# Expert consensus statement to guide evidence-based classification of vision-impaired paralympic athletes: a Delphi study

One of the main challenges in Paralympic sport is to provide a competitive environment that remains as fair as possible. Classification is a process by which an athlete’s impairment is evaluated to determine whether the athlete is eligible to compete in Paralympic sport and, if so, which ‘class’ they should compete in. The aim of Paralympic classification, according to the International Paralympic Committee (IPC), is to ‘minimise the impact of eligible impairments on the outcome of competition’.1 However, this is not a trivial task, given the wide range of eligible impairment types and the degrees to which those impairments can impact performance, making Paralympic classification a topic of significant ongoing debate.

Historically, athletes were classified based on a grading of their medical condition, for instance the severity of injury following spinal cord injury or vision loss.2 However, in 2007 the IPC published their first *Classification Code* (and a revised *Athlete Classification Code* in 2015)3 that required international sport federations to develop their own classification system that is sport-specific and evidence-based.4 These systems should be structured according to the degree to which an impairment limits performance in that distinct sport rather than the medical diagnosis of the athletes. Therefore, within each class, all athletes should have an impairment that impacts their performance in that particular sport to approximately the same degree. Moreover, this impairment–performance relationship should be established on the basis of scientific evidence. A number of papers have been published to outline the manner by which research can be conducted to establish an evidence-based system of classification.5,6,7,8

Although sport-specific classification has been in development for some time for athletes with physical or intellectual impairments, at this stage there has been minimal change to the classification systems for athletes with vision impairment.9 Recent research in non-vision-impaired elite athletes suggest that visual profiles are sport dependent,10,11,12 and so it seems reasonable to assume that the impact of vision impairment will differ according to the specific visual demands of each sport. Further guidance on the development of evidence-based classification systems specific for athletes with a vision impairment is provided by the recent IPC and International Blind Sports Federation (IBSA) joint position stand on classification of athletes with vision impairment.7 This consensus statement, also developed in part using a Delphi approach9, provides guidance on the most important issues in classification for athletes with vision impairment and how these should be addressed. In line with the IPC’s requirements,3,4,13 this work now needs to be followed for each of the eleven sports currently on the Paralympic programme for athletes with a vision impairment, so sport-specific classification systems can be developed which provide more legitimate competition. The joint IPC and IBSA position stand on vision impairment classification research7 suggests that the first step in sport-specific classification is to canvas expert opinion in the sport to guide classification research. Here we therefore initiate that process for the specific sport of track athletics for athletes with a vision impairment. The purpose of such expert consultation is three-fold. First, it is used to establish the aspects of vision impairment that are likely to impact running performance (e.g., loss of visual acuity, contrast sensitivity, depth perception). Second, expert consultation helps to determine the components of performance most likely to be impacted by vision impairment (e.g., navigation, monitoring opponents). Third, experts provide useful guidance about additional sport-specific issues that need to be considered in sport-specific classification (e.g., whether guides and/or blindfolds should be used during competition). The Delphi process has been used to produce a consensus statement to guide the evidence-based classification of Paralympic athletes with vision impairment9 and for other para-sports for athletes including swimming14 and judo.15

Track athletics for athletes with a vision impairment consists of multiple running events which can be separated into short distances (100m, 200m and 400m) and middle to long distance events (800m, 1500m, 5000m and Marathon). Athletes compete in the same class (T13, T12 or T11) regardless of race distance. There is some reason to believe that the impact of vision impairment might differ according to the nature of the race, for instance some races require navigation around corners while maintaining position in a lane, whereas other events do not (e.g., 100m). However, it remains unknown whether the impact of vision impairment on performance actually does vary depending on the event distance.

The current classification system for track athletics for athletes with a vision impairment requires athletes to be assessed using up to two different tests of visual function: monocular distance visual acuity and monocular visual fields3. Indeed, this is the same classification system used by almost all sports. Under this system, an athlete must meet a minimum level of impairment in order to be eligible to compete. These *minimum impairment criteria* (MIC) (or *minimum disability criteria*) should reflect the level of vision impairment that has an impact on an athlete’s performance in able-sighted track athletics. Vision impairment is different to physical impairment in that it is assessed with best correction (in the form of spectacles or contact lenses), whereas physical impairments are assessed without correction. Following confirmation that the athlete meets the MIC, and that there is an underlying medical condition that can explain the measured level of visual function, the athlete is allocated to one of three classes on the basis of their visual acuity or field: B3, B2 or B1, from the lowest to highest level of impairment, or more specifically in athletics, T13, T12 or T11 (see Table 1). The cut-off criteria that separate these classes were originally designed on the basis of the definitions of low vision and blindness outlined by the World Health Organisation.2 This means that there is yet to be any evidence to show that the classes reliably represent categories of impairment that have different effects on sport performance, and there is certainly no evidence to suggest that this represents the optimal way to structure competition for athletics for individuals with a vision impairment.

INSERT TABLE 1 ABOUT HERE

The aim of the current study was to obtain expert guidance on the specific needs for a sport-specific and evidence-based classification system for track athletics for individuals with vision impairment. The expert consultation took the form of a Delphi study, with opinions canvased from a panel of experts using a series of online questionnaires designed to guide sport-specific classification research in track athletics for athletes with a vision impairment. The Delphi method relies on a panel of experts who give their opinions in a series of consultation rounds. Following each round the opinions are summarised and fed back to respondents in subsequent round(s) in order to reduce disparity and achieve an expert consensus. Delphi analyses are often performed to identify areas where experts agree and there is a consensus in opinion, however, within this Delphi we were also interested in discovering areas which need further investigation before a track-athletics-specific classification system could be implemented, i.e. to identify controversial topics for which there is no clear and obvious agreement.

# METHODS

*Participants*

A panel was assembled comprising 17 participants with expertise in track athletics for athletes with a vision impairment. A list of potential candidates was compiled with the assistance of World Para-Athletics, the international governing body for para-sport athletics. From this list a panel was selected to maximise representation across sport roles and continents. All panellists possessed specific knowledge and/or expertise in athletics for athletes with a vision impairment as (i) an administrator, (ii) a current/former athlete, (iii) a coach/trainer, (iv) a classifier or (v) a sport scientist (Table 2). The panel all had expert knowledge of vision impairment and/or athletics, for example, the classifier worked in athletics for athletes with a vision impairment and was also an ophthalmologist. Participants completed all surveys in isolation and were masked with respect to other participants and their responses. Delphi reviews require a high level of language comprehension for accurate responses and so panel members were required to be proficient in English language or have access to a translator for assistance when responding to surveys. The research conformed with the tenets of the Declaration of Helsinki. The Faculty Research Ethics Panel at Anglia Ruskin University, Cambridge, UK gave ethical approval for the study and all panel members provided electronic informed consent to take part. There was no monetary compensation or incentive offered for participation.

INSERT TABLE 2 ABOUT HERE

*Procedures*

The study used the Delphi method: a structured, systematic process to gather the opinions of a panel of experts and, where possible, reach a consensus.16 Over a period of ten months, the panellists responded to three rounds of internet-based surveys (Qualtrics Research Suite, Qualtrics, Provo, Utah, USA) on a broad range of topics related to classification in para-athletics for athletes with a vision impairment. The initial survey was designed to (i) discuss the strengths and weaknesses of the present classification system in para-sport athletics, (ii) identify the aspects of vision that impact running performance and those components of a race that are likely impacted by vision impairment, and (iii) address issues specific to athletics for individuals with a vision impairment outlined in the position stand on classification.7 This study covered all short, middle, and long distance track athletics events (100m, 200m, 400m, 800m, 1500m, 5000m and Marathon distance).

The first survey was developed by the authors based on their previous experiences canvasing expert opinions on the classification of swimmers with vision impairment14 and in consultation with World Para Athletics. In the first survey the panellists were presented largely with open-ended questions. This approach helped establish the main areas of concern to the panellists, subsequently forming the basis of the subsequent surveys. As the process evolved, panellists were increasingly presented with closed questions, often with the option to agree or disagree with a statement. Due to the technical or event-specific nature of some of the questions, panellists always had an option to respond that they did not feel qualified to answer a question (e.g., an athlete competing in the 100m might not feel qualified to answer a question about the Marathon). In those cases, their responses were omitted from the calculation of consensus for that specific question. A potential limitation of the Delphi approach is that every panellist’s view counts equally irrespective of their level of expertise on the topic. The option for panellists to respond that they didn’t feel qualified to answer a question was chosen to minimise the influence of votes from those without expertise in a specific topic. Panellists were given the opportunity to explain their answer for each question and could raise any additional issues at the end of each survey. In each subsequent survey, panellists received a summary of the outcomes and main comments from the previous survey. Follow-up questions were devised to clarify previous questions that may have been unclear to the panel and/or to follow-up on related issues raised by the panel. Once consensus was reached on a particular topic, there were no follow-up questions on that topic in the subsequent round(s). In addition, when consensus was not achieved on a topic, the related questions were rephrased or clarified in the next survey based on the comments and answers provided by the panel. A summary of the final questions posed to the panel on each topic can be found in Appendix Table A1.

In this study, a minimum of 75% of panellists were required to agree or disagree with a statement to reach consensus, which is on the higher end of thresholds that are commonly adopted when using the Delphi approach.17,18 Panellists were given six week­s to complete and return their responses in each round. Responses from each survey were analysed and used to create the subsequent survey, resulting in a period of approximately ten weeks between each round.

# RESULTS

All 17 panellists completed the first survey. Fifteen of these panellists completed both the second and third survey. Each survey contained eight subsections that covered topics specific to classification in track athletics for athletes with a vision impairment and results are presented from each of the three survey rounds (see Appendix Table A1). We show how responses from one round led to the development of new questions for the subsequent round. Although we were most interested in the opinions of the experts on the panel, when consensus was reached, we indicate after which round it was obtained.

Section 1: *Aim of classification*

The aim of classification is 'to minimise the impact of eligible types of impairment on the outcome of competition'1; in other words, to ensure that the best athlete wins the competition rather than the athlete with the least severe impairment. The panel reached consensus (87%) in the first survey that the aim of classification is not entirely fulfilled by the current classification system for athletes with a vision impairment. Within this, the majority of the panel (62%) believed that the aim is partially fulfilled whilst 25% felt it is not fulfilled at all (see Appendix Table A1). The main issues raised by the panel concerning the current classification system were: (1) only visual acuity and visual field are measured during classification, while other aspects of vision might also affect running performance; (2) the current system is not specific for track athletics; (3) the current system is not specific to the conditions that athletes experience during training or competition (specifically that classification occurs under moderate lighting levels indoors whereas competition takes place outdoors where lighting levels can vary significantly); and (4) the vision tests currently used for classification have a degree of subjectivity and therefore are vulnerable to intentional misrepresentation whereby individuals could provide responses to make it appear as though their vision is worse than it actually is (to increase their chance of winning during competition).

The findings from Section 1 provides clear support for changes to be made to the way that track athletes with a vision impairment are classified and thus the development of an evidence-based and sport-specific system of classification.

Section 2: *Minimum impairment criteria*

The MIC represents the least severe level of impairment for which an athlete should become eligible to compete in a para-sport, and by definition should be the minimum level of impairment that significantly impacts performance in that sport.13 To meet the present MIC, athletes competing in track athletics for athletes with a vision impairment must have a visual acuity equal to or worse than logMAR 1.0 (6/60 or 20/200), and/or a visual field of 20 degrees radius or smaller.7 The panel reached consensus in the second survey that the current MIC would result in a significant decrease in performance in track athletics both for **visual acuity** (93% yes) and **visual field** (93% yes); though a number of panellists did express concern that the decrease in performance may depend on the specific area of the visual field lost. This suggests that a sport-specific MIC for track athletics should be at least as severe as it is presently.

In the second survey, we followed up on the concern that certain areas of the visual field may be more heavily relied on for athletic performance. The panel reached consensus (92%) that the location of an athlete's remaining visual field is important enough to be accounted for when setting the minimum impairment criteria (in contrast to the current approach where all areas of the visual field are treated equally). In the final survey, we sought clarification by asking the panel to rank the different areas of the visual field, from a list provided by the authors, in terms of the importance for optimal running performance. The panel indicated unanimously that central visual field is the most important for optimal running performance (see Appendix Table A1).

Section 3: *Sport classes*

*Appropriateness of the current class system*

When an athlete meets the MIC, they are then classified into a sport class. Track athletics for athletes with a vision impairment currently has three classes: T13, T12 and T11 (see Table 1). There was consensus (94%) in the first survey that more than one class is required.

In the first survey, we were interested whether the current class system allowed for the most equitable competition in all classes in terms of fairness, for all distances in track athletics. In track athletics for athletes with a vision impairment, athletes competing in the T11 class are required to run with a guide in competition, athletes in the T12 class are allowed but not required to do so, and T13 athletes are **not** allowed to run with a guide. We asked the panel to choose which of the following four options based would be fairest for track athletics (based on our prior experience of opinions in the sport): (1) the current arrangement (T13, T12, T11 as presently defined); (2) all athletes who use a guide (T11 and guided T12) should compete together in the same class, and all athletes who do not use a guide (T13 and non-guided T12) should compete together in another class; (3) all athletes who use a guide (guided T12 and T11) should compete together in the same class with unguided T12 and T13 athletes in separate classes; or (4) an alternative arrangement (provided by the panellists). The panel were spilt on this topic: some of the panel (23%) agreed that the current arrangement is the fairest; 47% suggested that guided T12/T11 athletes should compete together in one class and unguided T13/T12 in a separate class (but commented that the only way to make a single guided class fair would be to blindfold all athletes regardless of their T12/T11 classification status); 12% felt that guided T11/T12 athletes should compete in the same class with T13 and the remaining T12 athletes competing in separate classes; and 18% of the panel suggested that some other alternative arrangement would be more appropriate (see Appendix Table A1). On the issue of a single T12/T11 guided class, some panel members raised concerns that the T12 athletes may still have an advantage over T11 athletes in terms of training because they could gain time and cost advantages by training without a guide.

With regards specifically to short distance track athletics, the panel reached consensus (100m: 79%, 200m: 79%, 400m: 80%) in the first survey that the current class system provides the best option of the four posed to the panel. However, although the majority of the panel believed that the current class system provides equitable competition in the middle to long distance races, consensus was not reached (800m: 69%, 1500: 69%, 5000m: 63%, Marathon: 67%) (see Appendix Table A1). Although a consensual opinion was not attained, the main issues raised by the panel centred on the impact of guide runners in the middle to long distance races. This was proposed to largely be due to the additional logistical challenges of deriving training schedules convenient for both the runner and guide and how this might disadvantage those who required guidance during training and competing.

*Use of guides within the current class system/future system*

In the first survey, we wanted to clarify the perceived legitimacy of the current class system when considering guided running. As reported earlier, the panel did reach consensus that the current class system is suitable for short distance events, but there were concerns about suitability for the middle and long distances (800m, 1500m, 5000m and the Marathon). The panel did **not** reach consensus (58% yes, and 42% no) about whether the current classes allow for the most equitable competition in middle- and long-distance races when all athletes have equal access to a guide (see Appendix Table A1). Panellists indicated that it is inequitable for athletes who require a guide to compete against athletes who can run independently (a scenario that is currently possible in the T12 class). The main comments from the panellists were that: (1) guided T12 athletes are at a disadvantage when compared to unguided T12 athletes; and (2) all athletes who can run without a guide could equitably compete together. In the final survey, the panellists reached consensus (77%) in agreeing that: “middle/long distance races for athletes with a vision impairment should be run in two classes; one class for athletes who run with a guide while blindfolded, and one class for athletes who run without a guide and without a blindfold”. Empirical evidence would be required for such a statement (or change) to be implemented in an evidence-based system of classification.

In the second survey we also investigated whether guides provide athletes with a vision impairment any advantage *during* competition. When asked to consider the impact of a guide on running performance during *short distance* competition only (i.e., not taking training advantages into account), the panel did not reach consensus on whether a guided T12 athlete has an advantage over an unguided T12 athlete with the same level of vision (yes: 57%). Some panellists believed a guide facilitates a physical advantage while other panellists felt that guides restrain athletes and have a negative impact on optimal running form. In the final survey the panel did not reach consensus when asked if guided and unguided T12 athletes should complete against each other in the same class in short distance races (yes: 27%; no, unguided athletes have an advantage: 27%; no, guided athletes have an advantage: 46%). When considering middle to long distance events, the majority of the panel (71%) felt that a guided T12 athlete had an advantage over an unguided T12 athlete. The panellists commented that tactics in longer distance races are important to performance and guides can provide verbal coaching to the athlete on competitor position, track condition, lap times and drink stations (Marathon). In the final survey, the panel did not reach consensus when asked whether guided and unguided T12 athletes should compete together in the same class in middle/long distance events (yes: 33%; no, unguided athletes have an advantage: 14%; and no, guided athletes have an advantage: 53%) (see Appendix Table A1). This clearly demonstrates the need for research to investigate the potential performance benefits or detriments of guided running in the T12 class.

*Comparing athletes classified based on visual acuity or visual fields*

In the first survey, the panel could not agree whether an athlete classified on the basis of reduced visual acuity was at a relative (dis)advantage when compared to another athlete classified in the same class on the basis of reduced visual fields. In short distance races for both T13 and T12 athletes, generally, the panel believed either that (1) athletes with impairments to visual acuity will be at an advantage, or (2) that there is no relative advantage between athletes classified based on visual acuity or visual fields. Conversely, in the middle- and long-distance events, the panel generally believed either that (1) athletes with a visual field impairment would be at an advantage, or (2) there is no difference between athletes classified based on visual acuity or visual fields. With regards to the Marathon, the panel was completely divided. The main issue raised by the panel was that the (dis)advantage of an impairment to visual acuity over visual fields (or vice versa) is dependent on many factors, for example the location in which the loss of visual field has occurred.

Due to the differing opinions of the panel when considering the effect of an impairment to visual acuity or vision field, we developed this line of questioning further. In the second survey we questioned whether it should be possible for athletes to compete in the same class if they possess different types of impairment (i.e., some with visual acuity loss and some with visual field loss). The majority of the panel (62%) felt that athletes classified based on visual acuity and athletes classified based on visual field should compete together in the same class in short distance events. This was the same, albeit with less of a majority (55%), for the middle to long distance events. Similarly, to the section on minimum impairment criteria, the panel commented that the location of an athlete’s visual field loss will affect performance and thus sport class allocation. In the final survey, we asked the panel to consider whether there is any possible scenario in which an athlete classified based on their visual acuity and an athlete classified based on their visual field could **not** compete within the same class. The majority of the panel (70%) answered that there wasn’t any possible scenario (see Appendix Table A1).

Section 4: *Measures of visual function likely to impact running performance*

Classification is currently based solely on the assessment of monocular visual acuity and monocular visual field, but other aspects of visual function which are not currently assessed might also impact running performance and could be considered for inclusion in classification. In the first survey the panel did not reach consensus (yes: 62%) over whether the current test of **visual acuity** provides an appropriate test to assess the impact of VI on performance in track athletics. The panel also did not reach consensus (yes: 60%) over whether the current test of **visual field** provides an appropriate test to assess the impact of vision impairment on track athletics performance (see Appendix Table A1). The main comments from the panel were that: (1) the tests of visual acuity and visual field are presently performed in conditions that are not comparable to competition, more specifically there are a number of underlying ocular pathologies that may result in reduced performance in different lighting conditions; and (2) the present test of visual acuity is vulnerable to intentional misrepresentation because some athletes could intentionally underperform to give the impression that their impairment is worse that it truly is.

The panel reached consensus (80%) in the first survey that visual acuity and visual field are not the only measures of visual function that should be used for classification in track athletics for athletes with a vision impairment. Panellists were asked to indicate from a list which aspects of visual function they considered important enough to consider including in classification. Panellists were also provided with an opportunity to add other aspects of visual function that they believed to be missing, although no other measures were put forward. In the second survey, the panel then reached consensus on a number of aspects of visual function that are and are not important enough to consider for inclusion in classification (see Table 3). The panel agreed that visual acuity, visual field, contrast sensitivity and sensitivity to light were aspects of vision that were important enough to consider including in classification. In the cases of glare sensitivity, depth perception, dynamic visual acuity and motion perception, the panel could not agree on whether those measures might be important enough to include in classification. The panel agreed that colour vision need not be considered for inclusion in classification.

INSERT TABLE 3 ABOUT HERE

Section 5: *Classification procedures*Classification for athletes with a vision impairment is currently based on the results when the athlete performs vision tests monocularly using their *better eye* (i.e. the eye with the better visual acuity or visual field)*.* The panel reached consensus (81%) in the first survey that the current classification procedure is inappropriate and that athletes should be allocated a class based upon binocular assessment when using both eyes together. The panellists indicated that this would be more appropriate and better represents how athletes train and compete. Further to this, classification of vision impairment is also based on vision test results when an athlete wears their best optical correction. The panel reached consensus (77%) in the second survey that there is no scenario where a T12 or T13 athlete would **not** be able to wear their best optical correction during competition. Therefore, the panel reached consensus in the final survey (86%) that the current procedure of classification using best optical correction is appropriate for track athletics for athletes with a vision impairment (see Appendix Table A1). This is unlike other Paralympic sports such as judo or swimming, which have limitations or safety concerns surrounding the use of an athlete’s best optical correction during competition. This scenario would require athletes to compete with vision markedly worse than that displayed during classification.7 Such a finding calls for classification procedures to consider the specific individual differences between the Paralympic sports for athletes with a vision impairment.

Vision tests currently used for classification rely on subjective responses rather than being objective and therefore require athletes to give their best effort. This could make it easier for athletes to engage in intentional misrepresentation by deliberately underperforming on these tests. The panel reached consensus (93%) in the first survey that there are some track athletes with a vision impairment who intentionally misrepresent their level of vision impairment. In addition, 87% of the panel believed that there are some track athletes with a vision impairment currently competing who should be classified as ineligible for competition for athletes with a vision impairment but are found eligible because they have intentionally misrepresented their level of visual function. Strategies proposed by our expert panel for improving the current situation included the implementation of a reporting scheme that would allow classifiers to anonymously request further investigation of athletes who are observed outside of competition/classification to be able to perform tasks which could not be performed with their reported level of visual function.

Section 6: *Impact of vision impairment on specific aspects of track athletics performance*

In order to make classification sport-specific, it is important to understand which aspects of performance in track athletics might be affected by vision impairment. In the first survey the panel were presented with a list of performance parameters relevant to short distance events (100m, 200m, and 400m), and a separate list for middle to long distance events (800m, 1500m, 5000m, and the Marathon). The panellists were asked to choose those aspects of performance that they believed would become **worse** in the presence of vision impairment (Tables 4 and 5). Panellists were given the opportunity to add further performance parameters to the provided lists, but no additional parameters were added.

INSERT TABLES 4 AND 5 ABOUT HERE

The performance parameters deemed to be negatively impacted by the presence of vision impairment, irrespective of the severity, were used to create a model comprising of the three components of a track athletics race: the start; open running; and finish (Figures 1 and 2). The findings highlight that there are distance-specific challenges for track athletes with a vision impairment.

Panellists indicated a belief that in shorter distance events, the open running and finish sections of the race were affected more by vision impairment. Over shorter distances, the finish section represents a larger proportion of the overall race than in longer distances, so it is plausible that any effect on overall performance would be greater. The panel decided that in short distance races the time out of the blocks (i.e. the start of the race) is not negatively impacted by vision impairment, presumably because vision impairment does not impair the ability to respond to the starter’s gun, and that each athlete has their own designated lane. This is an important measure as there is strong evidence to suggest in elite athletes with normal vision that time out of the blocks is a clear determinant of sprint performance.19,20

INSERT FIGURE 1 ABOUT HERE

INSERT FIGURE 2 ABOUT HERE

In middle and longer distance events it was the start and the open running sections that were thought to be negatively affected by vision impairment. Over longer distances more weighting would be allocated to the longer open running sections rather than the finish. Furthermore, the panel agreed that there were aspects of the start, for instance navigation around and relative to competitors, which are affected by vision impairment, but not in the short distance races. This may be due to athletes needing to navigate themselves into a desired position in the longer races, i.e. at the front of the group, whereas short distance races are in marked lanes and start from blocks.

Section 7: *Impact of a congenital compared to an acquired impairment*Track athletes with a vision impairment currently compete in the same sport class irrespective of when they acquired their vision impairment, however, it has yet to be determined whether this stance needs to be updated in any revised classification system. A previous Delphi study across all sports for athletes with a vision impairment reported that in some sports the age at which a vision impairment is acquired might influence the impact of impairment on performance because it may affect an athlete’s ability to acquire the skills necessary for optimal performance in that sport.9 However, the relative impact of a congenital vs acquired impairment is likely to depend on the complexity of the skills required for that sport, with congenital impairments thought to more severely impact the performance of more complex movements.

In the first survey, the panel were asked whether the age at which vision impairment was acquired should be considered during classification. The majority of the panel (67%) believed that the age of acquisition should **not** be considered in classification (see Appendix Table A1). Comments included that the performance difference would be too small to justify inclusion in classification, with several panellists adding a caveat that they don’t know how this would be achieved during classification. When presented with a scenario where two track athletes had the same level of vision impairment, but one athlete had a congenital impairment (present from birth) and the other had an acquired impairment (developed as an adult), the panel could not reach consensus over which athlete would have an advantage (congenital: 14%; acquired 43%; impact equal for both athletes 43%) (see Appendix Table A1). The panellists commented that: (1) athletes with a congenital impairment have already adapted to their condition giving them an advantage over someone who has an acquired condition; (2) athletes with an acquired impairment may have had more chance to gain, with the benefit of vision, motor skills fundamental to running in early life; and (3) if both athletes have a history in sport, then there is no advantage between acquired or congenital impairments. Due to the comments from the panel, in the second survey we expanded on this topic and modified the questioning to address the severity of vision impairment (i.e. separately considering completely blind athletes and those with some remaining vision) to better understand whether the severity of vision impairment would alter the opinion of the panellists. The majority of the panel agreed that running performance would be impacted by the age at which an athlete acquired their impairment both for athletes who are completely blind(73%)and for athletes that have some remaining vision(64%). Moreover, in this second survey, the panel reached consensus (78%) that the age of acquisition should be included in classification, if it impacted the ability of an athlete to acquire running skills. Specifically, the panel stated that the benefits of accounting for the age of acquisition would in that case outweigh the complexity of including this factor in classification. This view supports the need to investigate further the relationship between the age of impairment acquisition and the ability to acquire sport-specific skills in track athletics.

Section 8: *Use of blindfolds*

Athletes in the T11 class are required to wear a blindfold during competition, regardless of any remaining vision, to ensure equitable vision during competition. In the present study, we asked the panel for their opinion about the appropriateness of blindfolds in track athletics for athletes with a vision impairment. Consensus was reached in the first survey that the use of blindfolds is a fair (100%) way of equalising the impact of impairment on performance in the T11 class. In addition, the panel reached consensus that blindfolds were the most appropriate (82%) method available to equalise the impact of impairment on performance. Furthermore, the panel reached consensus (93%) in the second survey that it would be inappropriate for *all* athletes (T11, T12 and T13) to wear blindfolds in order to create a single class (see Appendix Table A1). The main comments raised by the panel were that it would be unfair and undesirable to limit the vision of T13 and T12 athletes as it would increase the level of impairment of some athletes and deny them the use of any residual visual function.

More specific questioning revealed that the panel's views on the use of blindfolds also aligned with their views on the use of guides. In the second survey the majority of the panel agreed (71%) that all athletes who currently need a guide would be able to equitably compete together in one class. When asked if these athletes should compete with a blindfold if a single class for all guided athletes did exist, the panel agreed (80%) that they should all wear a blindfold.

# DISCUSSION

Efforts are currently underway to develop a sport-specific classification system for each of the eleven sports for athletes with a vision impairment currently included in the summer and winter Paralympic programmes. The aim of this Delphi study was to obtain expert guidance on the specific needs of a sport-specific and evidence-based classification system for track athletics for individuals with vision impairment. The main focus was on establishing guidance on: (1) the aspects of vision likely to affect running performance; (2) the components of a track athletics race most likely to be affected by vision impairment; and (3) how to best address practical and procedural matters around the assessment of visual function for classification.In addition, we wanted to identify any issues that generated a range of opinions that should be addressed in classification research. The panel of 17 experts reached clear consensus that the system presently used to classify track athletes does **not** fulfil the IPC’s aim to minimise the impact of vision impairment on the outcome of competition. Here we highlight some of the emergent issues worthy of consideration in research to design a sport-specific system of classification for track athletics for individuals with vision impairment.

*Aspects of vision that are likely to affect running performance*

There was clear agreement that visual acuity, visual field, contrast sensitivity and light adaptation were aspects of visual function likely to affect running performance. The location of an athlete’s remaining visual field was also deemed important for running performance, specifically whether the central visual field is intact. This seems intuitive given the importance of the central binocular visual field in mobility function.21

Contrast sensitivity is correlated with visual function in non-sport related activities such as driving22,23 and also in sports such as rifle shooting.24 Indeed Wood et al. reported that contrast sensitivity was a better predictor of driving performance than visual field,23 and furthermore, contrast sensitivity is correlated with gait measures such as stride length in older inividuals.25 In daily living, reductions in contrast sensitivity are associated with increased falls in the elderly.25 Accordingly it seems reasonable to expect that contrast sensitivity loss would be related to decreases in running performance.

Little is known about how sensitivity to light affects running performance; it would seem likely that in poor light adaptation would impact performance (e.g. in retinitis pigmentosa or ocular albinism). Empirical research is required to determine whether a test of sensitivity to light should be included in classification.

*Components of a track athletics race likely to be affected by vision impairment*

Specific components of short, middle- and long-distance track athletics were selected by the panel as being negatively affected by a vision impairment (see Figures 1 and 2). There was not one single factor of a track race which was exclusively affected by vision impairment; rather, several aspects are likely to be negatively impacted, and these were thought to be distance-specific to some extent, with some deemed to be affected more greatly in shorter distance races compared to middle/long distances, and vice versa.

When assessing performance parameters in sighted track athletics, researchers focus on physiological and biomechanical parameters including reaction times,19,20 ground reaction forces,26 step-frequency,26,27,27 and the relationships between lower limb strength, force and power velocity. 20,26,29

The most common performance parameters measured in fully sighted long-distance running are also physiological or biomechanical in nature but differ significantly from those measured in shorter distances. Running economy,30 stride length,31 VO2max itself,32 and velocity at VO2max33 have all been shown to be determinants of long-distance running performance. The race elements identified in athletes with a vision impairment were not necessarily parameters that would be considered limitations to optimal race performance for sighted athletes, including an impairment in the ability to navigate around competitors at the start, but measures which might be helpful in understanding how an athlete’s race performance correlates with their level of vision impairment. Distance specific models were developed to better consider how these components might affect performance (Figures 1 and 2). These models can then be tested empirically to determine which aspects of vision impairment relate to decreases in performance in track athletics.

In order to identify any biomechanical differences between athletes with and without a vision impairment, and therefore understand how the various model parameters (Figures 1 and 2) might vary in importance, biomechanical analysis is recommended. This would provide evidence of the impact of a vision impairment on distinct biomechanical components of running. However, it is noteworthy that these performance parameters may depend more on motor learning and input from the guide, if used, rather than the impairment itself.

*Considerations when assessing vision for classification*

An important finding from this study is the panellist’s belief that classification should be performed binocularly, with the athlete wearing their optimal optical correction. This differs from the current classification procedure with monocular testing performed using the athletes ‘best eye’. A shift to binocular testing during classification would be representative of in-competition conditions.

The panellists also raised significant concerns over the subjective nature of the current vision tests included in classification, which many believed left the process vulnerable to intentional misrepresentation. Intentional representation was a serious concern amongst the experts consulted in our study. There was an almost unanimous opinion that there are some track athletes with a vision impairment who should in fact be ineligible for competition but misrepresent their visual function so that they meet the eligibility criteria and can therefore compete. Tweedy *et al*. (2014) stated that reliable, precise and ratio-scaled measures of impairment would assist in methods to detect intentional misrepresentation.5 Recent research has confirmed that participants are successfully able to “cheat” the current test of visual acuity (Berkeley Rudimentary Vision Test), however, their responses were significantly more variable when doing so.34 The inclusion of more in depth and wide-ranging tests in the classification process (particularly tests designed to prevent misrepresentation), and comparison with individual athletes’ previous classification data, would presumably improve the detection of intentional misrepresentation.

*Other issues raised relating to athletics for athletes with a vision impairment*

*Guides and blindfolds*

The majority of the panel considered that track athletes requiring a guide runner should compete in the same class, and that those athletes should also all compete blindfolded. All athletes running without a guide should compete in a separate class(es). The impact that running with a guide has on performance is currently unknown, with a clear need for research to investigate the potential performance benefits or detriments of guided running, specifically for those in the T12 class who have some remaining vision. Potentially adverse factors associated with guided running raised by the panel include the technical challenge of moving whilst physically tethered (by the arm) to another person, and avoiding knocks and pulling against each other, particularly in the short distance races where attaining and holding maximum speed is of paramount importance. On the other hand, in middle to long distance races, the panel indicated that a guide is able to provide verbal feedback and encouragement to the athlete with a vision impairment whilst racing and assist with race strategy and keeping rhythm.35 For all race distances, training with a guide is logistically more challenging than training without one.

Although enforcing all athletes to compete blindfolded would provide a method of equalising visual impairments across all athletes, it was abundantly clear that our panel did not consider this to be appropriate because it would undermine the athletes’ capabilities and deny them of whatever remaining visual function they did have. The panel highlighted that, instead of making the competition more equitable, within track athletics for athletes with a vision impairment this would invalidate the values of Paralympic sport and could introduce unwanted psychological and emotional effects by temporarily increasing the impairment of many athletes during competition. This confirms that efforts to improve the current classification system, with multiple classes for different levels of impairment, is preferred and would be constructive for athletes with a vision impairment.

*Impact of a congenital compared to an acquired impairment*

There was majority agreement that the age at which an athlete acquired their vision impairment affects performance, though it was unclear whether this should be considered during classification. From the expert consultation across all sports for athletes with a vision impairment it was thought that the potential impact of congenital impairment on performance is likely to differ depending on the complexity of the motor skills required for the sport. While research into this is limited, it is known that children with vision impairment have less developed motor skills than children with normal vision,36 and also exhibit postural deviations, perhaps as they have not been able to see how others stand and move. Thus, it seems logical that motor skill acquisition would be superior in an athlete who was already a runner prior to gaining their vision impairment because they will have had the chance to observe other athletes running and imitate this in their own movements. Moreover, the longer the period of their life an athlete was sighted, the more visual exposure they will have had to running styles and hence greater opportunity for learning and applying motor skills. Nonetheless, any impact would vary on an individual basis, depending on how well the athlete adapted to loss of sight, their athletic performance prior to their sight loss, and their training, support and mindset after sight loss. Accounting for the age of impairment acquisition would be complex, but the views of our expert panel suggest that it would be worthwhile if there were to be evidence to suggest that vision impairment impairs the ability to acquire motor skills relevant for track athletics. Interestingly, in a recent Delphi study to guide classification of Paralympic swimmers with vision impairment, panel members unanimously agreed that a person who had acquired their vision impairment later in life has an advantage over someone who has the same level of vision but had their vision impairment from birth.9

Overall, the Delphi analysis presented here highlights the need for a sport-specific evidence-based classification system for track athletics for athletes with a vision impairment. Further research is needed to empirically test the relationship between the measures of vision and running performance outlined by the panellists in this paper. This research will in all likelihood require the development of new tests of visual function, or the adaptation of current tests, to cater for this population of athletes with moderate to severe sight impairment. Within our expert panel, consensus was not reached on a number of issues, namely the impact of running with a guide in the middle to long distance races, the relationship between age of impairment acquisition and the gaining of running skills, and whether the current class system provides equitable competition for different race distances. If future research does show specific issues impacted by visual impairment that are related to specific race distances, then different classification systems for different race distance may be required. This lack of clear opinion indicates that these points of contention require scientific investigation in order to clarify how they should be addressed in the classification process. Subsequently, an evidence-based system can be developed that outlines which tests of vision should be included in classification, along with the most appropriate number and structure of sport classes to be adopted for competition. The issue of intentional misrepresentation during classification also needs particular attention.

# DISCLOSURE

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INSERT APPENDIX TABLE A1 ABOUT HERE

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**Figure Legends**

Figure 1: Model of the performance parameters negatively impacted by vision impairment for short distance events

Figure 2: Model of the performance parameters negatively impacted by vision impairment for middle to long distance events