found with the academic database results. This suggests that within the UK at least, MDMA is the term that is being used. However the differentiation between the two terms requires further defining as technically they both refer to the same compound. To examine how a differentiation could be achieved the way both terms are used by a number of web-based information sources has been considered.

Web based Information sources

The lack of consistency in the description of Ecstasy could be an issue for a number of individuals and organizations, including healthcare professionals, drugs educators and law enforcement organisations. This role becomes difficult when the information provided is inconsistent, not only between the political and academic sources, but also when it is at odds with the vast array of internet and web based sources.

One of the most respected independent online sources of drug information is the website Erowid. Similar to the pages found on the EMCDDA's website, Erowid works with academics, medical experts and user based experiences to provide individual pages devoted to psychoactive substances. Parallels can be drawn between Erowid's page and the EMCDDA's, as both choose to use the term MDMA as the focus, with Erowid providing the following description;

'*MDMA is one of the most popular recreational psychoactive, most commonly sold in the form of "ecstasy" tablets'*

(http://www.erowid.org/chemicals/mdma/mdma.shtml)

Though its vaults provide a vast abundance of information on all things drugs related, Erowid is not considered to be an official drugs educational resource, nor is it specific to the British drug culture, yet a distinction is made by mentioning the form, namely ecstasy being tableted.

This could perhaps be the route to differentiation, whereby Ecstasy refers to tableted form and MDMA crystalline. This can be examined further by looking at other web based resources.

In 2003 the UK government launched the 'Talk to Frank' campaign as a 'standardised educational drugs prevention messages' programme (Smith, Moore & Measham, 2009, pg.16). As with the EMCDDA, the web-based service provides individualised profiles on the most common recreational drugs found in the UK. However, unlike the profile on the EMCDDA's website TalktoFrank has stuck with the term Ecstasy as the chosen term, with the option for MDMA being redirected to the Ecstasy page (http://www.talktofrank.com/drug/ecstasy). As a part of the profile a description of Ecstasy's appearance is given as;

'Pure ecstasy is a powder made of white crystals, known to chemists as MDMA. Ecstasy is usually sold on the street as tablets, although it's getting more common to see it sold as powder and called by its chemical name, MDMA, or 'crystal'.'

*(*http://www.talktofrank.com/drug/ecstasy)

Again the form in which the drug is found dictates the name which it is given, Ecstasy to tablets, MDMA to crystal or powdered. Yet the description may cause concern as it suggests that the newer powdered form is 'pure' without the relative purity having been established. If the communication from 'standardised educational message' is that MDMA powder is pure this could mislead users and inhibit harm reduction initiatives. This message is reiterated by the drugs educational charity DrugScope, whose own web based information portal states that;

'Ecstasy is an illegally manufactured drug that usually comes in tablet or capsule form. The chemical name of pure ecstasy is 3, 4 Methylenedioxymethamphetamine or MDMA for short'

(http://www.drugscope.org.uk/resources/drugsearch/drugsearchpages/ecstasy.)

Both of these resources provide an explanation that is misleading. With the emergence of these two terms, the perception being promoted is that the term MDMA means "pure". From the purely chemical sense this is true as it is the abbreviation of the longer chemical name. However the term MDMA has been used to effectively rebrand the new powdered and crystal

form of this recreational drug. A distinction needs to be made between what is understood as the pure chemical and this new product on the street.

A final information source that provides evidence in the shift in the use of these two terms is the search engine Google. In 2006, the internet giant launched a series of applications, one of which was its 'Trends' application (http://www.google.com/trends/), a system which records the frequency with which users search for terms which can then be limited by location and time. To further support the changing of use of these two terms is the data collected from this application displayed in Figure 5.

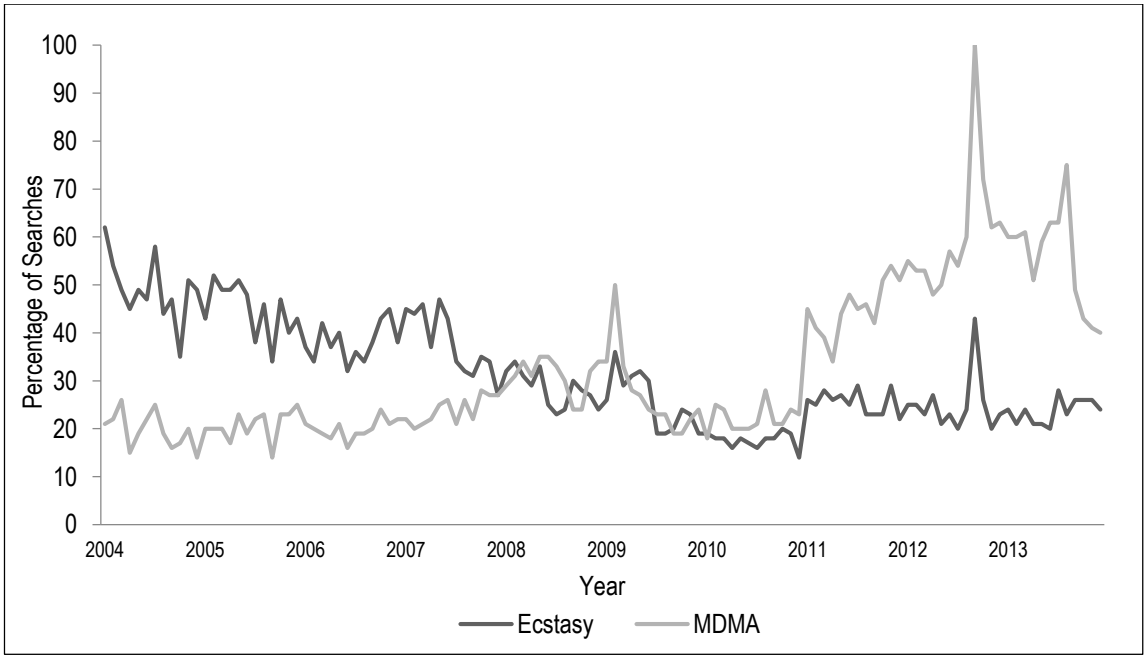

Figure 5: Frequency of searches for both search terms entered into Google Inc.

The data shows the search trends within the UK and reflects a similar pattern to the ones shown in both Figures 3 and 4. Similar to the findings from both the academic and media searches, it is seen that the term Ecstasy is the most prevalent term being used until 2010 when MDMA began to overtake and become to more dominant term. This supports the notion that not only have the academic community moved away from the use of Ecstasy to describe this recreational drug but so have the general public within the UK.

This data shown in figure 5 could also reflect the change in use and prevalence of the different form of MDMA powder becoming available. This can be explored by looking at the results of

the ‘Global Drug Survey’ run in collaboration with the magazine Mixmag (Mixmag 2010 – 2012). The survey asks its participants which drugs they have tried. Over the last 5 years, the language they have used to describe the substance MDMA has shifted, in 2010 participants were asked if they had tried Ecstasy or MDMA powder, with both answers being displayed as separate. In 2011 the option Ecstasy (pills or powders) was deployed. However since 2012 the Global Drug Survey has just used the term MDMA, omitting the use of the term Ecstasy (Globaldrugsurvey.com, Mixmag 2010, 2011, 2012). This change reflects the findings from the other sectors examined; that the change in language reflects a change in the type of drug being found and used, moving away from tablets towards the powders.

Conclusion

This paper has examined the different sources and groups concerned with the dissemination of information concerning illicit drugs. What has been shown is a distinct change in the prevalence of use of the term ‘MDMA’. It now being used to describe what was once known as ‘Ecstasy’ in the UK. However this shift in use has not been universal or consistent, as has been shown with the analysis of both the UNODC and the EMCDDA who both still exhibit a preference for the term ‘Ecstasy’,

The persistence in the use of ‘Ecstasy’ as the main term used in the annual reports produced by both organizations can be explained due to its encapsulating nature; in this regard it is not a direct synonym for MDMA but rather a descriptive for a group/class of substances – the ring-substituted phenethylamines. The use may also be explained in the persistent association with the form in which these substances are found, namely as tablets. Both sets of annual reports state that the most prevalent form is that of the ‘Ecstasy’ pill; however this is not necessarily now the case in the UK.

Recent years have seen the emergence of a new form of powdered and crystalline drug which is sold as ‘MDMA’ (Smith, Moore & Measham 2009). There is very little information available to date on the current prevalence of powdered MDMA compared to the tablets, or the relative purity of this new product. Yet the data suggests that the emergence of this new form may be a reason for the change in the use of these two terms. Whilst the term Ecstasy signifies the tablet form, MDMA has come to signify the powdered or crystalline. This change in the

language may not only reflect the different types now being found but the prevalence of use of each type.

Another factor that may have impacted not only the shift in terminology but changed the method of substance delivery is the reputation that Ecstasy pills have subsequently gained. Long since the 'heyday' of the eighties and nineties the declining purity of ecstasy tablets is well documented (Cole et al, 2001, Parrott, 2004, Smith, Moore & Measham, 2009,). The decline in purity led to a decline in the popularity and trust in Ecstasy tablets. This precipitated a change in the way that Ecstasy was being sold. Ecstasy is now an imprecise term where once it related to the branding of MDMA pills. It is now associated with a cheap and poor quality product (Smith, Moore & Measham, 2009) whilst a new product, MDMA powder, has emerged in its place with a reputation for purity.

So why is clarification of the terms necessary? There are a number of stakeholders to whom accurate consistent information is vital. There is much discussion around the need for harm reduction and evidence-led policy when it comes to the discussion around what to do about drug use. The most important issue is to make sure that every party is using the same terminology when describing the same problem, for example if the UNODC claim Ecstasy use is on the decline, a statement based on tablet seizures and yet the Global Drug Survey and other organizations state that MDMA use is on the increase, what are policy makers, law enforcement and the health professionals to use? Admittedly the social reaction in the UK is different to that of the rest of the global population, as the UK is reportedly the largest market for the new psychoactive substances (NPS) in Europe (UNODC, 2013). However it is important to understand the different terms people use when selling products and using them to be able to provide the right information.

There is a need for a consistent use of language and a universal description of illicit substances is important when identifying issues within the recreational drug market at local, regional, national and, indeed, international levels. Is Ecstasy use on the decline or has there just been a shift to using MDMA powders? From a health perspective, when someone claims to have taken Ecstasy, are they talking about a pill or a powder? Is there a reason differentiate between the two? The answer has to be an emphatic "yes", especially from a harm reduction perspective as there is very little information regarding the relative purity of the new powdered MDMA, what it actually contains, and at what concentrations?

There has been a change in the use of language to describe Ecstasy. This change may reflect more than just what people are saying and may actually provide an insight into the change in the type and form of MDMA being used. It may also provide important information for healthcare professionals, educators and law enforcement professionals.

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Appendix II: Conference Publications

FORREST CONFERENCE 25-26 June 2013

Abstract Submission Form

If you wish to submit an abstract for this meeting, please email this form to forrest2013@anglia.ac.uk no later than Friday 26th April 2013.

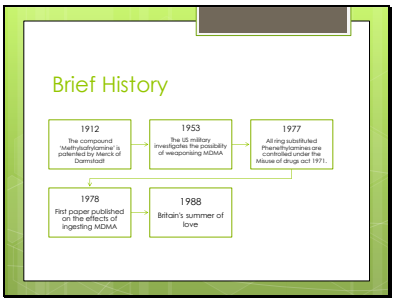
Please indicate on the form whether you wish to present a 15-minute talk or a poster. Advice for preparing talks and posters can be found on our website www.anglia.ac.uk/FORREST2013

Poster or talk? **Talk**
Title: **Ecstasy:- An Evolution of a Party Drug**
Authors: **Alexandra Turner**
Academic address: **Mel 210, Melish-Clark Building, Anglia Ruskin University, Cambridge Campus, CB1 1PT** **Email address: Alexandra.Turner@anglia.ac.uk**
Abstract (Max 250 words): This talk will examine the journey taken by one of the most interesting illicit drugs, the evolution of Ecstasy. From humble beginnings as an intermediate chemical in the development of a lifesaving medicine, 3, 4-methylenedioxymethamphetamine's (MDMA) true potential as a psychoactive substance would not be discovered until 75 years after its discovery. It was not until pioneering chemist Dr Alexander Shulgin published his first paper in 1978 on the effects of this substance that its properties were known. From Shulgin this compound found its way into the developing psychedelic therapeutic movement of the late 70's, early 80's, whereby it was reportedly successful in the treatment of a number of psychotic disorders. Alongside the lofty ideals of the psychologists behind the psychedelic therapy, MDMA had found its way into the general population. MDMA quickly became a part of the American recreational drug scene, where it received its trademark name, 'Ecstasy' from an anonymous dealer. Ecstasy use spread outward from the United States; following the growing dance movement it eventually found its way onto British Shores. DJ's coming from the party island of Ibiza brought back a new sound and a new product. However once a product had become established unscrupulous producers became greedy, and the quality of the product available began to decline, allowing for the introduction of new synthetic chemicals to replace Ecstasy as the drug du jour of the party scene. Nevertheless the later part of the 00's has seen resurgence in the appearance of the chemical MDMA in a new form.

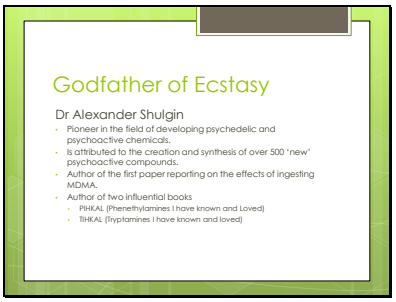
Presentation Slides for FORREST 2013

Slide 1

Slide 2



Slide 3



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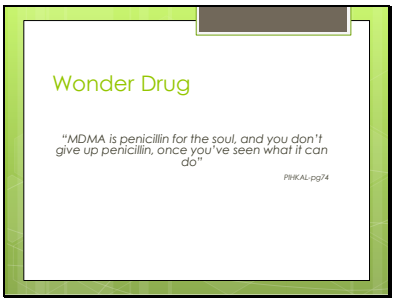
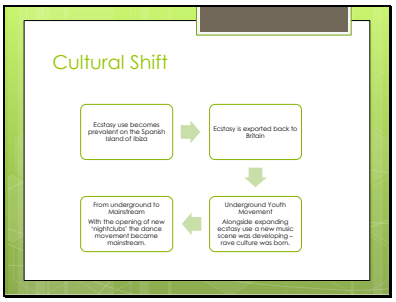


Slide 5



Slide6

Loss of Faith

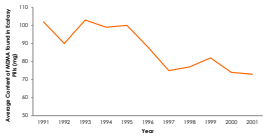


Fig.1The mean MDMA content of ecstasy tablets analysed by the Forensic Science Service in the United Kingdom between 1991 and 2001 (data taken from Cole, J et al, 2002. The content of ecstasy tablets: implications for the study of their long-term effects. Addiction, 97, pp1331-1336)

Slide 7

Tragedy

On November 16th 1995 British School girl Leah Betts died. It was 5 days after her 18th birthday where she consumed 1 ecstasy tablet and copious amounts of water which landed her into a coma. It was later believed that the tablet was contaminated.

Deaths by ecstasy are widely publicised however between 1993 and 2011 there were 3.5 times as many deaths attributed to taking Cocaine compared to ecstasy.

Slide 8

Along came the Pretenders

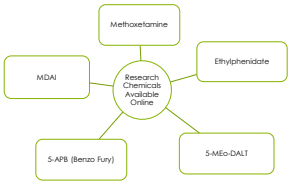
Slide 9

'Legal' Highs

Piperazines	Substituted Cathinones	Synthetic Cannabinoids
Chemicals: BZP, TFMPP, mCPP	Chemicals: 4MMC, 4MEC, Bk-PMMA	Chemicals: JWH-018, JWH-073
Street Names: Smileys, Legal E, Legal X, Silver bullet.	Street Names: Methedrone, Mephedrone, M-Cat	Street Names: Spice, Black Mamba
Effects: Stimulant	Effects: Stimulant	Effects: Cannabinoid receptor antagonist
Legal Status: Class C (as of 2009)	Legal Status: Class B (as of 2010)	Legal Status: Class B (As of 2009)

Slide 10

Research Chemicals



Slide 11

The Dangers of Legal 'E'

- Deaths Associated with Contaminated pills- PMMA!
- Untested
- Inconsistent
- With constant regulation and control new substances are being created to circumvent legislation.

Slide 12

Introducing a New Product

MDMA Powder/ Crystal

Global Drug Survey 2013

- 60.8 admitted taking MDMA Crystal
- 40.2 took in tableted form

Slide 13

Brand awareness

How many people associate the street names with the relevant chemicals?

Ecstasy – MDMA Mephedrone -4MMC

Speed – Amphetamine

Benzo Fury – 5-APB Ice - Methamphetamine

Slide 14

Drug consumerism; What's popular vs. what's available?

'Cocaine and Ecstasy are out and Mephedrone and Ketamine are in'

(Crazy for Party drugs, BBC 2013)

Do people take what's available or is there 'brand' loyalty?

Have the new chemicals truly supplanted Ecstasy as the party drug?

Slide 15

What does the Future hold?

Current e-petition to reassess the impact of the Misuse of Drugs Act 1971

Could lead to decriminalisation or possibly even legalisation of certain substances based on scientific evidence.

Slide 16

Thank you for listening

Slide 17

Appendix III: Participant Information Sheet for Social Surveys

Opening Statement

The purpose of this piece of research is to investigate the awareness the general public has regarding drugs, drug names and the information sources available. It is necessary for the purposes of this research that you are either a national or a resident of Great Britain as we are only looking at British legislation and society.

We also ask that you be at least 18 years old to participate in this research.

About the research

This research is a project of two parts, firstly to investigate the current state of the public knowledge and awareness of drugs; it will be looking at information sources and the perceptions around the accuracy of the information available. The second part is an analysis of which drugs people admit to taking and examining whether there is a preference for specific drugs. This is then to be related to seizure data collected from collaborating police stations to see whether there is a correlation between what people like and levels found on the street. This research will give an insight into links between user preference and street drug seizure trends.

Consent

By ticking the box at the beginning of the survey and filling out and submitting your responses you are authorising the author of the survey to use the information you provide for the purposes of this research. At no point will any personal information be required past a general location, age and gender. The researcher will not contact you directly about your responses and no information will be stored that will enable the researcher or third parties to identify participants. Due to the nature of the data collection you will be unable to withdraw your responses once you have clicked on the final submission button at the end of the survey. However if you close the webpage at any point before submitting your responses they will not be stored.

If you wish to contact the researcher please e-mail:

AngliaRuskinDrugSurvey@Gmail.com

There will be a link at the end of this survey, once you have completed it that will take you to the adjoining survey on drug use and preference. You do not have to fill the second survey if you filled the first survey.

Concluding Statement

Thank you for completing the survey your responses have now been recorded.

Due to the nature of the data collection you will be unable to withdraw your responses at this point, however all responses are recorded anonymously.

Appendix IVa: Additional Material for Chapter 4.1

Table 4.1.i: Responses to Question 1 (n = 440)

Drug	Frequency	Percent response
Amphetamine	405	94.1%
Cannabis	434	98.6%
Cocaine	427	98.4%
Crack	435	97.1%
Ecstasy	433	98.6%
Heroin	414	98.7%
Ketamine	431	92.1%
LSD	434	98.0%
MDMA	344	78.2%
Mephedrone	318	72.3%
Piperazines	96	21.8%
2CB	62	14.1%

Table 4.1.ii: Responses for Question 1 separated by the variable Gender, including significance tests.

Substance	Male Responses (n=163)		Female Response (n=277)		χ^2	P value	Significant
	Heard	Not	Heard	Not			
Amphetamine	160	3	254	23	7.709*	0.005	Yes
Cannabis	162	1	272	5	1.083*	0.420	No
Cocaine	162	1	271	6	1.580*	0.267	No
Crack	160	3	267	10	1.121*	0.290	No
Ecstasy	163	0	271	6	3.579*	0.089	No
Heroin	161	2	274	3	0.019*	1.000	No
Ketamine	154	9	251	26	2.093	0.148	No
LSD	161	2	270	7	0.866*	0.495	No
MDMA	138	25	206	71	6.375	0.012	Yes
Mephedrone	125	38	193	84	2.518	0.113	No
Piperazine	40	123	22	155	23.352	<0.001	Yes
2CB	58	105	38	239	28.758	<0.001	Yes

[* indicates the application of the Fishers Exact test; used when expected frequencies are <5]

Table 4.1.iii: Significance test for the variable Age on the responses to Question 1

Substance	χ^2	P value	Significant
Amphetamine	6.528	0.182	No
Cannabis	1.660	0.918	No
Cocaine	0.998	1.000	No
Crack	7.368	0.102	No
Ecstasy	2.564	0.707	No
Heroin	2.443	0.734	No
Ketamine	9.347	0.061	No
LSD	1.349	0.927	No
MDMA	20.380	0.001	Yes
Mephedrone	8.671	0.123	No
Piperazine	6.911	0.220	No
2CB	1.121	0.952	No

Table 4.1.iv: Responses to Question 2 shown as frequency and percentage against total population (*n = 440*)

Drug		Class A	Class B	Class C	Don't Know
Amphetamine	Frequency	176	157	27	80
	(%)	*40.0*	*35.7*	*6.1*	*18.2*
Cannabis	Frequency	33	253	135	19
	(%)	*7.5*	*57.5*	*30.7*	*4.3*
Cocaine	Frequency	388	31	5	16
	(%)	*88.2*	*7.0*	*1.1*	*3.6*
Crack	Frequency	379	29	7	25
	(%)	*86.1*	*6.6*	*1.6*	*5.7*
Ecstasy	Frequency	301	86	24	29
	(%)	*68.4*	*19.5*	*5.5*	*6.6*
Heroin	Frequency	414	9	2	15
	(%)	*94.1*	*2.0*	*0.5*	*3.4*
Ketamine	Frequency	128	144	94	74
	(%)	*29.1*	*32.7*	*21.4*	*16.8*
LSD	Frequency	272	112	23	33
	(%)	*61.8*	*25.5*	*5.2*	*7.5*
MDMA	Frequency	209	89	25	117
	(%)	*47.5*	*20.2*	*5.7*	*26.6*
Mephedrone	Frequency	80	117	68	175
	(%)	*18.2*	*26.6*	*15.5*	*39.8*
Piperazine	Frequency	14	47	38	341
	(%)	*3.2*	*10.7*	*8.6*	*77.5*
2CB	Frequency	52	43	25	320
	(%)	*11.8*	*9.8*	*5.7*	*72.7*

Table 4.1.v: Chi-Squared Test statistics of independence between responses for each of the substance in Question 2

Drug	χ^2	P Value	Significant
Amphetamine	130.491	<0.001	Yes
Cannabis	320.764	<0.001	Yes
Cocaine	939.873	<0.001	Yes
Crack	879.600	<0.001	Yes
Ecstasy	463.764	<0.001	Yes
Heroin	1120.964	<0.001	Yes
Ketamine	27.564	<0.001	Yes
LSD	361.327	<0.001	Yes
MDMA	159.236	<0.001	Yes
Mephedrone	63.073	<0.001	Yes
Piperazines	652.091	<0.001	Yes
2CB	537.982	<0.001	Yes

Table 4.1.vi: Chi-Squared Test statistics of independence between correct and incorrect responses to question 2.

Drug	Correct Responses	Incorrect Responses	χ^2	P Value	Significant
Amphetamine	157	283	35.52	<0.001	Yes
Cannabis	253	187	9.60	0.0019	Yes
Cocaine	388	52	255.06	<0.001	Yes
Crack	379	61	228.38	<0.001	Yes
Ecstasy	301	139	58.92	<0.001	Yes
Heroin	414	26	340.38	<0.001	Yes
Ketamine	94	346	143.18	<0.001	Yes
LSD	272	168	24.12	<0.001	Yes
MDMA	209	231	1.10	0.317	No
Mephedrone	117	323	95.52	<0.001	Yes
Piperazines	38	402	299.48	<0.001	Yes
2CB	52	388	255.06	<0.001	Yes

Table 4.1.vii: Chi-Squared Test statistics of the variables of age and gender applied to Question 2

Substance	Variable	Chi Squared	P value	Exact	Significant
Amphetamine	1) Gender 2) Age	9.106 31.245	0.028 0.011	χ^2 MC	Yes Yes
Cannabis	1) Gender 2) Age	22.602 24.646	<0.001 0.048	χ^2 MC	Yes Yes
Cocaine	1) Gender 2) Age	6.732 14.389	0.075 0.339	MC MC	No No
Crack	1) Gender 2) Age	5.533 17.579	0.150 0.186	MC MC	No No
Ecstasy	1) Gender 2) Age	0.345 54.825	0.951 <0.001	χ^2 MC	No Yes
Heroin	1) Gender 2) Age	2.237 18.297	0.548 0.145	MC MC	No No
Ketamine	1) Gender 2) Age	4.085 28.010	0.252 0.023	χ^2 MC	No Yes
LSD	1) Gender 2) Age	4.494 30.566	0.213 0.007	χ^2 MC	No Yes
MDMA	1) Gender 2) Age	18.548 50.232	<0.001 <0.001	χ^2 MC	Yes Yes
Mephedrone	1) Gender 2) Age	10.169 23.794	0.017 0.070	χ^2 MC	Yes No
Piperazine	1) Gender 2) Age	10.612 17.334	0.014 0.223	χ^2 MC	Yes No
2CB	1) Gender 2) Age	15.997 10.553	0.001 0.764	χ^2 MC	Yes No

Table 4.1.viii: Gender responses that correctly identified the classifications of Ecstasy and MDMA

Gender	Both Correct	Both Not correct	χ^2	P value
Male	87	163	13.1	<0.001
Female	99	178		

Table 4.1.ix: Age Responses that correctly identified the classifications of Ecstasy and MDMA

Age	Both Correct	Both Not correct	χ^2	P value
18-21	71	106	18.7	0.002
22-29	61	67		
30-39	30	27		
40-49	17	22		
50-59	2	17		
60+	5	20		

Table 4.1.x: Two-way chi squared analysis of the alternate names for select substance by gender

Substance	Name	χ^2	P value	Significant
Cannabis	Dope	0.359	0.549	No
	Grass	1.430	0.232	No
	Green	5.290	0.021	Yes
	Hash	0.035	0.852	No
	Pot	1.177	0.278	No
	Skunk	2.934	0.087	No
	Weed	0.209	0.647	No
Ketamine	Dust	1.946	0.166	No
	Green	1.777	0.299	No
	K	4.327	0.038	Yes
	Special K	4.600	0.032	Yes
Ecstasy	Adam	1.057	0.304	No
	Crystal	<0.001	0.999	No
	E	0.561	0.454	No
	Mandy	6.008	0.014	Yes
	MDMA	3.862	0.049	Yes
	XTC	8.657	0.003	Yes
Mephedrone	4MMC	7.887	0.005	Yes
	Bubble	2.062	0.151	No
	Meow-Meow	2.617	0.106	No
	White Magic	0.359	0.549	No

Table 4.1.xi: Chi Squared test of significance for the variable of Age applied to the results of Question 3

Substance	Name	χ^2	P value	Test	Significant
Cannabis	Dope	4.062	0.545	MC	No
	Grass	10.187	0.064	MC	No
	Green	55.653	<0.001	χ^2	Yes
	Hash	2.478	0.782	MC	No
	Pot	0.834	0.968	MC	No
	Skunk	11.389	0.027	MC	Yes
	Weed	5.866	0.198	MC	No
Ketamine	Dust	1.778	0.843	MC	No
	Green	2.110	1.000	MC	No
	K	5.471	0.334	MC	No
	Special K	6.714	0.243	χ^2	No
Ecstasy	Adam	4.310	0.445	MC	No
	Crystal	6.769	0.186	MC	No
	E	7.032	0.155	MC	No
	Mandy	14.607	0.007	MC	Yes
	MDMA	11.677	0.039	χ^2	Yes
	XTC	7.039	0.218	χ^2	No
Mephedrone	4MMC	1.889	0.886	MC	No
	Bubble	2.701	0.725	MC	No
	Meow-Meow	17.297	0.004	χ^2	Yes
	White Magic	9.678	0.055	MC	Yes

Table 4.1.xii: The results of the two way chi square test on the cross tabulation of question 1 against whether participants had drugs education

Substance	Test	χ^2	P Value	Significant
Amphetamine	X^2	0.217	0.641	No
Cannabis	FE	0.352	0.626	No
Cocaine	FE	0.316	0.696	No
Crack	FE	3.970	0.086	No
Ecstasy	FE	0.352	0.626	No
Heroin	FE	0.803	0.594	No
Ketamine	FE	1.452	0.228	No
LSD	FE	5.407	0.035	Yes
MDMA	X^2	4.489	0.034	Yes
Mephedrone	X^2	6.015	0.014	Yes
Piperazine	X^2	7.847	0.005	Yes
2CB	X^2	7.106	0.008	Yes

Table 4.1.xiii: The results of the two way chi square test on the cross tabulation of question 2 against whether participants had drugs education

Substance	χ^2	P Value	Significant
Amphetamine	1.75	0.186	No
Cannabis	0.29	0.590	No
Cocaine	0.46	0.498	No
Crack	0.49	0.484	No
Ecstasy	0.57	0.450	No
Heroin	0.89	0.345	No
Ketamine	0.00	1.000	No
LSD	0.05	0.823	No
MDMA	1.52	0.217	No
Mephedrone	2.26	0.133	No
Piperazine	0.53	0.467	No
2CB	1.91	0.167	No

Table 4.1.xiv: The results of the two way chi square test on the cross tabulation of question 4 against whether participants had drugs education

Question 4	Test	χ^2	P Value	Significant
a) Prevalence of Drugs	MC	21.287	<0.001	Yes
b) Health Risks	MC	7.468	0.118	No
c) Cannabis	MC	5.107	0.270	No
d) Ketamine	χ^2	2.906	0.574	No
e) Ecstasy	MC	8.064	0.089	No
f) MDMA	χ^2	7.014	0.135	No
g) Mephedrone	χ^2	7.805	0.099	No

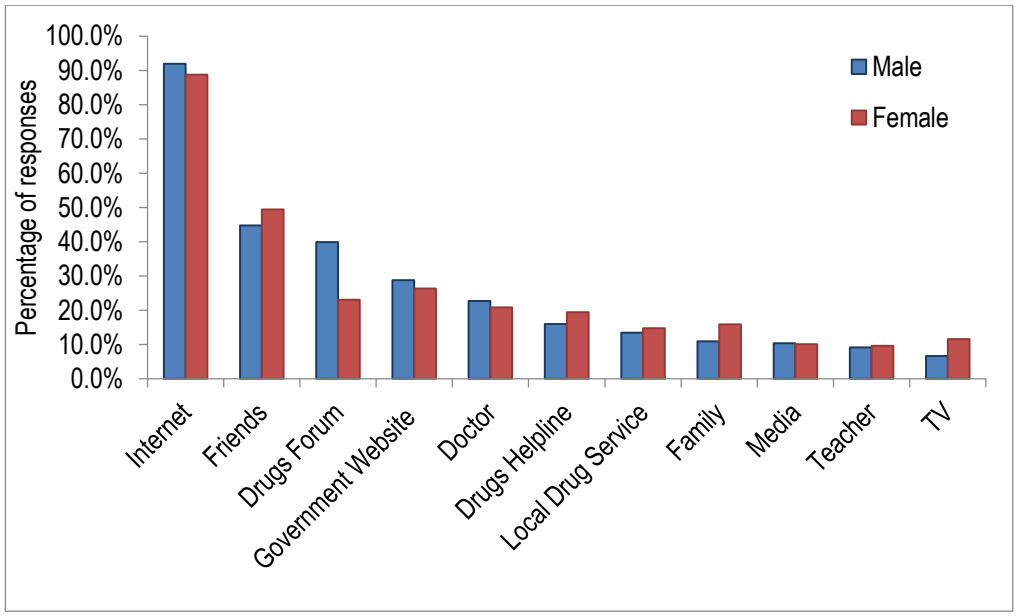


Figure 4.1.i: Results for Question 6a separated by the variable of gender (female n= 277, male n=163)

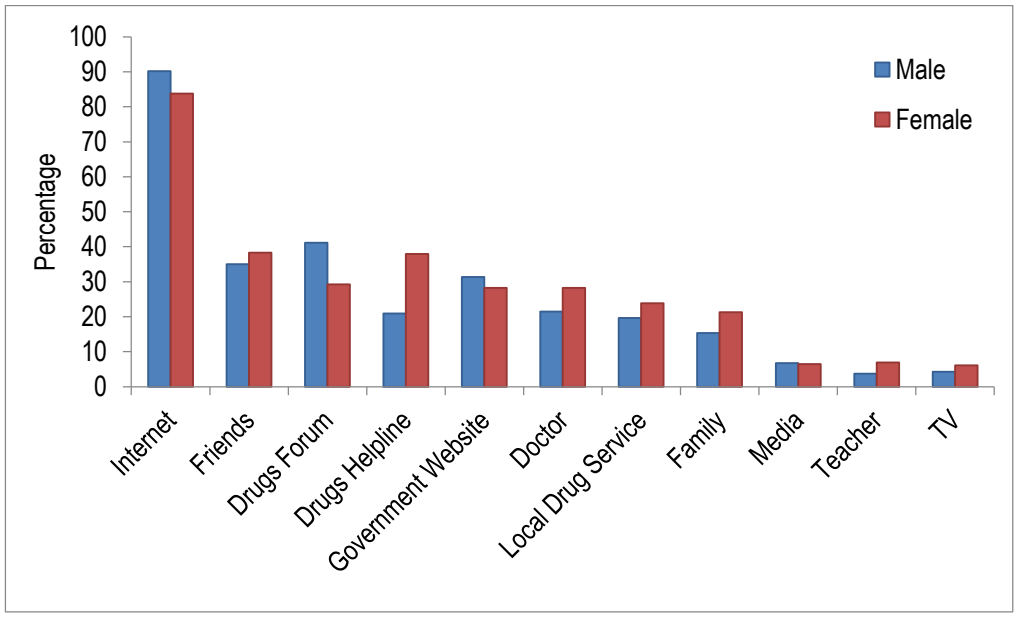


Figure 4.1.ii: Question 6b responses separated by the variable of gender (female *n*= 277, male *n*=163)

Table 4.1.xv. Top three choices to questions 6a (themselves) and 6b (someone else) by age group

	6a) Themselves			6b) Someone else		
	1st	2nd	3rd	1st	2nd	3rd
Overall	Internet	Friends	Drugs Forum	Internet	Friends	Drugs Forum
18-21	Internet	Friends	Drugs Forum	Internet	Friends	Drugs Forum
22-29	Internet	Friends	Government Website	Internet	Friends	Drugs Forum
30-39	Internet	Friends	Drugs Forum	Internet	Government Website	Drugs Forum and Drugs Helpline
40-49	Internet	Friends	Government Website	Internet	Drugs Helpline	Friends and Government Website
50-59	Internet	Drugs Helpline	Government Website and GP/Doctor	Internet	Drugs Helpline	Government website
60+	Internet	GP/Doctor	Government Website and Hotline	Internet	Friends and Drugs Helpline	Government Website and Local Drug Service

Table 4.1.xvi: Mean values for each of the options in Question 7 by the variable of Age

Question	Mean Values For Age groups					
	18-21	22-29	30-39	40-49	50-59	60-69
7a: The Government	2.84	2.89	2.82	2.72	3.37	2.6
7b: Scientist	3.54	2.81	3.67	3.74	3.74	3.85
7c: Media	1.91	2.01	1.98	1.77	1.89	1.85
7d: User	2.99	3.02	2.91	2.92	2.11	2.00
7e: Doctor	3.97	3.7	3.72	3.56	3.95	3.3
7f: Internet	3.12	3.26	3.14	3.05	3.26	3.15

Table 4.1.xvii: Results for Questions 7a to 7f for the Chi Squared test when applied using the variable of age

Question	χ^2 Value	P Value	Significant
7a: The Government	18.043	0.557	No
7b: Scientist	21.908	0.282	No
7c: Media	9.188	0.850	No
7d: User	32.559	0.020	Yes
7e: Doctor	34.333	0.007	Yes
7f: Internet	17.211	0.584	No

Table 4.1.xviii: The frequency of occurrence for the

Word	Frequency of occurrences
People	205
Know	163
Effects	140
Aware	130
Taking	89
Informed	84
Important	81
Risks	64
Healthy	56
Help	38
Consequences	36
Knowledge	35
Decision	31
Awareness	29
Information	28
Danger	25
Decisions	24
Harm	20
Dangerous	19
Choices	17

Table 4.1.xix: Response to Question 10 by theme compared to whether participants reported to have had drugs education

Themes	Q5: Education		χ^2	P value	Significant
	Yes (*n* = 338)	No (*n* =102)			
Informed Choice	118	32	0.04	0.842	No
	35%	31%			
Dangers	93	22	0.26	0.61	No
	28%	22%			
Deterrent	34	13	1.48	0.224	No
	10%	13%			
Help	24	8	0.36	0.548	No
	7%	8%			
Prevalence	21	9	1.64	0.2	No
	6%	9%			

Appendix IVb: Additional Material for Chapter 4.2

Table 4.2.i: Reported use for selected substances to the question of Ever taken by the different genders with the user group

Substance	χ^2	P Value	Significant
Cocaine	2.58	0.136	No
Ecstasy	0.76	0.446	No
MDMA	0.08	0.887	No
Ketamine	0.05	0.887	No
Mephedrone	2.19	0.189	No

Table 4.2.ii: Reported use for selected substances to the question of Ever taken by the different genders with the user group compared to non-user group

Substance	χ^2	P Value	Significant
Cocaine	0.243	0.622	No
Ecstasy	2.422	0.120	No
MDMA	4.775	0.029	Yes
Ketamine	4.992	0.025	Yes
Mephedrone	10.263	0.001	Yes
Piperazines	4.651	0.031	Yes

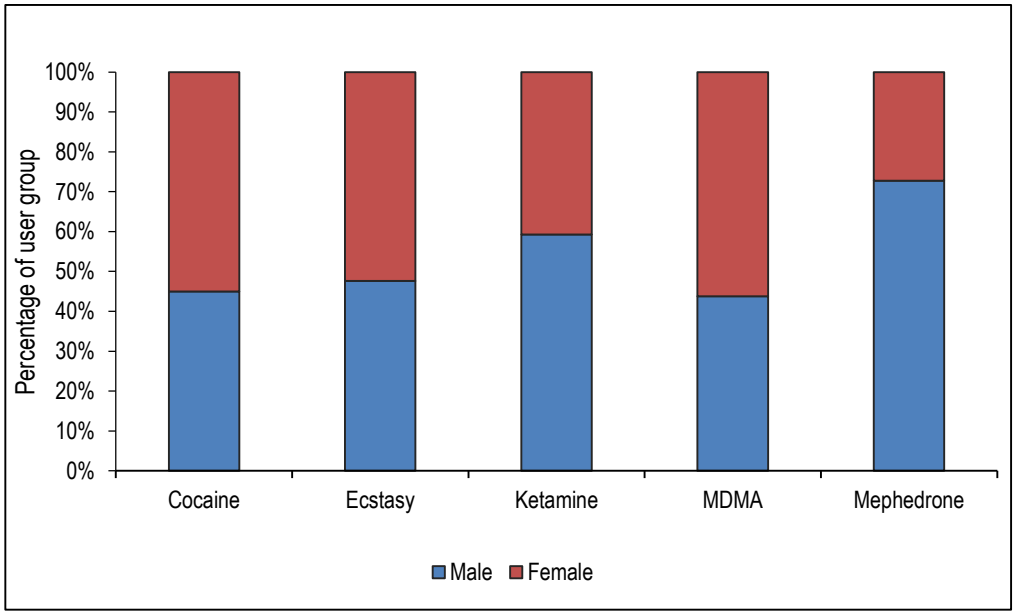


Figure 4.2.i: Percentage of male and female participants reporting to have 'Taken in the Last year' each of the five substances (*n:* Cocaine = 76, Ecstasy = 84, Ketamine = 52, MDMA = 76 and Mephedrone = 37)

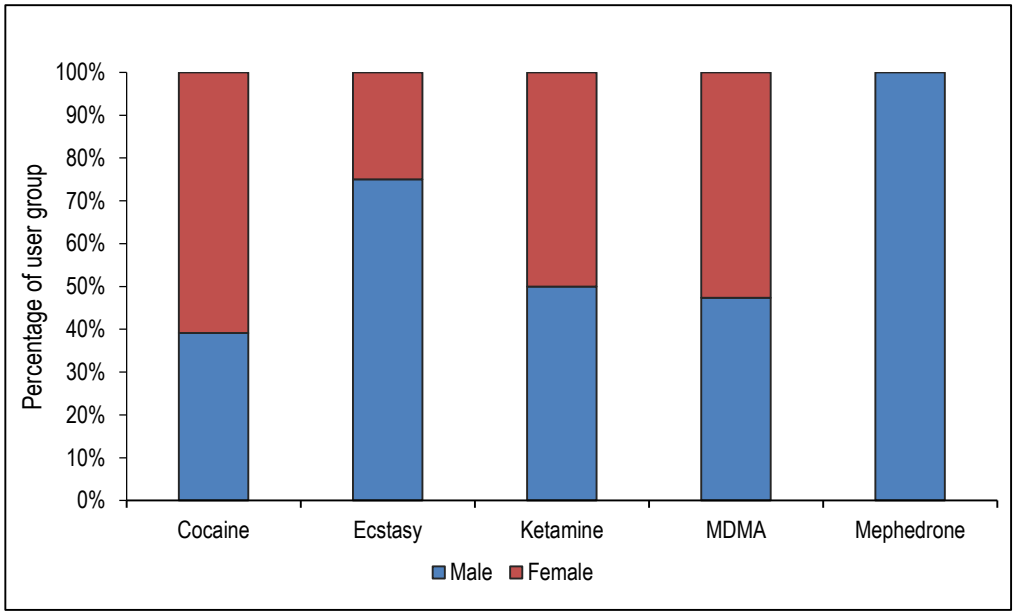


Figure 4.2.ii: Percentage of male and female participants reporting to have 'Taken in the Last Month' each of the five substances (*n:* Cocaine = 76, Ecstasy = 84, Ketamine = 52, MDMA = 76 and Mephedrone = 37)

Table 4.2.iii: Reported use for selected substances to the questions of taken in the last year and last month by the different genders with the user group compared to non-user group

Substance		χ^2	P Value	Significant
Cocaine	Last Year	0.857	0.356	No
	Last Month	0.004	0.947	No
Ecstasy	Last Year	1.773	0.183	No
	Last Month	7.093	0.012	Yes
MDMA	Last Year	0.692	0.405	No
	Last Month	0.684	0.408	No
Ketamine	Last Year	5.509	0.019	Yes
	Last Month	0.462	0.489	No
Mephedrone	Last Year	5.694	0.025	Yes
	Last Month	No responses		

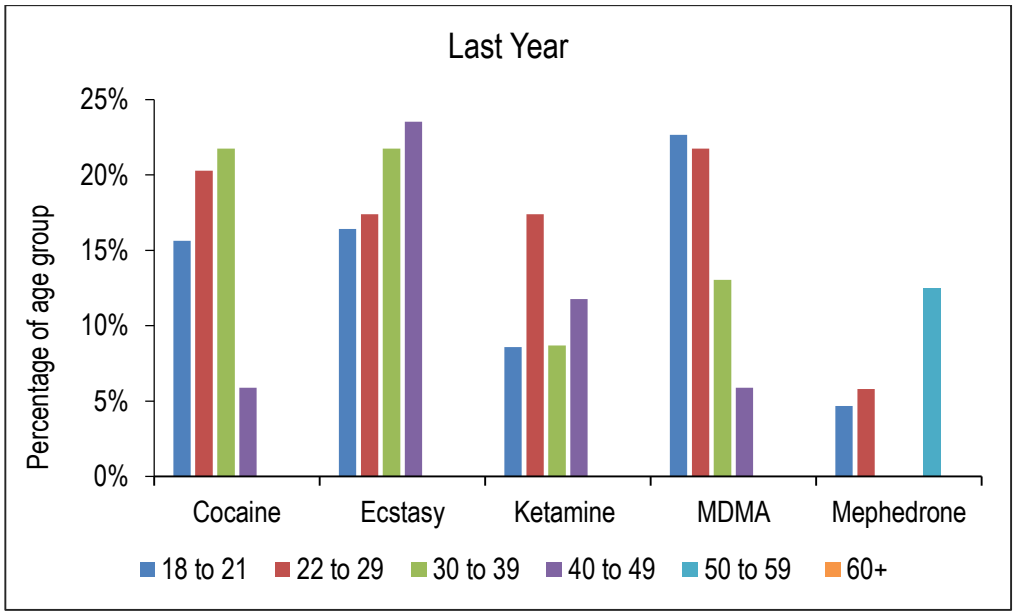


Figure 4.2.iii: Reported use of substance 'Taken Last Year' separated into age group (percentage calculated against size of age group)

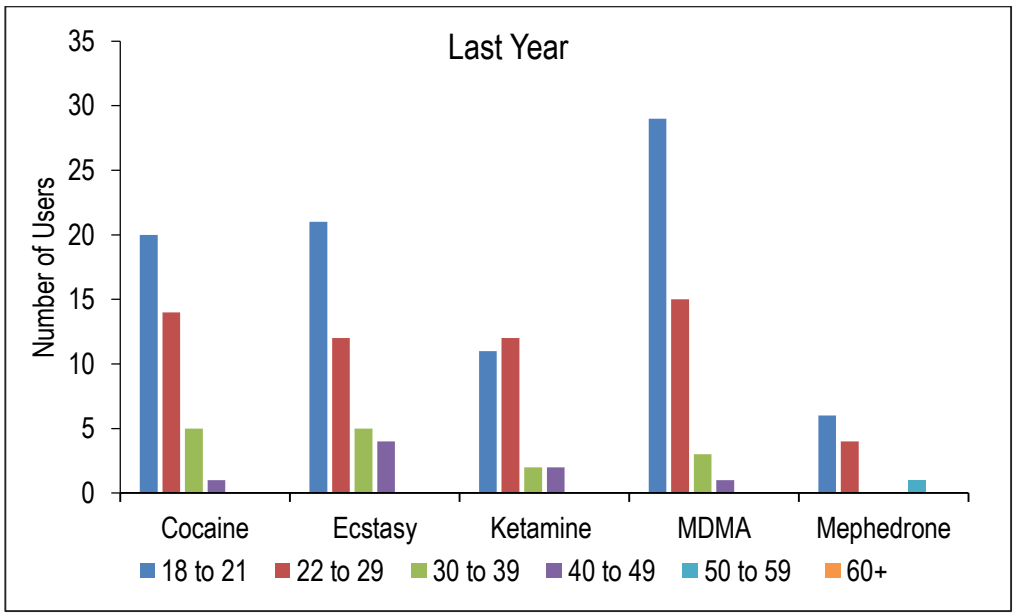


Figure 4.2.iv: Reported use of substance 'Taken Last Year' separated into age group

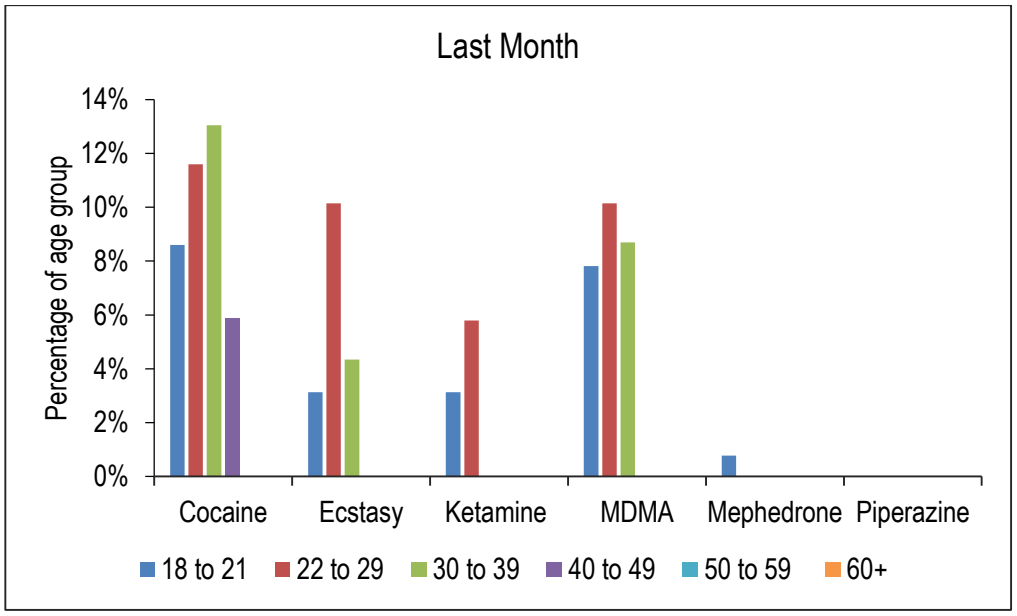


Figure 4.2.v: Reported use of substance 'Taken Last Month' separated into age group (percentage calculated against size of age group)

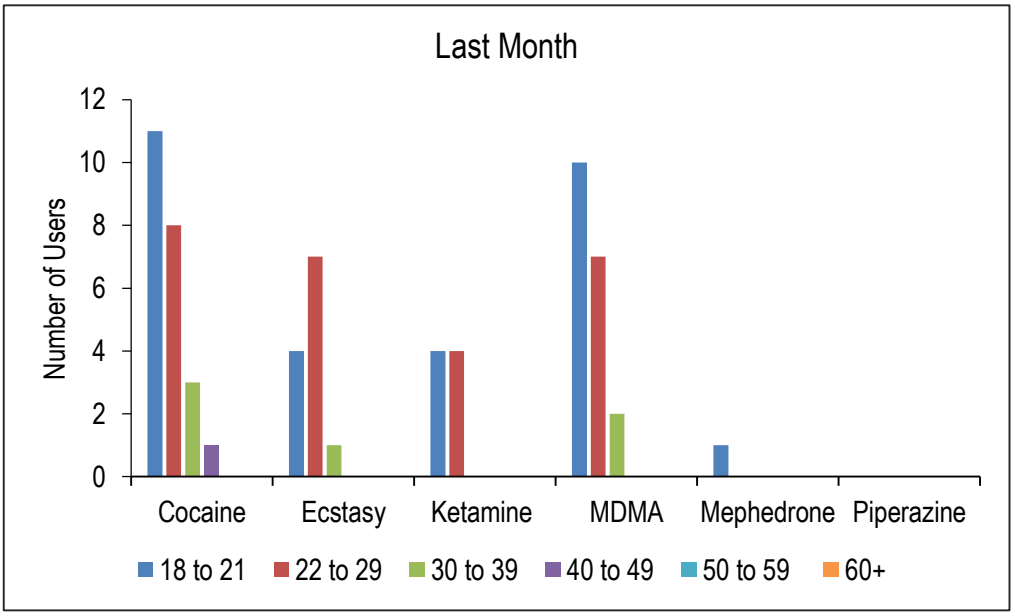


Figure 4.2.vi: Reported use of substance 'Taken Last Month' separated into age group

Table 4.2.iv: Gender responses to Question 4 and statistical significance using two way chi squared (critical significance level 0.05)

Drug	Gender	Negative	Indistinct	Positive	χ^2	P Value	Significant
Cocaine	Male	2	9	20	1.264	0.531	No
	Female	7	16	22			
Ecstasy	Male	1	6	29	0.416	0.812	No
	Female	4	7	35			
MDMA	Male	0	3	34	0.850	0.079	No
	Female	5	3	31			
Ketamine	Male	7	4	16	3.325	0.189	No
	Female	6	5	13			
Mephedrone	Male	4	7	10	2.300	0.316	No
	Female	7	2	5			

Table 4.2.v: Gender responses to Question 5 and statistical significance using two way chi squared (critical significance level 0.05)

Drug	Gender	Negative	Indistinct	Positive	χ^2	P Value	Significant
Cocaine	Male	1	11	19	1.964	0.374	No
	Female	7	16	22			
Ecstasy	Male	0	2	28	1.361	0.506	No
	Female	4	1	41			
MDMA	Male	0	0	37	1.348	0.510	No
	Female	3	1	35			
Ketamine	Male	6	5	16	3.48	0.175	No
	Female	8	8	8			
Mephedrone	Male	4	4	13	0.694	0.707	No
	Female	5	3	6			

Table 4.2.vi: Cross tabulation of responses between Questions 4 and 5 for Cocaine

		Q4 Cocaine - Physical				Total
		Negative	Indistinct	Positive	Not Taken	
Q5 Cocaine - Emotional	Negative	4	3	2	0	9
	Indistinct	3	18	5	0	26
	Positive	1	8	39	0	48
	Not Taken	0	0	0	169	169
Total		8	29	46	169	252

Table 4.2.vii: Cross tabulation of responses between Questions 4 and 5 for Ecstasy

		Q4 Ecstasy - Physical				Total
		Negative	Indistinct	Positive	Not Taken	
Q5 Ecstasy - Emotional	Negative	2	1	2	0	5
	Indistinct	2	2	9	0	13
	Positive	0	1	59	0	60
	Not Taken	0	0	0	168	168
Total		4	4	70	168	246

Table 4.2.viii: Cross tabulation of responses between Questions 4 and 5 for MDMA

		Q4 MDMA - Physical				Total
		Negative	Indistinct	Positive	Not Taken	
Q5 MDMA - Emotional	Negative	2	1	2	0	5
	Indistinct	0	1	6	0	7
	Positive	1	0	66	0	67
	Not Taken	0	0	0	173	173
Total		3	2	74	173	252

Table 4.2.ix: Cross tabulation of responses between Questions 4 and 5 for Mephedrone

		Q4 Mephedrone - Physical				Total
		Negative	Indistinct	Positive	Not Taken	
Q5 Mephedrone - Emotional	Negative	8	0	3	0	11
	Indistinct	0	6	4	1	11
	Positive	1	2	13	1	17
	Not Taken	0	0	0	213	213
Total		9	8	20	215	252

Table 4.2.x: Cross tabulation of responses between Questions 4 and 5 for Ketamine

		Q4 Ketamine - Physical				Total
		Negative	Indistinct	Positive	Not Taken	
Q5 Ketamine - Emotional	Negative	12	1	2	0	15
	Indistinct	0	10	0	0	10
	Positive	5	3	22	0	30
	Not Taken	0	0	0	197	197
Total		17	14	24	197	252

Table 4.2.xi: Cross tabulation of responses between Questions 4 and 5 for Piperazines

		Q4 Piperazine - Physical				Total
		Negative	Indistinct	Positive	Not Taken	
Q5 Piperazine - Emotional	Negative	1	4	0	0	5
	Indistinct	1	2	1	0	4
	Positive	0	0	1	0	1
	Not Taken	0	0	0	242	242
Total		2	6	2	242	252

Table 4.2.xii: Gender responses to Question 6 'Yes-Myself' and statistical significance using two way chi squared (critical significance level 0.05)

Drug	Gender	Yes - Myself	Other	χ^2	P Value	Significant
Cocaine	Male	4	27	0.596	0.440	No
	Female	7	28			
Ecstasy	Male	8	30	0.483	0.487	No
	Female	7	39			
MDMA	Male	5	32	0.193	0.660	No
	Female	4	35			
Ketamine	Male	9	18	0.624	0.429	No
	Female	11	14			
Mephedrone	Male	7	16	1.416	0.234	No
	Female	7	7			

Table 4.2.xiii: Gender responses to Question 6 'Yes-someone else' and statistical significance using two way chi squared (critical significance level 0.05)

Drug	Gender	User	Non-user	χ^2	P Value	Significant
Cocaine	Male	16	18	6.21	0.013	Yes
	Female	12	43			
Ecstasy	Male	18	13	4.64	0.031	Yes
	Female	18	35			
MDMA	Male	16	9	3.63	0.057	No
	Female	9	28			
Ketamine	Male	15	19	9.28	0.002	Yes
	Female	8	46			
Mephedrone	Male	8	8	3.39	0.065	Yes
	Female	5	18			

Table 4.2.xiv: Gender responses to Question 7 and statistical significance using two way chi squared (critical significance level 0.05)

Drug	Gender	User	Non-user	χ^2	P Value	Significant
Cocaine	Male	15	16	1.251	0.263	No
	Female	16	29			
Ecstasy	Male	12	24	0.293	0.588	No
	Female	18	28			
MDMA	Male	16	21	0.429	0.512	No
	Female	14	25			
Ketamine	Male	12	12	0.01	0.920	No
	Female	13	11			
Mephedrone	Male	10	11	3.353	0.067	No
	Female	11	3			

Table 4.2.xv: Chi squared test results for significance between yes and no responses to question 8

Substance	χ^2 value	P Value	Significant
Cocaine	30.04	<0.001	Yes
Ecstasy	28.77	<0.001	Yes
MDMA	37.33	<0.001	Yes
Ketamine	7.33	0.007	Yes
Mephedrone	3.314	0.069	No
Piperazines	7.2	0.007	Yes

Table 4.2.xvi: Chi squared test results for non-user response to question 8

Substance	χ^2	P Value	Significant
Cocaine	0.25	0.807	No
Ecstasy	1.92	0.265	No
MDMA	0.82	0.548	No
Ketamine	1.32	0.359	No
Mephedrone	0.53	0.624	No
Piperazines	9.31	0.005	Yes

Table 4.2.xvii: User responses to Question 8: Has knowledge of someone else bad experience changed your usage

Substance	χ^2 Value	P Value	Significant
Cocaine *(n = 74)*	33.78	<0.001	Yes
Ecstasy *(n = 81)*	40.11	<0.001	Yes
MDMA *(n = 73)*	38.48	<0.001	Yes
Ketamine *(n = 47)*	15.51	<0.001	Yes
Mephedrone *(n = 34)*	2.94	0.123	No
Piperazine *(n = 7)*	0.14	1	No

Table 4.2.xviii: Gender responses to Question 8 – User group and statistical significance using two way chi squared (critical significance level 0.05)

Drug	Gender	Yes	No	χ^2	P Value	Significant
Cocaine	Male	4	25	0.206	0.649	No
	Female	8	37			
Ecstasy	Male	4	31	0.56	0.454	No
	Female	8	38			
MDMA	Male	3	32	1.495	0.221	No
	Female	7	31			
Ketamine	Male	6	19	0.017	0.896	No
	Female	4	18			
Mephedrone	Male	5	15	1.292	0.256	No
	Female	7	7			

Table 4.2.xix: Gender responses to Question 8 – Non-user group and statistical significance using two way chi squared (critical significance level 0.05)

Drug	Gender	Yes	No	χ^2	P Value	Significant
Cocaine	Male	2	5	0.327	0.567	No
	Female	5	4			
Ecstasy	Male	4	1	0.002	0.964	No
	Female	5	3			
MDMA	Male	2	2	0.004	0.949	No
	Female	2	5			
Ketamine	Male	1	2	0.265	0.607	No
	Female	11	5			
Mephedrone	Male	2	2	0.029	0.864	No
	Female	5	8			

Table 4.2.xx: Gender responses to Question 11 to 14 statistical significance using two way chi squared (critical significance level 0.05)

Drug	Gender	Ecstasy	MDMA	χ^2	P Value	Significant
Q11	Male	11	37	0.722	0.379	No
	Female	18	41			

Drug	Gender	MDMA	Mephedrone	χ^2	P Value	Significant
Q12	Male	42	4	0.094	0.759	No
	Female	44	4			

Drug	Gender	MDMA	Piperazine	χ^2	P Value	Significant
Q13	Male	41	1	0.014	0.905	No
	Female	46	2			

Drug	Gender	MDMA	Ketamine	χ^2	P Value	Significant
Q14	Male	31	14	1.13	0.288	No
	Female	40	11			

Table 4.2.xxi: Chi squared test for difference between responses to question 15: preference

	Substances					
	Cocaine	Ecstasy	MDMA	Ketamine	Mephedrone	Piperazines
χ^2	176.93	125.32	136.42	320.16	377.69	590.02
P value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Significance	Yes	Yes	Yes	Yes	Yes	Yes

Appendix V: Statistical Tests Used for Hypothesis Testing

Chi Squared Test

Example of one-way chi squared test

The following example demonstrates how the one chi squared test was applied to the following survey data using the example from the first question, whether participants had heard of Ecstasy.

Equation

$$\chi^2 = \sum \frac{(observed - Expected)^2}{Expected}$$

Table 5.i: Example of One way chi square contingency table

Response	Observed Value	Expected	O – E	(O – E)^2	(O – E)^2 /E
Heard	434	220	+214	45796	208.16
Not Heard	6	220	-214	45796	208.16
Total	440	440			416.32

χ^2 = 416.32
P = <0.001

Using the above calculation the χ^2 value obtained for this question came back as 416.32 with a P value of <0.001, which is significant at the critical significance level of 0.05 (95% confidence level).

Example of two-way chi squared test

The following example demonstrates how the two chi squared test was applied to the survey data. Using another example from the first question, whether participants had heard of MDMA this time including the variable of gender, the numbers in the brackets indicate the expected values for each variable.

Table 5.ii: Example of a 2 x 2 contingency table for the results from Question 1

Heard of MDMA	Male	Female	Total
Yes	138 (127.44)	206 (216.56)	344
No	25 (35.56)	71 (60.44)	96
Total	163	277	440

The above information can be inputted into the same equation as for the one way chi square

Table 5.iii: Example of two way chi squared calculation table

Response	Observed Value	Expected	O – E	(O – E)2	(O – E)2 /E
Male Heard	138	127.44	10.56	111.51	0.88
Male Not Heard	25	35.56	-10.56	111.51	3.14
Female Heard	206	216.56	-10.56	111.51	0.51
Female Not Heard	71	60.44	10.56	111.51	1.85
Total	440	440			6.37

$\chi^2 = 6.37$
P = 0.012

Using the above calculation the χ^2 value obtained for this question came back as 6.37 with a P value of 0.012, which is significant at the critical significance level of 0.05 (95% confidence level). Though the data can be assessed manually, this project used the statistical analysis software SPSS to conduct the statistical tests.

Mann Whitney U

The following example demonstrates how the Mann-Whitney U test was applied to the findings from the analytical chapter, using the data for MDMA powders and tablets.

Equation 1

$$U = n_a n_b + \frac{n_a(n_a + 1)}{2} - TA$$

n_a = number of samples from group a (23)
n_b = number of samples from group b (8)
TA = sum of ranks from larger group (458)

Table 5.iv: Rank scores for Analytical data

Powder %	Rank a	Tablet %	Rank b
42	7	17	1
58	16	33	2
52	14.5	34	3
52	14.5	37	4
69	19	39	5.5
70	20.5	39	5.5
77	27	45	8
75	25	46	9
87	31		
73	23.5		
85	30		
72	22		
65	18		
70	20.5		
51	13		
73	23.5		
78	28		
79	29		
76	26		
61	17		
48	11		
47	10		
50	12		
TA	458		

Calculated U value using above data

$$U = (23)(8) + \frac{23(23+1)}{2} - 458$$

Therefore

U = 2

Once the U value has been calculated this can then be used to calculate the z value. The equation to calculate the z value is:

Equation 2

$$z = \frac{U - \frac{n_a n_b}{2}}{\sqrt{\frac{n_a n_b (n_a + n_b + 1)}{12}}} \quad z = \frac{2 - \frac{(23)(8)}{2}}{\sqrt{\frac{(23)(8)(23+8+1)}{12}}}$$

z = -4.06

As the z value is less than -1.96 the null hypothesis is rejected and there is a significant difference between the purity of the two types of Ecstasy examined.

Appendix VI: Additional Material for Chapter 8

Table 8.i: Description of first set of samples collected from Parkside Police Station (collected March 2013) (* sample and packaging weight)

Sample	Description	Weight (g)
A4	White circular tablet Unidentifiable imprint (possibly bulls head) -poor quality imprint Diameter: 9mm Depth: 3mm	0.3065
A29	Cream crystals	4.6178*
A30	White crystals	1.3567*
A31	White powder	1.3707*
A35	Brown crystals	1.5041*
A40	Cream powder	3.6085*
A41	Cream Power	1.2580*
A42	Cream powder	3.2975*
A44	Cream crystals	1.7798*
A45	Large cream crystals	1.6144*
A47	Pale blue circular tablet Mickey mouse imprint on one side, Fantasia hat on other Diameter: 8mm Depth: 3mm	0.2075
A48	Teal heart shaped tablet with gold flecks Height: 1cm Width: 8mm Depth: 3mm	0.4225
A49	Pale red circular tablet Cupid design on one side Blank on other side Diameter: 8mm Depth: 4mm	0.3225
A50	Dark orange circular tablet Armani design Blank on other side Diameter: 9mm Depth: 3mm	0.3156
A51	White rectangular crystals	2.4193*
A52	White powdered crystals	0.7720*
A53	Brown crystals	0.6291
A54	Brown crystals	2.1894
A55	Brown powder	0.6424*

Table 8.ii: Description of second set of samples included in chemical analysis (* sample and packaging weight)

Sample	Description	Weight (g)
A3	Green circular tablet CND Logo design (homogenised before measurements taken)	0.3097
A7	Yellow circular tablet Star imprinted design (homogenised before measurements taken)	0.2655
A9	Pink circular tablet No identified design (homogenised before measurements taken)	0.2229
A11	Orange circular tablet Star imprint design (homogenised before measurements taken)	0.2908
A12	White powder	5.8806*
A27	Pale brown crystals	6.2204*
A28	Pale brown crystals	1.1955*
A32	White powder	1.3583*
A37	Pale brown crystals	0.8614*

Table 8.iii: Description of third set of samples included in chemical analysis (collected from Parkside Police station February 2014) (* sample and packaging weight)

Sample	Description	Weight (g)
A61	White powder	0.269*
A63	Pale brown crystals	2.397*
A64a	Pale brown crystals (in wrap/bomb)	0.083
A64b	Pale brown crystals (in wrap/bomb)	0.073
A64c	Pale brown crystals (in wrap/bomb)	0.163
A64d	Pale brown crystals (in wrap/bomb)	0.105
A64e	Pale brown crystals (in wrap/bomb)	0.088
A65	White crystals	1.050*
A66	White crystals	1.802*
A67	White crystals	1.803*
A68	Pale brown crystals	1.882*
A69	Large brown crystals	2.055*
A70a	Pale brown crystals (in wrap/bomb)	0.914*
A70b	Brown powder/crystals (in wrap/bomb)	0.144
A70c	Pale brown crystals (in wrap/bomb)	0.142
A71	Pale brown powder/crystals (in a wrap)	0.075
A72	Pale cream crystal (in a wrap)	0.088
A73a	Pale cream crystal (in wrap/bomb)	0.055
A73b	Pale cream crystal (in wrap/bomb)	0.040
A73c	Pale cream crystal (in wrap/bomb)	0.082
A74	Pale brown crystal	1.846*
A75	Large pale brown crystals	2.063*
A76	Pale brown crystals	2.283*
A77	Pale brown crystals	1.921*
A78	White powder	2.254*
A79a	Pale cream crystal/ powder	0.417*
A79b	Red circular tablet No Design, rough top & Bottom Diameter: 8mm Depth: 4mm	0.223
A80	White Circular Tablet Star Design, blank other side Diameter: 1cm Depth: 4.5mm	0.326

Table 8.vi: Concentration conversion table for MDMA HCl to Free base in GCMS standards

Approximate Concentration (mg/mL)	Starting Concentration as Salt Form (mg/mL)	Conversion to Free Base (mg/mL)	Volume Taken (ml)	Final Volume (ml)	Final Concentration (mg/mL)
0.05	2.044	1.717	0.0025	0.100	0.043
0.1	2.044	1.717	0.0050	0.100	0.086
0.2	2.044	1.717	0.0100	0.100	0.172
0.3	2.044	1.717	0.0150	0.100	0.258
0.4	2.044	1.717	0.0200	0.100	0.343
0.5	2.044	1.717	0.0250	0.100	0.429
0.6	2.044	1.717	0.0300	0.100	0.515
0.7	2.044	1.717	0.0350	0.100	0.601
0.8	2.044	1.717	0.0400	0.100	0.687
0.9	2.044	1.717	0.0450	0.100	0.773
1.0	2.044	1.717	0.0500	0.100	0.858

Figure 8.i: Exemplar chromatogram displaying integrated peaks for MDMA and IS (n-hexadecane) used to calculate PAR

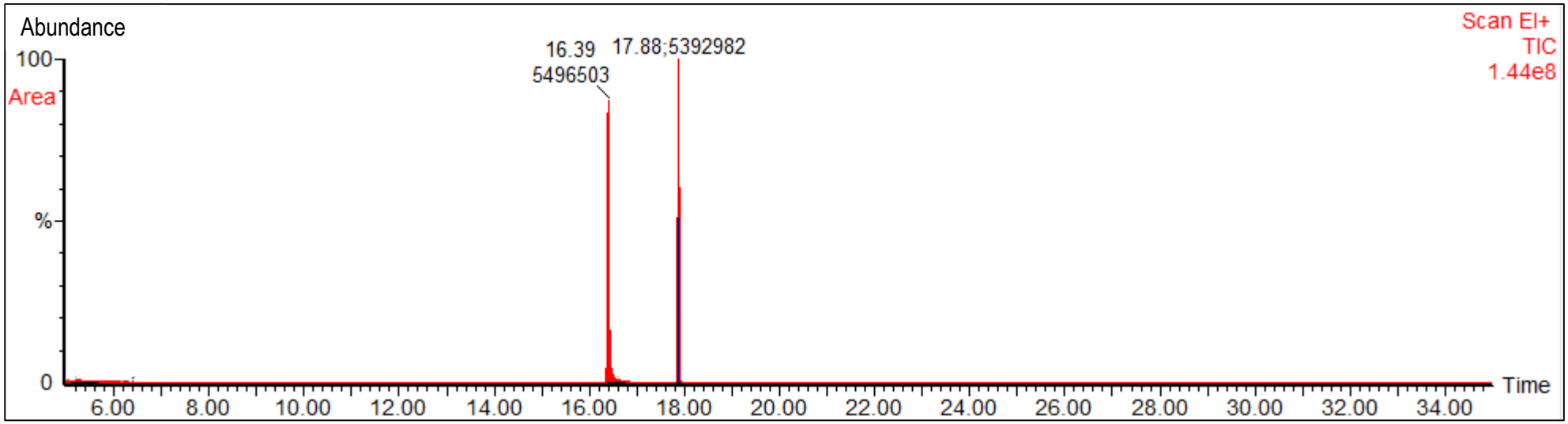


Table 8.v: The retention times recorded for the analytical standard compounds

Group	Compound	Retention Time (Minutes)	Relative Retention Factor	Base Ion m/z	Confirmation Ions
Amphetamine Type Stimulants (ATS)	Amphetamine	6.05	0.339	44	39, 42, 45, 65, 91,
	Methamphetamine	7.38	0.413	58	42, 56, 59, 65, 91
	3,4-Methylenedioxyamphetamine (MDA)	15.01	0.840	44	42, 51, 77, 135, 136
	3,4-Metheylenedioxymethamphetamine (MDMA)	16.39	0.918	58	51, 56, 77, 135, 136
	3,4-Metheylenedioxyethylamphetamine (MDEA)	17.52	0.981	72	44, 70, 73, 77, 135
	Para-Methoxyamphetamine (PMA)	12.52	0.701	44	45, 77, 78, 121, 122
	Para-Methoxymethamphetamine (PMMA)	13.95	0.781	58	42, 56, 59, 77, 121
Cathinone Derivatives	Methcathinone (MCat)	11.38	0.637	58	51, 56, 77, 105, 148
	4-Methylmethcathinone (4-MMC/Mephedrone)	14.47	0.810	58	56, 91, 65, 42, 119
	4-Methylethcathinone (4-MEC)	15.92	0.891	72	42, 44, 65, 70, 91
	3,4-Methylenedioxymethcatinone (MDMC/Methylone)	20.73	1.161	58	56, 59, 63, 65, 149
Piperazine Derivatives	3-Trifluoromethylphenylpiperazine (TFMPP)	16.34	0.915	188	56, 95, 145, 172, 230
	1-Benzylpiparazine (BZP)	15.37	0.861	91	56, 65, 92, 134, 176
Adulterant	Caffeine	23.38	1.309	194	55, 67, 82, 109, 165
Internal Standard	n-Hexadecane	17.86	1.000	194	42, 55, 67, 82, 109

Table 8.vi: Calibration results table for MDMA standards

Concentration (mg/mL)	MDMA PAR				
	1st PAR	2nd PAR	3rd PAR	Mean	Standard Deviation
0.043	0.038	0.021	0.022	0.027	0.010
0.086	0.048	0.058	0.099	0.068	0.027
0.172	0.171	0.169	0.214	0.185	0.025
0.258	0.351	0.335	0.320	0.335	0.016
0.343	0.495	0.499	0.483	0.492	0.008
0.429	0.782	0.771	0.768	0.774	0.007
0.515	1.211	1.055	1.034	1.100	0.097
0.601	1.394	1.292	1.377	1.354	0.055
0.687	1.502	1.593	1.658	1.584	0.078
0.773	1.900	1.778	1.969	1.882	0.097
0.858	2.105	2.063	2.086	2.085	0.021

Table 8.vii: Calibration Table for MDMA using selected ions (m/z 58 for MDMA divided by m/z 57 for the IS)

Concentration (mg/mL)	1st Calibration point	2nd Calibration point	3rd Calibration point	Mean	Standard Deviation
0.043	0.119	0.057	0.058	0.078	0.071
0.086	0.089	0.126	0.129	0.115	0.022
0.172	0.411	0.318	0.489	0.406	0.086
0.258	0.748	0.843	0.619	0.737	0.112
0.343	0.977	1.044	1.126	1.049	0.075
0.429	2.067	1.895	2.104	2.022	0.112
0.515	2.491	2.306	2.827	2.541	0.264
0.601	3.632	3.455	3.628	3.572	0.101
0.687	3.338	4.741	3.504	3.861	0.767
0.773	4.969	4.523	4.738	4.743	0.223
0.858	5.142	5.466	5.351	5.320	0.164

Table 8.viii: Calculated Residuals for EIC Calibration Data

Concentration (mg/mL)	Actual Y for EIC	Estimated Y for EIC	Residuals
0.172	0.406	0.106	0.300
0.258	0.737	0.755	-0.018
0.343	1.049	1.396	-0.347
0.429	2.022	2.045	-0.023
0.515	2.541	2.694	-0.153
0.601	3.572	3.343	0.229
0.687	3.861	3.992	-0.131
0.773	4.743	4.640	0.103
0.858	5.32	5.282	0.038

Table 8.ix: Original concentrations for samples of the street samples analysed by GC-MS

Sample	Weight (mg)	Concentration Salt Form (mg/mL)	Concentration Free Base (mg/mL)	Final Sample Concentration (mg/mL)
A3	20.23	2.02	1.70	0.68
A4	40.50	4.05	3.40	1.36
A7	19.00	1.90	1.60	0.64
A9	20.40	2.04	1.71	0.69
A11	19.00	1.90	1.60	0.64
A27	20.80	2.08	1.75	0.70
A28	23.24	2.32	1.95	0.78
A37	19.90	1.99	1.67	0.67
A44	22.30	2.23	1.87	0.75
A48	21.30	2.13	1.79	0.72
A50	21.10	2.11	1.77	0.71
A53	19.90	1.99	1.67	0.67
A54	20.20	2.02	1.70	0.68
A55	21.20	2.12	1.78	0.71
A63	25.96	2.60	2.18	0.87
A64a	20.15	2.02	1.69	0.68
A64b	19.70	1.97	1.65	0.66
A64c	20.69	2.07	1.74	0.70
A64d	22.25	2.23	1.87	0.75
A64e	20.81	2.08	1.75	0.70
A69	21.62	2.16	1.82	0.73
A71	22.28	2.23	1.87	0.75
A72	21.69	2.17	1.82	0.73
A73a	19.89	1.99	1.67	0.67
A73b	20.00	2.00	1.68	0.67
A73c	20.83	2.08	1.75	0.70
A74	23.50	2.35	1.97	0.79
A76	28.62	2.86	2.40	0.96
A77	19.70	1.97	1.65	0.66
A79a	22.31	2.23	1.87	0.75
A80	21.25	2.125	1.79	0.71

Table 8.x: Instrumental response for street samples in triplicate

Sample	1st Calibration point	2nd Calibration point	3rd Calibration point	Average	Std Deviation
A3	0.401	0.338	0.341	0.360	0.036
A4	0.327	0.249	0.261	0.279	0.042
A7	0.522	0.359	0.482	0.454	0.085
A9	0.35	0.45	0.317	0.372	0.069
A11	0.524	0.399	0.38	0.434	0.078
A27	0.439	0.395	0.482	0.439	0.044
A28	1.008	0.836	0.861	0.902	0.093
A47	0.451	0.704	0.646	0.600	0.133
A44	0.667	0.741	0.76	0.723	0.049
A48	0.19	0.27	0.349	0.270	0.080
A50	0.38	0.335	0.337	0.351	0.025
A53	0.853	0.973	0.957	0.928	0.065
A54	1.066	0.852	0.982	0.967	0.108
A55	1.265	1.169	1.122	1.185	0.073
A63	1.433	1.55	1.479	1.487	0.059
A64a	1.266	1.36	1.316	1.314	0.047
A64b	0.91	0.962	1.088	0.987	0.092
A64c	1.649	1.095	1.198	1.314	0.295
A64d	1.13	1.06	1.263	1.151	0.103
A64e	0.804	0.996	0.967	0.922	0.104
A69	1.116	0.998	1.115	1.076	0.068
A71	0.703	0.706	0.692	0.700	0.007
A72	1.192	1.08	1.137	1.136	0.056
A74	1.433	1.356	1.378	1.389	0.040
A76	2.04	1.762	1.615	1.806	0.216
A77	1.058	1.088	0.986	1.044	0.052
A79a	0.933	0.969	0.89	0.931	0.040
A80	0.25	0.342	0.301	0.298	0.046

Table 8.xi: Calculation for concentrations of street samples as free base MDMA and as a percentage of original sample

Sample	Y Value	Calculated X (mg/mL)	Original Concentration (mg/mL)	Purity (%)
A3	0.360	0.27	0.68	39%
A4	0.279	0.24	1.36	17%
A7	0.454	0.30	0.64	46%
A9	0.372	0.27	0.69	39%
A11	0.434	0.29	0.64	45%
A27	0.439	0.29	0.7	42%
A28	0.902	0.45	0.78	58%
A47	0.60	0.35	0.67	52%
A44	0.723	0.39	0.75	52%
A48	0.270	0.23	0.72	33%
A50	0.351	0.26	0.71	37%
A53	0.928	0.46	0.67	69%
A54	0.967	0.47	0.68	70%
A55	1.185	0.55	0.71	77%
A63	1.487	0.65	0.87	75%
A64a	1.314	0.59	0.68	87%
A64b	0.987	0.48	0.66	73%
A64c	1.314	0.59	0.7	85%
A64d	1.151	0.54	0.75	72%
A64e	0.922	0.46	0.7	65%
A69	1.076	0.51	0.73	70%
A71	0.7	0.38	0.75	51%
A72	1.136	0.53	0.73	73%
A74	1.389	0.62	0.79	78%
A76	1.806	0.76	0.96	79%
A77	1.044	0.50	0.66	76%
A79a	0.931	0.46	0.75	61%
A80	0.298	0.24	0.71	34%

Table 8.xii: The calibration data for the Mephedrone standards run in triplicate

Calibration Point	Concentration (mg/mL)	1st PAR	2nd PAR	3rd PAR	Mean	Standard Deviation
1	0.049	0.014	0.009	0.010	0.011	0.003
2	0.098	0.038	0.043	0.043	0.041	0.003
3	0.197	0.135	0.082	0.119	0.112	0.027
4	0.295	0.219	0.222	0.179	0.207	0.024
5	0.393	0.341	0.332	0.316	0.330	0.013
6	0.492	0.472	0.485	0.454	0.470	0.016
7	0.590	0.623	0.643	0.632	0.633	0.010
8	0.688	0.795	0.753	0.751	0.766	0.025
9	0.786	0.925	0.881	0.918	0.908	0.024
10	0.885	1.012	0.951	1.058	1.007	0.054
11	0.983	1.132	1.147	1.116	1.132	0.016

Table 8.xiii: Residuals calculated from Mephedrone Calibration Data

Concentration (x) (mg/mL)	Actual Y	Estimated Y	Residual
0.049	0.011	-0.052	0.063
0.098	0.041	0.009	0.032
0.197	0.112	0.134	-0.022
0.295	0.207	0.257	-0.051
0.393	0.33	0.381	-0.051
0.492	0.47	0.506	-0.035
0.59	0.633	0.629	0.004
0.688	0.766	0.752	0.014
0.786	0.908	0.876	0.032
0.885	1.007	1.000	0.007
0.983	1.132	1.124	0.008

Table 8.xiv: Instrumental response and calculated concentration value for seized Mephedrone samples

Sample	1st	2nd	3rd	Mean	Standard Deviation	Calculated Concentration (mg/mL)
A12	0.712	0.726	0.843	0.760	0.072	0.696
A29	0.970	1.110	1.293	1.124	0.162	0.966
A40	0.636	0.598	0.549	0.594	0.044	0.572
A42	0.615	0.611	0.625	0.617	0.007	0.589
A51	0.743	0.676	0.618	0.679	0.063	0.635
A52	0.272	0.284	0.290	0.282	0.009	0.340
A61	0.972	0.814	0.839	0.875	0.085	0.781

Table 8.xv: Actual concentrations of samples produced from precise weight

Sample	Weight (mg)	Concentration (mg/mL)	Volume Taken (mL)	Final Volume (mL)	Final Concentration (mg/mL)
A12	22.16	2.216	0.04	0.1	0.886
A29	36.83	3.683	0.04	0.1	1.473
A40	20.63	2.063	0.04	0.1	0.825
A42	19.88	1.988	0.04	0.1	0.795
A51	20.53	2.053	0.04	0.1	0.821
A52	9.03	0.903	0.075	0.1	0.677
A61	19.5	1.95	0.04	0.1	0.781