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The prevalence of physical activity among informal carers: a systematic review of international literature

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Abstract:	Background Previous research has found physical activity levels among carers are low, and that carers are at greater risk of physical inactivity than their non-carer counterparts. Alternatively, research also suggests providing care may be associated with higher levels of physical activity than the general population, due to physically active care duties. Overall, there is a need to better understand the physical activity levels of carers to develop appropriate interventions and policies to promote health and well-being among carers. Aim To systematically review studies reporting the prevalence of physical activity among carers. Method PubMed, SPORTDiscus, PsycINFO, and CINAHL, OpenGrey, Google and Google Scholar were searched for eligible articles. Results A total of 77 observational studies and 20 interventional studies were included. In low quality studies which examined adherence to physical activity guidelines, 16%-84% of carers self-reported not meeting PA guidelines, whilst medium-high quality studies found 29.9% -99%< of carers self-reported not meeting physical activity guidelines. However, it is not clear if carers are at higher risk of physical inactivity than non-carers. Studies which compared the physical activity levels of carers to non-carers reported conflicting results, and the association between hours of carers time, burden or strain, and physical activity was not consistent across studies. Conclusion Further research with validated measures of different physical activity domains (leisure time, daily physical activity, caregiving duties), mental and physical health, is needed to better understand the physical activity behaviours of carers, and the associated health outcomes.
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The prevalence of physical activity among informal carers: a systematic review of international literature

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Abstract

Background: Previous research has found physical activity levels among carers are low, and that carers are at greater risk of physical inactivity than their non-carer counterparts. Alternatively, research also suggests providing care may be associated with higher levels of physical activity than the general population, due to physically active care duties. Overall, there is a need to better understand the physical activity levels of carers to develop appropriate interventions and policies to promote health and well-being among carers.

Aim: To systematically review studies reporting the prevalence of physical activity among carers.

Method: PubMed, SPORTDiscus, PsycINFO, and CINAHL, OpenGrey, Google and Google Scholar were searched for eligible articles.

Results: A total of 77 observational studies and 20 interventional studies were included. In low quality studies which examined adherence to physical activity guidelines, 16%-84% of carers self-reported not meeting PA guidelines, whilst medium-high quality studies found 29.9% -99%< of carers self-reported not meeting physical activity guidelines.

However, it is not clear if carers are at higher risk of physical inactivity than non-carers. Studies which compared the physical activity levels of carers to non-carers reported conflicting results, and the association between hours of carers time, burden or strain, and physical activity was not consistent across studies.

Conclusion: Further research with validated measures of different physical activity domains (leisure time, daily physical activity, caregiving duties), mental and physical health, is needed to better understand the physical activity behaviours of carers, and the associated health outcomes.

Key words: Care, physical activity, health, well-being

1. Introduction

An informal carer may be defined as an individual 'who looks after a family member, partner or friend who needs help because of their illness, frailty, disability, a mental health problem or an addiction and cannot cope without their support. The care they give is unpaid' [1]. Across the international literature the terms carer and caregivers are often used interchangeably, for the purpose of this review we will use the term carer to refer to studies which use the term carers or caregivers. Research has found providing care is associated with poorer physical and mental health outcomes including higher levels of perceived stress, depression, poorer quality of life, lower self-rated health [2-4] and mortality [5]. Given that the global population is aging [6], and that health and social care systems are under increasing pressure [7], it is likely the need for informal carers will increase. Therefore, it is essential to develop a better understanding of the health behaviours which may mediate the relationship between providing care and poor health. One such behaviour is that of physical activity (PA).

PA is defined as 'any movement produced by skeletal muscles that requires energy expenditure – including activities undertaken while working, playing, carrying out household chores, travelling, and engaging in recreational pursuits' [8]. Adequate levels of PA has been shown to provide multiple health benefits including reduced risk of cardiovascular disease, colon and breast cancer, anxiety and depression, and improved cognitive health, wellbeing and sleep [9,10]. It is recommended by the World Health Organisation (WHO) that adults (age 18+) engage in 150 minutes of moderate, or 75 minutes of vigorous PA throughout the week [11]. Research which has explored carers' PA levels have reported mixed results. For example, a study of 12,044 carers across 50 US states reported carers engaged in higher levels of PA than non-carers [12]. Another study which included 546,156 carers representative of the US state of Wisconsin, found no difference between the PA levels of carers and non-carers [13]. In addition, there is evidence PA levels of informal carers vary substantially across countries. A cross-sectional study of 38 low- and middle-income countries reported the prevalence of low PA among informal carers ranged from 8.4% in Pakistan to 81.8% in Mauritania [14]. Moreover, a review of the prevalence of PA among UK carers found no studies which reported the levels of PA among UK based carers, thus highlighting the need for an international review to further investigate PA among carers [15]. Overall, there is a need to synthesise the data reporting PA levels of carers, to assist the development of interventions and policies which can promote PA to improve the health and well-being of this population.

Given this background the aim of this review is to explore the prevalence of PA among carers globally.

2. Method

Search strategy

The review protocol was registered with PROSPERO 2020 (CRD42020184204) available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020184204 .To identify studies which reported the prevalence of PA among informal carers electronic data bases, PubMed, SPORTDiscus, PsycINFO, and CINAHL, were searched for English language articles published from database inception to 16th September, 2021. The search terms (Title/Abstract) were "Carer" OR "caregiver" OR "family member" OR "informal carer," AND "physical activity." Grey literature was also searched using the term "physical activity of carers" in OpenGrey, Google and Google Scholar. The title and abstracts of all search results were screened by two trained reviewers (NK and JH) to determine articles eligible for full text screening. Any disagreements between reviewers were resolved by a third reviewer (RL). An equal number of articles eligible for full text screening were then allocated to each reviewer (RL, NK, JH, LS, MT, JDL, DP, PS) for screening, each article was screened independently by two reviewers, any disagreements between reviewers were resolved by a third reviewer. In addition, the reference lists of all articles included in the final review were hand searched for relevant studies.

Study selection

There were no restrictions on study design or date. To provide a comprehensive overview of this research topic, all existing literature were included, e.g. primary research studies, systematic reviews, meta-analyses, letters, guidelines, websites etc.

Studies were excluded if they were not written in English language, examined the PA levels of parents for children without additional needs, or examined the PA levels of bereaved carers. Studies conducted among participants who were caring as part of their professional vocation i.e. they were paid for caregiving, were also

excluded. In addition, studies which examined the PA levels of UK based carers were excluded as this is the focus of another published review [15].

Data extraction

The first author, year of study/report, aim of the study, geographical area, study population (e.g. age and gender of carers and condition of individuals being cared for), sample size, study design, and the PA levels of carers were extracted by one reviewer (R.L) and verified with a second reviewer (N.K). Table 1 includes all intervention studies, Table 2 includes studies which examined overall PA levels (i.e. examined multiple PA domains and provided an overall PA figure or did not specify a PA domain), Table 3 includes all studies which explicitly measured exercise engagement or leisure time PA, and Table 4 includes all studies which used objective PA measurement tools.

3. Critical appraisal

Each study was appraised using the CASP checklists [16], with a different or adapted checklist being used dependent on the study design. Following critical appraisal, studies were categorised by one reviewer (RL) as 'low' 'medium' or 'high' quality, and checked by a second reviewer (NK). Observational studies were judged on their ability to answer the research question 'what is the prevalence of PA among carers?', and not on the overall quality of the study. The quality assessment of observational studies classified 3 studies to be high quality, 45 studies to be medium quality and 28 studies to be low quality. Overall, observational studies were deemed to be high quality if they used random sampling to recruit carers into the study, the sample was representative of a defined population of carers (i.e. carers for cancer patients, carers from a selected country), and used a validated measure of PA. Studies which used a validated measure of PA to assess PA in a small non-representative sample were considered medium quality, as well as studies which did not use a validated tool to measure PA but used a large representative sample size to collect PA data. Studies which were low quality were more likely to be small scale studies which did not use a validated measure of PA, or did not provide specific details about the level of PA engaged in (i.e. excluded details about the time engaged in PA).

Intervention studies were deemed to be of a higher quality if they were randomised control trials (RCTs), minimised risk of bias and used a validated tool to measure PA. Intervention studies which did not use a validated tool to measure PA, and studies in which a low proportion of eligible participants agreed to participate, were considered lower quality studies. Overall, 10 intervention studies were classified as medium quality and 10 intervention studies were classified as low quality.

4. Results

The database search yielded 2937 results, of these 1803 duplicates were removed. The grey literature search yielded two results. Following abstract and title screening, 261 articles were eligible for full text screening. Of these articles, 86 were eligible for inclusion, and 11 additional eligible studies were found in the reference lists of articles included in full text screening (Figure 1), yielded a final total of 97 included studies (77 observational and 20 interventional studies).

Observational studies

Eligible studies which reported the PA levels of carers, included one qualitative study which included 10 [17] participants and 76 quantitative studies, with sample sizes ranging from 9 [18] to 546,156 [19] participants. In addition, we found 20 PA intervention studies which reported PA levels/adherence to exercise among carers pre and post intervention, with sample sizes included ranging from 9 [20] to 318 [21] participants. The majority of studies included a higher proportion of female carers than male carers and were conducted among older adults (aged over 65+ years). The most common sub-groups of carers included spousal carers, adult-children caring for their parents, and parents caring for children who have additional care requirements.

Various tools were used across observational studies to measure PA levels. Studies used a range of self-report tools to assess PA (n=71/77 studies) including the International Physical Activity Questionnaire (IPAQ), Physical Activity Scale for the Elderly (PASE), the Rapid Assessment of Physical Activity (RAPA) questionnaire, the Godin Leisure Time Exercise Questionnaire (GLTEQ), Habitual Physical activity questionnaire (HPAQ), Simple Physical Activity Questionnaire (SIMAQ), Human Activity Profile (HAP), Global Physical Activity Questionnaire (GPAQ), 7-day Physical Activity Recall (7-day PAR) scale and activity

logs/diaries, Physical Activity Questionnaire score (QS) for the elderly, the Health Promoting Lifestyle Profile II (HPLP-II) questionnaire and study specific PA questions. Objective measures of PA used in studies included accelerometers, pedometers and heart rate monitors to assess PA levels. Studies examined various domains of PA including habitual or general overall levels of PA, leisure time/exercise PA, PA associated with caregiving duties and objectively measured PA.

Intervention studies

Of the twenty intervention studies included [20-39], all of the PA interventions were conducted in high income countries (Table 1). The mean age of participants ranged from 44.2 to 70.2, and the percentage of female participants ranged from 53% to 100%. The majority of studies (14/20) were conducted among carers for people with dementia or other forms of memory impairment.

Self-reported PA levels

Forty-nine studies examined general PA levels which was not specified as leisure time PA or exercise [12-14, 40-85] (Table 2). The majority of these studies were conducted in high income countries, and three studies were conducted in middle /low-income countries.

Leisure time and exercise PA

Twenty-nine studies examined leisure time or exercise PA [17,18,73, 86-111] (Table 3). The majority of studies examining leisure time PA among carers were conducted in high income countries, with only two studies conducted in middle income countries and [91,107] no studies conducted in low-income countries. Studies used a range of questionnaires to assess leisure time PA which were not comparable. However, three studies used the GLTEQ, and four studies used the HPLP-II to assess leisure time PA.

Objectively measures PA levels

Seven studies used accelerometers to measure of PA [47, 112-117], with two of these studies collecting both self-reported and objectively measured PA (Table 4). Studies using objective measurement tools were all conducted in high income countries, and had small sample sizes ranging from 6-33 participants, which limits the generalisability of the studies' findings. In addition, studies reported different outcomes associated with PA, including steps, metabolic equivalent of task (METs), and minutes of PA per week, thus making it difficult to draw comparisons between studies using objective measurement tools.

PA association with caregiving

Overall, it is not clear if carers are less active than non-carers. A study, which used national survey data, from 38 low- and middle-income countries, found that carers engaged in more overall PA than non-carers [14]. Concurrently, a recent study conducted on a population in Hong Kong reported that carers engaged in more overall PA than patients [72]. Another study which used survey data from 50 US states, also reported carers had a lower risk of physical inactivity than non-carers aged 18-64, and that there was no significant difference in PA between carers and non-carers aged over 65 years [12]. In contrast, six studies, including one study which used national survey data to examine leisure time PA among carers [107] found that non-carers engaged in more PA than carers [43,54,77, 79,111]. One study found that PA was significantly lower among carers for children with down syndrome, however no differences were observed between carers for children with other developmental difficulties or health care needs and non-carers [92]. Nine studies, five of which used data from population based surveys, found no significant differences between carers and non-carers' PA levels [13,32,53, 57, 62,65, 66,78, 110] and one study, which specifically measured leisure time PA, found no significant difference between carers and non-carers [88]. Two studies reported leisure time PA was lower in carers compared to non-carers, however one study reported overall PA was the same [97], whilst the other study reported PA associated with household chores was higher among carers [73].

In addition, studies reported mixed associations between care responsibilities and PA levels. Five studies reported PA was positively associated with caregiving hours [12,14,78] or carers burden [105,113]. However, other studies found no association between PA and carers burden [78] or trade-off between caregiving hours and PA [88]. A study of carers in Ghana, India and Russia reported lower PA among carers reporting moderate caregiving, however no other associations between caregiving burden level and PA were found [60]. In contrast, three studies reported lower levels of PA associated with hours spent caregiving [90], higher caregiving distress

[55], financial strain and/or upsetting care recipient behaviour [70]. One study reported lower levels of exercise and scheduled PA associated with carers strain [40].

5. Discussion

Overall, this systematic review examining PA prevalence amongst informal carers, including 77 observational studies and 20 intervention studies found among low quality studies, 16% [78] to 84% [74] of carers self-reported not meeting WHO PA guidelines. Medium to high quality studies reported 29.9% [14] to 99%< [91] of carers self-reported not meeting WHO PA guidelines. Globally, it is estimated that 28% of adults do not meet PA guidelines [118]. Therefore, the results from medium to high quality studies would suggest that carers s engage in lower levels of PA compared to the global population average. However, studies which compared PA levels of carers to non-carers with similar demographic characteristics reported conflicting results, and the association between hours of caregiving time, burden or strain, and PA was not consistent across studies.

Five studies in this review reported that PA was positively associated with caregiving hours or carers burden. It is plausible that PA is associated with caregiving in some studies due to caregiving responsibilities being physically active, and that PA may increase the burden felt by carers. For example, assisting with activities of daily living, cleaning and doing errands could all be forms of physically active caregiving duties. In this sense the role of informal carer may also have similar qualities to physically demanding occupations, for example low levels of autonomy over work performed and insufficient recovery time. Previous research suggests that occupational PA is detrimental to health [119], whilst leisure time PA is beneficial for health [120, 121]. In contrast, workplace PA interventions can have health benefits for physically active workers [122]. The theories which explain the different relationship between leisure time PA, occupational PA and health outcomes, may also be applicable to caregiving duties. For example, a continuously elevated heart rate due to physically active care duties throughout the day may lead to persistently elevated blood pressure, in comparison to a bout of leisure time PA where heart rate is elevated for a shorter period and then followed by a fall in blood pressure. Restricted ability to engage in leisure time PA may explain why a study of dementia carers found high activity restriction was associated with higher blood pressure, despite no association between overall PA and blood pressure [49]. In addition, mental health benefits associated with leisure time PA, such as social interactions and stress relief, may not be associated with caregiving PA, if caregiving related PA is perceived as a burden and contributes to social isolation. There was evidence to support this theory from one small scale study in the review, which reported that domestic PA approached a significant correlation with depressive symptoms, whilst leisure time PA did not [64]. Further research in large scale, representative populations are needed to identify if there are significant associations between caregiving PA, leisure time PA and health outcomes, in particular in low-income countries where no studies examined carers leisure time PA. Overall, PA policies and programs which encourage social support, improve fitness, and allow adequate rest and recovery for carers, may be more effective at promoting health benefits than encouraging carers to increase overall levels of PA.

The review also found that there was a large range in the PA levels of carers, and eight studies found no difference between carers and non-carers' PA levels. In addition, although three studies reported that the majority of carers (42%-60%) self-reported reducing their PA since becoming a carer, 7.9%- 14% of carers reported increasing their PA levels, since becoming a carer [45,77,108]. As previously discussed, it is not clear how carers PA behaviour influences long term health outcomes, or if overall PA levels may mask differences in the type or intensity of PA that carers engage in. However, these findings may provide evidence in line with previous research which suggests carers may not be at risk of poorer health behaviours than non-carers, and that providing care may be beneficial to health [123]. Future research should aim to understand the influences of behaviour change among carers who increase or sustain their PA levels when they become carers. The transition from non-carer to carer may be an opportunity to establish healthy habits, in particular as previous research has reported an association between previous exercise engagement and future exercise engagement among carers [124].

PA interventions among carers

A review of PA intervention studies among carers published between 1975 and 2012, reported that PA intervention studies are limited by their small sample size and results are predominantly generalisable to older female dementia carers. The current review also found that more recently published studies evaluating PA interventions among carers have the same limitations as noted by Loi and colleagues in their review [125]. Another review of PA intervention studies aimed at carers, published between 1985-2014, found evidence from

moderate quality studies, that PA interventions can significantly increase PA levels among carers [126]. Whilst the studies in this review build on previous reviews which have found evidence to support that PA interventions can effectively increase PA among carers, future research should consider recruiting carers with a broader range of characteristics, including male, younger, non-Caucasian carers. Furthermore, this review has highlighted that not all carers engage in low levels of PA, and that care responsibilities may be associated with increased levels of PA. Future interventions should evaluate the influence of PA interventions on caregiving PA and leisure time PA, and the associated health outcomes. PA interventions may be more feasible for a wider range of carers if they aim to balance moderate-high intensity exercise with the duties of caregiving. For example, previous studies have shown that including carers and care recipients in PA interventions may be beneficial for carers, whilst providing a non-exercise or respite service for carers may also be beneficial to carers health [127]. In addition, carers who are already classified as 'active' due to high levels of active caregiving duties, may still benefit from PA interventions due to the unique benefits associated with different forms of exercise, e.g. social support, mindfulness, improved cardiorespiratory fitness.

6. Limitations and areas for future research

A limitation of this review included the wide range of tools used to assess PA across studies and different definitions of PA within the literature, thus making it difficult to draw comparisons between studies. Furthermore, there were no studies which used objective measures of PA among large scale representative samples of carers. In addition, it was not always clear from the description of PA measurement tools if the PA measured was leisure time PA or all forms of PA including physically active caregiving duties. Future research should consider using objective measurement tools, alongside validated self-report tools to assess the time, frequency, intensity and type of PA that carers engage in. Longitudinal research is required to observe the relationship between changing carer responsibilities and PA characteristics over time.

7. Conclusion and recommendations:

The PA of carers varied across studies, and it is not clear if carers are at higher risk of physical inactivity than then general population. Further research comparing PA levels of non-carers and carers is required to understand which carer population groups are at a higher risk of not achieving the benefits of PA. For example, age, gender, care recipient diagnosis, geography, socioeconomic group may put select groups of carers s at a higher risk of poor health behaviours. Longitudinal research is also required to understand the relationship between changes in care responsibilities and PA behaviour. For example, periods of illness in the home or hospital, availability of carers support and respite services, may influence the carers PA. In addition, studies in this review used a variety of tools and measured different domains of PA, so future research should use validated measures of PA to assess different PA domains and their association with health outcomes.

The findings of this review have led to the proposal of three key recommendations for future policies and interventions:

1) PA guidelines should be tailored to informal workers, including carers, who may be engaged in PA during their unpaid work role, but are not achieving the benefits of leisure time PA.

2) Interventions should support carers to balance caregiving PA with PA which benefits their health and wellbeing. For example, PA interventions which are aimed at carer and care recipient dyads, or PA opportunities offered to carers as part of respite services.

3) Further research in a diverse range of carers, in particular male, black and ethnic minority groups, and younger adults (aged 18-65) are needed to develop effective PA interventions which target a range of carers.

4) Interventions and policies should aim to support the transition from non-carer to carer status to help establish positive PA habits.

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Table 1: Physical activity intervention studies conducted among carers

Author	Aim of study	Sample size of carers	Gender and age of participants in intervention group	Condition of care recipient	Country	Tool used to measure PA an PA levels reported.	Study design	Quality
Castro, C. M., et al. 2002 [22]	To describe factors associated with retention and adherence to an exercise program for women carers.	Intervention group: 51 Control group: 49	All female Mean age (SD): 62.16 (9.33)	Dementia	USA	Tool: Monthly exercise logs On average, the exercise group adhered to 74% of their prescribed exercise sessions (approximately three exercise sessions per week). The average duration of the sessions was 35.77 minutes (SD =22.97).	RCT	Medium
Connell, C. M., et al. 2009 [23]	To examine the effect of a telephone based exercise intervention.	Intervention group: 86 Control group: 71	All female. Average age (SD): 66.8 years (9.4)	Dementia	USA	Tool: telephone interview at baseline, and follow up interviews at 6 and 12 month: self-reported one-week recall of time spent on three types of exercise Baseline: 20.4% reported engaging in	RCT	Low

						vigorous PA for at least 20 minutes, three times a week The intervention increased exercise behaviour among less-active participants, however the increase in exercise was not sustained at 12 months.		
Cothran, F. A., et al. 2017 [24]	To examine racial differences in carer mental health outcomes and PA following an PA intervention.	Intervention group baseline: African American (n = 56) Caucasian (n = 138) Intervention group 12 months: African American (n = 34)	Baseline: African American: Mean age (SD): 57.69 (11.39) Female: 51 (91%) Caucasian: Mean age (SD): 63.54 (11.72) Female: 108 (78%)	Dementia	USA	Tool: Questionnaire African American: Mean total minutes of PA (SD): At baseline 710.38 (637.61), at 12 months 481.71 (307.34) Mean minutes of moderate PA (SD): at baseline 60.23 (88.14), at 12 months 63.97 (91.86)	RCT	Low

		Caucasian (n = 80) Control group: n=211				Caucasian: Mean total minutes of PA (SD): at baseline 690.36 (529.24), at 12 months 833.21 (493.67) Mean minutes of moderate PA (SD): at baseline 69.76 (124.36), at 12 months 106.21 (151.22)		
Crane, T E. Et al. 2021 [25]	To assess feasibility, acceptability, and preliminary efficacy of an integrated symptom management and lifestyle intervention to improve nutrition and PA among Latina cancer survivors and their informal carers.	45 Latina cancer survivor and carer dyads Carers in intervention: n=21 Carers in control: n= 13	Intervention group: Mean age (SD) 57.67 (17.34) Control group: Mean age (SD): 46.62 (19.01)	Cancer	USA	Tool: The Women's Health Initiative (WHI) Physical Activity Questionnaire. Mean minutes of PA (SD): Baseline intervention group: 193.8 (212.9) Baseline control group: 201.5 (169.2) Intervention group post 12-week intervention: 167.39 (49.36)	Randomised pilot trial	Low

						Control group: 237.83 (46.94)		
Cuthbert, C. et al. 2018 [26]	To examine the effects of a 12-week exercise program on mental health and physical health outcomes among family carers of cancer patients.	Intervention group: n= 38 Control: n= 39	Exercise group: Female: 63.2% Male: 36.8% Mean age (SD): 51.42 (12.6) Control: Female: 59% Male: 41% Mean age (SD): 55.03 (11.76)	Cancer	Canada	Tool: GLTEQ Baseline PA levels exercise group mean (SD/range): Strenuous activity: 0.53 (1.2/0–5) Moderate activity: 1.76 (1.98/0–6) Mild activity: 3.24 (3.08/0–15) Total weekly score: 23.26 (18.96/0–96) Baseline PA levels control group mean (SD/range): Strenuous activity: 0.59 (1.83/0–10) Moderate activity: 1.95 (2.48/0–7) Mild activity: 2.95 (2.45/0–7) Total weekly score: 23.90 (25.21/0–122) Intervention adherence measured by PA logs	RCT	Medium

						and class attendance. Mean attendance of 24 classes across 12 weeks: 69% GLTEQ: Exercise group, mean total weekly score at 12 weeks (SD): 38.5 (21.1) Control group, mean total weekly score at 12 weeks (SD): 22.37 (18.37)		
Farran, C.J., et al. 2016 [27] Farran, C. J., et al. 2016 [28]	To examine the secondary benefits of an individualized PA intervention on improving dementia family carers' subjective burden, depressive symptoms and positive affect. To compare the effects of the Enhancing Physical Activity Intervention (EPAI) group, versus the Caregiver Skill Building Intervention (CSBI)	Baseline: n=211 12 months: n=126 (Intervention group, n=106; Control group, n=105)	Female: 82% Male: 18% Mean age (SD): 62 (13)	Dementia	USA	Tool: Community Health Activities Model Program for Seniors (CHAMPS) Intervention group Total PA minutes/week: baseline =670±512, 12 months (n=53)= 811 ±534 Moderate PA minutes/week: baseline= 207 ±377,	RCT	Medium

	control on PA and physical function.					12 months (n= 53)= 248 ±275 Control group Total PA minutes/week: baseline= 762 ±651, 12 months (n=73)= 638 ±395 Moderate PA minutes/week: baseline=193 ±279, 12 months (n=73) =123 ±207		
Farran, C. J., et al. 2008 [29]	To examine the effects of lifestyle PA in carers for people with Alzheimer's disease.	14	Female: 53% Male: 47% Mean age (SD): 65.4 (10.8)	Dementia	USA	Tool: Community Healthy Activities Model Program for Seniors (CHAMPS) survey. Total PA minutes/week: Baseline (n=15)= 205 ±182 3 months (n=12-14)= 161 ±102	Interrupted time series	Low

						6 months (n=14)= 188 ±97 Moderate PA minutes/week: Baseline (n=15)= 164 ±216 3 months (n=12-14)= 161 ±145 6 months (n=14)= 95 ±62 Waist Actical Baseline (n=15): Light activity:1866 ±696 Moderate activity: 969 ±657 Vigorous activity: 0 6 months (n=12): Light activity: 1122 ±741 Moderate activity: 395 ±359 Vigorous activity: 0.07 ±0.26		

Guzman, J., et al. 2018 [30]	To describe PA levels of Latina carers of children with developmental disabilities and identify if one educational session led to changes in PA.	18	Mean age: 44.2	Developmental disabilities	USA	Tool: Accelerometer Participant's average step count significantly decreased at post-test (M=11092, SD=2705) from baseline (M=12055, SD=3247).	Before-after study	Low
Hill, K., et al 2007 [31]	To evaluate the health benefits of a PA program for older carers.	116	Female: 98 (85%) Male: 18 (15%) Mean age (SD): 64.4 years (7.9)	Unwell, frail or disabled.	Australia	Tool: Human Activity Profile (HAP) questionnaire HAP-adjusted activity scores: Baseline: 63.7 (10.5) 6 month follow up after completion of PA program: 66.5 (11.0)	Before-after study	Low
Hirano A., et al 2011 [32]	To examine the effectiveness of moderate exercise three times per week for 12 weeks, on the subjective sense of burden, the daily PA levels, and subjective physical symptoms in elderly carers.	Intervention group:17 Control group:14	Intervention group: Female: 11 Male: 6 Age (SD): 72.6 (4.0) Control group: Female: 10	Dementia	Japan	Tool: PA Questionnaire score (QS) for the elderly and pedometers Changes in QS between the baseline and the follow-up, mean ± S.D: Intervention group: 0.9 ± 0.0 ($p<0.01$**) Control group: −0.3 ± −0.0 ($p<0.02$*)	RCT	Low

			Male: 4 Age (SD): 75 (4.6)			The average numbers of steps per day: Exercise group: 9017.0 ± 1927.0 Control group: 5766.3 ± 2602.7 ($p < 0.01$).		
King, A.C., et al 1997[b] [33]	To examine levels of PA and related health practices and preferences, and to evaluate a home-based exercise program aimed at older family carers.	Intervention group: 11 Control group: 12	Female: 20 Male: 3 Age exercise group: 60.2 ± 8.1 Age control group: 63.2 ± 6.4	Alzheimer's disease or another memory related disorder	USA	Tool: PA logs and Casio PB-1000 pocket computer to record PA levels and ambulatory heart rate data. Average adherence to the exercise prescription across 4 months: 79.2 ± 28.7% (range = 12.5-122%). PA levels among those assigned to exercise intervention group increased by approximately 95 minutes per week.	RCT	Medium
King, A.C., et al 2002 [34]	To determine the health and quality-of-life effects of moderate-intensity exercise among older women family carers.	Intervention group: 45 Control group: 40	All female Mean age (SD): 62.2 (9.3)	Dementia	USA	Tool: community Health Activity Model Program for Seniors (CHAMPS) physical activity questionnaire PA increased in intervention group (baseline-adjusted 12-month mean, 2.1 kcal/kg/day). Those in	RCT	Medium

						the PA group engaged in an adjusted mean of 5 hours per week of all PA.		
Prick, A., et al. 2015 [35]	To investigate the effects of this multi-component dyadic intervention on carers' mood, burden, general health, and salivary cortisol levels.	Intervention group: 57 Control group: 54	Female: 38 (66.7%) Male: 19 (33.3%) Mean age (SD): 73 (9.91)	Dementia	Netherlands	Exercise compliance (3 times a week for 30 minutes): 3 or more time weekly exercise: 23 (40.4%) 1–2 times weekly exercise: 16 (28.1%) 0 times weekly exercise: 18 (31.6%)	RCT	Medium
Ptomey, L. T., et al. 2019 [20]	To evaluate the feasibility of a group video conference approach for increasing moderate PA in adults with dementia and their carers.	9	Female: 33% Male: 67% Mean age (SD): 67 ± 13.0	Dementia	USA	Tool: HR monitor Baseline (average of weeks 1-3) MPA: 166.4 ± 54.7 minutes per week. Weekly MPA and light PA increased from the start (weeks 1–3) to end of the study (weeks 10–12) in carers 49 minutes (30%) and 11.6 minutes per week (3%) retrospectively .	Before and after study	Low
Puterman E., et al. 2018 [36]	To examine the effect of aerobic exercise on changes in telomerase levels and telomere lengths in inactive carers.	68 (Waitlist: n=34,	Waitlist age (SD):63.3 (6.4)	Dementia	USA	Tool: Adherence to intervention was validated by accelerometery	RCT	Medium

		Intervention: n=34)	Intervention age (SD):59.3 (5.7) Female waitlist: (%): 25 (73.5) Female intervention (%): 30 (88.3)			Adherence to 24 week aerobic exercise intervention: 81% of participants completed at least 80% of the exercise intervention.		
Regan, K., et al. 2019 [21]	To evaluate a weekly exercise and mental stimulation program aimed at carers and people with dementia.	318	Female: 305 (77.8%) Mean age (SD): 70.2 (9.7)	Dementia	Canada	Tool: Questionnaire Physical activity frequency, intensity and duration increased among participants, however PA levels were still below recommended PA guidelines.	Before and after study	Medium
Teri. L., et al. 2020 [37]	Describes and evaluates the multicomponent exercise plus behavioral/psychosocial intervention (Reducing Disability in Alzheimer's Disease-North West).	Enrolled: 255 Completed intervention and 3 month post treatment assessment: 207	Female: 190 (74.5%) Mean age (SD): 68.7 (12.4)	Dementia	USA	Tool: Telephone interviews Baseline: Mean days exercise ≥ 30 min (0–7): 2.89 (SE=0.13)	Interrupted time series	Medium

						Mean exercise ≥ 60 min past week (0/1): 0.62 (SE= 0.02) Exercised increased significantly from pre- to posttreatment (0.21, [95% CI: 0.11 to 0.31], p < .001) but no significant increase at 13 months post treatment.		
Lin XY., et al. 2020 [38]	To evaluate carers experience with an exergame and the impact on wellbeing.	18	Mean age (SD, range): 49.27 (15, 22-70) Male: 2 Female: 16	Dementia	USA	Tool: Fitbit Alta HR activity tracker There was a significant increase in weekly steps (p=.05) 83% logged in to the exergame at least 3 days per week during the 6 week study period.	Before and after study	Low
Van Puymbroeck, M. & Hsieh, PC. 2010 [39]	To compare the effects of a mindfulness stress reduction intervention (which did not include moderate-vigorous physical activity or walking) and a walking intervention on wellbeing among female carers.	18 (Mindfulness stress reduction intervention: n=12, walking intervention: n=6)	Female: All Mindfulness stress reduction intervention age (SD,	Not specified.	USA	In the walking group, one attendee dropped out, the remaining 5 participants had a mean weekly attendance of 77.8% (range 63-100%).	Comparative intervention	Low

			range): 57.29 (5.76, 50-66) Walking intervention age (SD, range): 62.4 (12.82, 49-78)					

Table 2: Self-reported overall PA levels of carers

Author	Aim of study	Sample size of carers	Gender and age of participants	Condition of care recipient	Country	Tool used to measure PA an PA levels reported.	Study design	Quality
Aggarwal, B., et al. 2009 [40]	To determine the prevalence and predictors of carers strain and to evaluate the association between caring and Cardiovascular disease (CVD) lifestyle and psychosocial risk factors among family members of recently hospitalized CVD patients.	129	Female: 104 (81%) Male: 25 (19%) Carers with high carer strain, mean age: 49 Carers with low carers strain, mean age: 50	Cardiovascular disease (CVD)	USA	Tool: Questionnaire Carers with high carer strain (mean): 17 minutes of PA per day, 1.02 days per week. Carers with low carer strain (mean): 29 minutes of PA per day, 2 days per week.	Longitudinal analysis of participants enrolled in a RCT.	Medium
Bailey, J. M., et al., 2020 [41] Bailey, J. M., et al., 2019 [42]	Two studies used the same participant sample and reported the same PA data. The study by Bailey, J.M at al., (2020) explored carers expectations of health services for people with a mental health condition. Bailey, J.M., et al., (2019) aimed to identify modifiable health risk behaviours among carers for people with a mental health condition.	144	Female: 117 (81%) Male: 27 (19%) 18–54: 35 (24.6%) 55–74: 92 (64.8%) 75 and over: 15 (10.6%)	People with a mental health condition	Australia	Tool: Questionnaire 57.6% (n=76) engaged in inadequate levels of PA (Participating in at least 30 minutes of PA that increase heart rate/breathing, 5 or more days per week was deemed adequate)	Cross sectional	Medium

Barbosa, F., et al., 2020 [43]	To assess the prevalence of co-residential care and the health impact of carers on carers age 50 and over living in Portugal.	141	Male: 40.4% Female: 59.6% Mean age (SD): 63.26 (8.57)	Requires regular assistance with personal care, e.g. washing, getting out of bed, or dressing.	Portugal	Tool: Questionnaire Physically active: 14.9% Physically inactive (never practised vigorous or moderate PA): 85.1%	Longitudinal	Medium
Bechard, L. E., et al., 2020 [44]	To explore the perceptions, experiences, and beliefs relating to PA among older adults with cognitive impairment and their carers..	10	Female: 5 (50%) Male: 5 (50%) Mean age (SD): 65.6 (17.4)	Alzheimer's disease and mild cognitive impairment	Canada	Tool: 2 participants 65< years completed the IPAQ, all other participants completed the PASE. On average carers engaged in 440 min/week moderate-vigorous PA (MVPA) (SD = 502 min/week; range 0–1215 min/week).	Cross sectional	Low
Beesley, V. L., et al. 2011 [45]	To explore behaviour changes and their determinants in carers of women with ovarian cancer.	101	Female: 25% Male: 75% Mean age (range): 58 (22-84)	Ovarian cancer	Australia	Tool: Active Australia survey Sufficiently active (150 min per week): 44%	Cross-sectional	Medium

						Insufficiently active (1–149 min per week): 27% Sedentary (no PA): 27%		
Madore, S.L. 2016 [46]	To examine the relationship between carers' neuroendocrine and immune responses, psychological processes, patient-carer relationship characteristics, carers' health behaviors and quality of life during caring.	51	Mean age (SD): 62.9 (7.85) Female: 39 (77%) Male: 12 (23%)	Multiple Myeloma	USA	Tool: Questionnaire Mean minutes per week (SD): 315 (324.59)	Cross sectional	Medium
Carpenter, C. A., et al., 2020 [47]	To characterize the weight status, sedentary behavior, and PA of carers of individuals with Alzheimer's disease.	47	Female: 87% Male: 13% Mean age (SD): 57.5 (7.9)	Alzheimer's disease	USA	Tool: IPAQ (n=47) 3.1 + 3.3 hours per day of moderate-to-vigorous PA.	Cross sectional	Medium
Castro, C. M., et al., 2007 [48]	To examine health behaviors in a sample of rural family carers.	147	Women: 25% Men: 75% Age (SD): 49.12 (18.02)	Sick or frail	USA	Tool: Questionnaire Active (moderate-intensity activities 5 or more days per week for at least 30 min per day, or vigorous intensity activities 3 or more days per week for at least 20 min per day): 33%	Cross sectional	Medium

						Under-Active (some PA but under the recommender guidelines): 41% Inactive (reported no PA): 24%		
Chattillion, E. A., et al., 2013 [49]	To test the Pleasant Events and Activity Restriction (PEAR) model to explain level of blood pressure (BP) in a sample of elderly dementia carers.	66	Female: 50 (75.8%) Mean age (SD): 71.19 (8.71)	Alzheimer's disease or another form of dementia	USA	Tool: RAPA questionnaire RAPA score mean (SD): 3.52 (1.58) A number of less than 6 on the RAPA questionnaire suggests participants are not meeting PA guidelines.	Cross Sectional	Medium
Fakolade, A., et al. 2018 [50]	To identify the determinants of perceived need, and barriers to co-participation in PA among people with multiple sclerosis (MS) and the family carers.	46	Mean age (SD): 51.6 (8.7) Female: 37% Male: 63%	Multiple Sclerosis	Canada	Tool: IPAQ Carers engaged in PA for an average of 3.7 days/week (SD = 2.6) and spent 94.4 min/week (SD = 58.6). 12% of carers met PA guidelines.	Cross sectional	Medium
Farrugia, T., et al. 2019 [51]	To examine differences in the participation of Australian women, aged 50 years and over, with and without care responsibilities, in self-	93	All women 50–54 years: 37.6% 55–59 years: 21.5%	Disability or older people (aged 65 years and over).	Australia	Tool: IPAQ-SF IPAQ- SF vigorous activity subscale: 0 minutes	Cross sectional	Medium

	selected health promoting activities, self-reported mental health and participation in PA.		60-64: 17.2% 65-70: 12.9% 70+: 10.8%			IPAQ- SF moderate activity subscale: 60 minutes IPAQ- SF walking: 210 minutes		
Gallant, M. P., et al. 2003 [52]	To examine the mediating role of health behaviours in the relationship between neuroticism and depressive symptoms among spouse carers.	233	Male: 109 men (47%) Female: 124 (53%) Mean age: 68 years (range 30-92)	Dementia	USA	Tool: Questionnaire Almost 50% of carers were classified as sedentary.	Cross sectional	Medium
González-de Paz, L. et al., 2011 [53]	To measure the impact of disease, health-related habits, and risk factors associated with informal carers.	515	Female: 63.1% Male: 36.9% Mean age (SD): 58.01 (15.12)	Individuals with a functional limitation or disability unable to self-care.	Spain	Tool IPAQ: Low PA: 160 (46.9%) Moderate PA: 110 (32.3%) Vigorous PA: 71 (20.8%)	Cross sectional	High
Gottschalk, S., et al., 2020 [12]	To compare the health behaviours of informal carers/dementia carers to non-carers, and identify factors associated with health risk behaviours.	Carers: n=12,044 (of whom 1214 were dementia carers)	Carer: Female: 63% Mean age (SD): 56.1 (15.5) Dementia carers: Female: 66.2% Mean age (SD):59.7 (13.8)	Someone who has a health problem or disability which required care.	USA	Tool: Telephone interviews Insufficiently active (i.e. not meeting PA guidelines of 150 minutes of moderate-vigorous PA) Carers:43.2% Carers for people with dementia: 43.7%	Cross sectional	Medium

Gusi, N., et al. 2009 [54]	To assess the health-related quality of life and physical fitness of female carers compared with non-carers.	54	All female Mean age (SD): 60.6 (6.6)	Dementia	Spain	Tool: Questionnaire Physically inactive (never walked at least 30 minutes per day): 74.2%	Cross sectional	Low
Hipólito, N., et al., 2020 [55]	To explore the relationship between distress and PA in informal carers of patients with COPD, and the influence of carers' (age, sex) and patients' (age, sex, lung function) characteristics and caring duration on this relationship.	50	Female: 44 (88%) Male: 6 (12%) Mean years (SD): 62.7 (9.8)	Chronic obstructive pulmonary disease	Portugal	Tool: Habitual PA questionnaire (HPAQ). The median HPAQ score was 4.8 (Q1–Q3: 4.3–6.3). PA-Sport:2.3 (2.0–3.3) PA-Leisure: 2.6 (2.3–3.0)	Cross sectional	Low
Hirano, A., et al. 2011 [56]	Identify factors associated with lower PA in elderly carers of dementia patients.	50	Age (SD): 73.3 (4.2) Male: 18 Female: 32	Dementia	Japan	Tool: PA questionnaire (QS) for the elderly Total QS score: 3.9 ± 2.7 Household activity scores: 2.1 ± 0.5 Sport activity scores: 1.2 ± 2.4 Leisure activity scores: 0.6 ± 1.6	Cross-sectional	Low
Hoffman, G. et al. 2012 [57]	To examine health behaviours among baby boomer carers and non-carers.	5688	Mean age (SD): 53.59 (0.11) Female: 59.8%	Not specified.	USA	Tool: Questionnaire Population reporting either at least 3 days/week and 20 min/day of vigorous leisure	Cross sectional	Medium

						activity or at least 5 days/week and 30 min/day of moderate leisure activity: 79.5%		
Jacob, L., et al., 2020 [14]	To examine the association between informal carers and PA in low and middle income countries.	Approximately 39,841	Female: 50.7% Mean age (SD): 38.6 (16.1) years	Physical or mental illness, or disability, or old and weak.	38 low and middle income countries	Tool: International PA Questionnaire (IPAQ) Low PA (i.e. participants who did not meet PA guidelines of 150 minutes moderate-vigorous PA per week): 29.9% (95%CI = 29.1%–30.8%).	Cross sectional	High
King, A. C., et al 1997 [58]	To examine the PA levels of carers and compare them to non-carers.	103	Female: 73 Male: 30 Mean age (SD): Female: 72.4 (5.7) Male: 73.0 (5.6)	Sick or frail	USA	Tool: Telephone interviews Reported engaging in PA on three or more times a week which was sufficient to increase their heart rate and breathing rate: Female: 6.7% Male: 17.6%	Cross sectional	Medium
Laditka, S. B. et al., 2012 [59]	To examine beliefs about promoting cognitive health among Filipino Americans who care for persons with dementia, their awareness of media	25	Female: 24 (95.8%) Male: 1 (4.2%) Mean age (SD): 58 (12.8)	Dementia	USA	Tool: Questionnaire Met PA guidelines (engaged in PA which increased	Cross sectional	Low

	information about cognitive health, and their suggestions for communicating such information to other carers.					heart rate or breathing for at least 30 minutes on most days each week): 40%		
Lambert, S. D. et al., 2017 [60]	To determine the level of burden experienced by carers, explore associated factors and assess whether carers' and non-carers' health differed.	Ghana: 143 Russia:270 India:490	Ghana: Male: 68 Female: 75 Age: 50-59: 76 60-69:37 70<:30 India: Male: 222 Female: 268 Age 50-59: 259 60-69: 167 70<: 64 Russia: Male: 88 Female: 182 Age 50-59: 101 60-69: 80 70<: 89	Primary person providing care to an adult in their household in the past 12 months (excluding children and deceased) .	Ghana Russia India	Tool: GPAQ Mean minutes PA per day (SD): Ghana: 198 (180) India: 174 (178) Russia: 247 (177)	Cross sectional	High
Lee, M. H., et al. 2020 [61]	To examine the indirect effects of several health-promoting behaviors on the relationship between parenting stress and health-related quality of life in mothers of children with cerebral palsy.	180	Female: all participants Mean age (SD): 39.7 (4.7)	Mothers of children with Cerebral Palsy	Korea	Tool: Survey-Korean version of Health Promoting Lifestyle Profile -II included a sub scale to measure PA. PA score (Mean= 1.53, SD= 0.57)	Cross sectional	Low

Lim, K., et al., 2005 [62]	To examine factors associated with PA in the New South Wales adults aged 65+.	Participants caring for someone = 665	There was no subgroup analysis reporting the age and gender of the group which reported caring for someone.	Not specified	Australia	Tool: Telephone survey Adequate levels of PA: 338 Inadequate levels of PA: 327 (An adequate level of PA was defined as at least 30 min of walking, moderate or vigorous activity on 5 or more days in the last week.)	Cross-sectional	Medium
Litzelman, K. et al. 2014 [13]	Evaluate the association between caregiving, stress, and caregiver strain and a marker of cellular aging (relative telomere length).	546,156	Female: 63.6% Male: 36.4% Mean age (SD): 51.6 (12.7)	Long term illness or disability	USA	Tool: Questionnaire (Leisure time and transportation related PA) Mean MET-minutes/week (SD): 2,030.6 (3,011.6)	Cross-sectional	Medium
Litzelman, K., et al., 2018 [63] **Error! Bookmark not defined.**	To assess the correlations among health behaviors and coping strategies in a population of lung and colorectal cancer carers.	1482	Female: 75% Over 50: 73%	People who have had lung or colorectal Cancer.	USA	Tool: Questionnaire At least 150 minutes per week of moderate PA: 43% No moderate PA: 23%	Cross sectional	Medium

						Some level of non-exercise daily activity: 81% Low activity ("sit during the day and do not walk about very much"): 16%		
Loi, S. M., et al. 2016 [64]	To identify previously unexplored factors associated with depression among older carers.	202	Female: 74.3% Male: 25.7% Mean age (SD): 70.8 (8.5)	Not specified	Australia	Tool: Questionnaire Mean total PA (minutes) (SD): 155.0 (57.5–360.0) Mean Leisure-PA MET hours (SD): 7.0 (1.1–15.5) Mean domestic-PA MET hours (SD): 0.0 (0.0–5.0)	Cross sectional	Medium
Madaleno, T. R., et al., 2019 [65]	To evaluate mood, lifestyle and the presence of cardiovascular risk factors in older women carers of patients with Alzheimer´s disease dementia compared to non-carers living in the neighbourhood.	31	All female Mean age (SD): 69.4 (6.5)	Alzheimer's disease	Brazil	Tool: Questionnaire 29% did not engage in regular PA (at least twice a week).	Case control	Low
Marquez, D. X., et al., 2012 [66]	To examine and compare PA, PA preferences, psychosocial determinants of PA, and mental health indicators between older non-exercising carers and non-carers.	24	Mean age (SD): 68.6 (9.1) Female: 75%	Alzheimer's disease or another form of dementia.	USA	Tool: PASE PASE mean (SD): 148.6 (81.3)	Cross sectional	Medium

Mazanec, S. R., et al., 2011 [67]	To describe health promotion behaviors and work productivity loss in informal carers of individuals with advanced stage cancer.	70	Mean age: 57.01 Female (%): 49 (70) Male (%): 21 (30)	Cancer	USA	Tool: Questionnaire Carers reported: Never doing 30 minutes moderate PA: 16 (22.9%) 30 minutes of moderate PA 1 day per week: 7 (10.0%) 30 minutes of moderate PA 2–3 days per week: 22 (31.4%) 30 minutes of moderate PA more than 3 times per week: 25(35.7%)	Cross sectional	Medium
Mazanec, S et al. 2015 [68]	To describe the impact of the cancer experience on the health behaviors of survivors' family members and to determine factors associated with family members' intentions for health behavior change.	39	Female: 18 Male: 21 Age: 57.18	Cancer	USA	Tool: Questionnaire 30 minutes of daily moderate-intensity PA in the past month: Never: n = 2 1 day per week: n = 10 2-3 days per week: n = 16 More than 3 days per week: n= 11	Cross sectional	Medium
McKeon, G et al., 2020 [69]	To examine the health impact of friends and family providing informal	30	Female (%): 23 (77) Male: 7 (23)	Mental health	Australia	Tool: SIMAQ Mean (SD)	Cross sectional	Low

	care to emergency service workers.		Age (%): 18–30: 5 (17) 31–40: 9 (30) 41–50: 6 (20) 51–60: 9 (30) 60+: 1 (3)			Sedentary time (hours/day): 13.2 (4.5) MVPA (min/week): 127.3 (157.9) Walking (min/week): 73.8 (74.7) Meeting health guidelines (>150 min/week) n (%): 9 (30)		
Mochari-Greenberger, H., et al. 2012 [70]	To determine whether carer burdens are associated with lifestyle behaviors 1 year following the hospitalization of a family member with CVD.	423	Age, y, mean (SD) 48.7 (13.5) Female: 284 (67%)	Hospitalized CVD patients	USA	Tool: Questions adapted from the validated Behavioral Risk Factor Surveillance System (BRFSS) survey PA which works up a sweat ≥4 days/week:118 (28%)	1-year nonexperimental prospective analysis	Medium
Mohanty, I., et al. 2019 [71]	To examine the influence of carer's PA, smoking and drinking status, social connectedness and workforce engagement on their health status.	The number of carers varied from 566 (wave 7) to 989 (wave 12).	Carers' age ranged from 15 to 92 years with an average age of 52 years across all waves.	Disabled/elderly relative	Australia	Tool: Questionnaire PA levels Not at all:10.52% Less than once a week:15.81% 1 to 2 times a week: 23.66% 3 times a week: 16.07%	Longitudinal	Medium

						More than 3 times a week: 33.94%		
Ng, S. et al. 2021 [72]	To investigate the relationship between PA and heath related quality of life in patient-carer dyads	233	Patients: 57.4 (10.4) Carers: 53.6 (12.7)	Cancer	Hong Jong	Tool: IPAQ Mean (SD): 7.6 (1.2)	Cross-sectional	Low
O'Connell, M. E., et al. 2015 [73]	To understand the PA and exercise levels and attitudes towards PA and exercise among carers and patients at a memory clinic.	43	58% of carers and patients were female. Mean age of caregiver (SD): 63.59 (10.61)	Patients at memory clinic	Canada	Tool: Questionnaire Engaging in no weekly PA and exercise (n): 16 (43%) Engaging in some PA and exercise but below recommended weekly guidelines (n): 18 (41%) Engaging in PA and exercise that meets or exceeds weekly guidelines (n): 9 (16%)	Cross sectional	Low
Osaki, T., et al. 2016 [74]	To examine chronic fatigue among carers for people with dementia.	44	Female: 77% Male: 33% Age: 69.0 (60.0–75.0)	Dementia	Japan	Tool: PASE PASE median (interquartile range) PASE total: 29.6 (93.6–161.9) PASE-L (leisure time PA): 14.9 (5.0–25.8)	Cross sectional	Medium

						PASE-H (Household PA): 85.0 (85.0–121.0) PASE-W (Work-related PA): 0.0 (0.0- 0.0)		
Paek, M. S., et al. 2018 [75]	To examine variables which may be associated with head and neck carers' physical and psychological well-being.	33	Female n (%): 27 (81.8) Male n (%):6 (18.2) Mean age (SD): 60.0 (11.2)	Head and Neck cancer	USA	Tool: Mail or telephone survey ≥3 days PA/week: Yes: n=22 (66.7%) No: n=11 (33.3%)	Cross sectional	Low
Post, D et al. 2021 [76]	To understand how movement behaviour and health behaviours of carers of veterans relate to carers' physical and psychological well-being.	28	Female: 96.4% Mean age (SD): 61.6 (12.7)	Veterans	Australia	Tool: International PA Questionnaire short form (IPAQ-SF) Mean minutes of self- reported PA undertaken in the previous week: 179.33 (SD = 220.71, range=10-780 min)	Cross sectional	Low
Rha, S. Y., et al. 2015 [77]	To describe the caregiving burden and health-promoting behaviors of the family carers of cancer patients and to determine the relationship between carer burden and health-promoting behaviors.	227	Male: 44 (19.4%) Female: 183 (80.6%) Mean age (SD): 46.6 (11.98)	Cancer	Korea	Tool: Questionnaire Time spent in moderate-intensity PA was estimated as 351.82 ± 297.55 min/week (range 60-840). 16.3% participated in 75≤ minutes of	Cross-sectional	Medium

						vigorous PA per week. 3% participated in ≥150 min/week moderate per week.		
Snyder, S. A. et al., 2020 [78]	To compare the psychological distress, burden, and health behaviors of dementia carers and non carers over 2 years.	122	Mean age (SD): 71.72 (8.85) 61.48% women	Alzheimer's	USA	Tool: Questionnaire Baseline PA score mean (SD): 77.64 (61.33) 2 years post baseline PA score mean (SD): 81.8 (49.00)	Longitudinal	Low
Stacey, A.F., et al. 2019 [79]	To compare the biomedical health profile and morbidity of adult carers with non-carers.	191	Male (n): 78 Female (n): 113 Age group (n): 40-59: 92 60<: 99	Disability, frail, aged, a chronic mental or physical illness.	Australia	Tool: Questionnaire No activity: n= 49 Activity but not sufficient (less than 150 minutes of walking, moderate and/or vigorous activity) :n= 71 Sufficient activity (150 minutes or more per week) :n= 58	Cross sectional	Medium
Steel, J. L., et al. 2019 [80]	To examine psychosocial and behavioral predictors of metabolic syndrome,	104	77% female Mean age (SD): 59.5 (12.8)	Cancer	USA	Tool: IPAQ	Cross sectional	Medium

	an intermediate endpoint of CVD.					Mean METs (SD) range: 5646.06 (7640.71) 0–46,357		
Tung, W C. 2003 [81]	To determine whether constructs from the transtheoretical model (TTM) were applicable to Taiwanese family carers PA and explore factors which affect the TTM.	108	Female: 61 (65.5%) Male: 47 (43.5%) Mean age (SD): 52.24 (15.41)	Mental illness receiving home care from a psychiatric hospital	Taiwan	Tool: Questionnaire Mean hours of PA for the past two weeks (SD): 30.57 (38.91), range= 0-200	Cross sectional	Low
von Känel, R. et al. 2011 [82]	To test the hypothesis that cardiometabolic risk is attenuated when carers are relieved from caring stress when the care recipient transitions out of the home.	119	Female: 69.7% Male: 30.3% Mean age (SD): 78.5 (8.1)	Alzheimer's	USA	Tool: Rapid Assessment of PA scale (RAPA) PA score, mean ± SD: Baseline: 3.59 ± 1.64 3 months post transition (either death or placement of spouse): 3.56 ± 1.73 12 months post transition: 3.30 ± 1.72	Longitudinal	Medium
von Känel, R. et al., 2011 [83]	To test the hypothesis that regular PA would moderate cardiometabolic risk in dementia carers.	115	Female: 69.6% Male: 30.4% Mean age (SD): 73.8 (8.2)	Alzheimer's disease.	USA	Tool: Rapid Assessment of PA scale (RAPA) Total PA score: 5.14 ± 2.97 Light PA score: 2.97 ± 1.4 Moderate PA score: 1.62 ± 1.53 Strenuous PA score: 0.55 ± 1.10	Cross sectional	Medium

Willette-Murphy, K. et al. 2009 [84]	To evaluate for differences in subjective and objective measures of sleep between physically active and inactive female family carers of oncology patients.	68	All female Inactive group Mean age (SD): 65.5 (8.3) Active group Mean age (SD): 62.8 (9.3)	Patients who underwent primary or adjunctive radiation therapy	USA	Tool: Self reported activity diary, average PA over 2 days: Mean: 2.7 (0.88), median of 2.5 and a range of 1.5 to 5. Inactive group (i.e., less than 2.5): n=38 Active group (i.e., greater than or equal to 2.5): n=30	Cross sectional	Medium
Zalewski, K. R., et al. 2011 [85]	The study aimed to compare daily PA and barriers to PA for people with stroke and their partners (spouse or significant other).	19	Mean age (SD): 68.1 (7.0)	Stroke	USA	Tool: Accelerometer and self-report questionnaire: 7-day PA recall (7-day PAR) scale. Mean steps per day (SD): 6378 (2149) Mean energy expenditure (7-day PA recall) (SD): 19918 (4744) this was classified as low activity.	Cross-sectional	Medium

Table 3: Leisure time and exercise PA

Author	Aim of study	Sample size of carers	Gender and age of participants	Condition of care recipient	Country	Tool used to measure PA an PA levels reported.	Study design	Quality
Alves Costa, M. S., et al., 2018 [86]	To analyse the predictors and moderators of quality of life, in carers of amputee patients due to type 2 diabetes.	101	Female: 85.1% Male: 14.9% Mean age (SD): 51.54 (15.33)	Type 2 diabetic patients with diabetic foot which had been amputated.	Portugal	Tool: Questionnaire 28.6% practice PA or exercise at least once a week. 71.4% did not practice PA or exercise at least once a week.	Cross sectional	Medium
Arora, K., & Wolf, D. A. 2014 [87]	To examine if there is a trade-off between informal care and leisure time PA.	8658	Female: 3,892 (45 %) Male: 4,766 (55 %) Age: Under 65 years.	Care provided by adult children for parents	USA	Tool: Questionnaire Moderate exercise multiple times per week (%): Females: 56 Males: 60 Vigorous exercise multiple times per week (%): Females: 25 Males: 33	Cross sectional	Medium
Brown, W. J., et al. 2000 [88]	To ascertain what constitutes a healthy level of PA for young, middle-age, and older women in Australia.	5607	Young: 1052 Middle aged: 2615 Older: 1940	Frail, infirm, disabled	Australia	Tool: two questions used to derive PA scores: Mean PA scores (SD): Young: 19.9 (15.3) Middle aged: 13.3 (12.4) Older: 14 (12.4)	Cross sectional	Medium

						(Scores of 5-<15= low to moderate PA, scores of 15-<25=moderate to high PA)		
Chakraborty, B., et al. 2019 [89]	To examine the physical and mental health of carers for a disabled child and the association between stress and quality of life.	69	Female: 48 (70.6%) Male: 20 (29.4%)	Disabled	India	Tool: Questionnaire Inactive: 11 (15.9%) Moderate: 52 (75.4%) Scheduled PA at least 5 times per week for 30 min: 6 (8.7%)	Case-control study	Medium
Cuthbert, C. 2017 [90]	To examine gender differences in physical health, PA levels, and predictors of PA among carers.	130	Mean age of male carers (SD): 70.09 (6.55) Mean age of female carers (SD): 70.29 (6.88) Male: 53 (40.8%) Female: 77 (59.2%)	Breast, prostate, or colorectal cancer.	Canada	Tool: GLTEQ Male mean GLTEQ score: 30.06 which is considered 'active'. Female mean GLTEQ scores: 22.69 which is considered moderately active.	Cross sectional	Medium
Denham, A., et al., 2020 [91]	To examine the self-reported health risk behaviours and the associated factors among carers across countries.	384	Australia (n=181): Female: 154 (85.08%) Male: 27 (14.92%) 18-45: 41 (22.65%) 45-65: 104 (57.46%) 65+: 36 (19.89%) Canada: (n=56) Female: 52 (92.86%) Male: 4 (7.14%)	Chronic illness or disability	Australia, Canada, New Zealand, the UK and the USA.	Tool: GLTEQ Majority of carers in the sample which included UK carers (n = 354, 99.4%) reported low levels of PA; only two carers who participated in the survey met PA guidelines. Australia: Met guidelines: 1 (0.57%) Low PA: 173 (99.43%)	Cross sectional	Medium

			18-45: 8 (25%) 45-65: 20 (62.50%) 65+: 4 (12.50%) New Zealand: (n=32) Female: 30 (93.75%) Male: 2 (6.25) 18-45:8 (25%) 45-65: 20 (62.5%) 65+: 4 (12.5%)			Canada: Met guidelines: 0 Low PA: 55 (100%) New Zealand: Met guidelines: 0 Low PA: 32 (100%) USA: Met guidelines: 1 (1.85%) Low PA: 53 (98.15%)		
Diaz K. M. 2020 [92]	To examine differences in physical inactivity among a population-based sample of parents of children with and without Down syndrome.	Parents of children with Down Syndrome: n=150 Other special health care needs: n = 8847 Developmental disability without high functional impact: n = 3403 Developmental disability with high functional impact: n = 2143	Parents of children with Down Syndrome: Male: 34.4% Mean age (SD): 40.1 (12.1) Other special health care needs: Male:34% Mean age (SD): 39.6 (10.6) Developmental disability without high functional impact: Male: 34.5% Mean age (SD): 38.3 (10.5) Developmental disability with	Children with Down Syndrome, other special health care needs, children with developmental disabilities without high functional impact, children with developmental disabilities with high functional impact.	USA	Tool: Questionnaire Physically inactive (0 minutes per week of both vigorous-intensity and light/moderate-intensity leisure-time PA) Parents of children with other special health care needs: 36.8% Parents of children with developmental disabilities without high functional impact: 36.3% Parents of children with developmental disabilities with high	Cross sectional	Medium

			high functional impact: Male: 37.7% Mean age (SD): 39.3 (10.4)			functional impact: 36.4% Parents of children with Down syndrome: 47.7%		
Dionne-Odom, J. N., et al. 2017 [93]	To explore differences in carers' discrete self-care practices associated with varying levels of carers well-being, preparedness, and decision-making self-efficacy.	294	Mean (SD) age: 65.5 (12.7) Female: 214 (72.8%)	Cancer	USA	Tool: Health promoting lifestyle profile II (HPLP-II), PA defined as following an exercise program or taking part in leisure-time physical activities. Response categories are "Never=1," "Sometimes=2," "Often=3," or "Routinely=4" Mean (SD): 2.0 (.73)	Cross sectional	Low
Dreer, L. E., et al. 2009 [94]	To examine the relationships between carer resilience and a comprehensive set of sociodemographic and health-related quality of life (HRQOL) predictors among both carers and injured service members.	87	Mean age (SD): 40.30 (11.92) Men: 11 (12.6%) Women: 76 (87.4%)	Injured service members	USA	Tool: Health promoting lifestyle profile II (HPLP-II), PA defined as following an exercise program or taking part in leisure-time physical activities. Response categories are "Never=1," "Sometimes=2," "Often=3," or "Routinely=4" Mean (SD): 2.26 (0.77)	Cross sectional	Low
Etkin, C. D., et al. 2008 [95]	To examine the exercise behaviours among carers and	208	Female: 187 (90%) Male: 19 (10%)	81% of carers were caring for someone with a	USA	Tool: Questionnaire taken from a measure used in the Chronic	Cross sectional	Medium

	influences of carers on exercise.		Mean age (SD): 60.8 (12.4)	memory impairment.		Disease Self-Management Program Mean minutes per week (SD): Strength training: 9.4 (25.7) Aerobic activity: 33 (49.9) Walking: 20.4 (35.8) Less than 24% of carers engaged in 5x 30minutes of PA per week. 55% engaged in any aerobic activity for 30 minutes or more per week.		
Ellis, K.R., et al. 2017 [96]	To examine the influence of chronic conditions, symptom distress, and perceived social support on exercise and diet behaviors of patients with advanced cancer and their carers.	484	Mean age (SD): 56.5 (13.4) Female: 56.8% Male:43.1%	Cancer	USA	Tool: Questionnaire % of carers engaging in moderate or vigorous exercise at least 3 days a week: Baseline (within three months of care recipient diagnosis): 43.9% 3 months post baseline: 44.6% 6 months post baseline: 40.4%	Longitudinal	Medium
Fredman, L., et al. 2006 [97]	To compare leisure-time exercise and overall PA in elderly women carers and non-carers.	179	All women Spouse care givers (n=153): mean (SD): 80.8 (3.1)	Physical, cognitive, or mental impairments.	USA	Tool: Leisure-time exercise based on two questions 1) usually walk for exercise (walk one block or more without stopping) and 2) usually engage in any regular exercise	Cross sectional	Medium

			Non-spouse carers (n=26) mean (SD): 80.1 (4.3)			other than walking at least once a week. Two questions assessed daily PA: Number of city blocks (or equivalent) a respondent walked during her daily routine and number of stairs climbed in a typical day during the past week. No leisure-time exercise or daily physically active: Spouse carers (n): 22.9 Non- spouse carers (n): 38.5 Leisure-time exercise and daily physically active: Spouse carers (n):22.9 Non-spouse carers (n): 23.1 All other carers in the sample either engaged on in leisure time PA or only in daily PA.		
García-Torres, F., et al. 2020 [98]	To examine the predictive utility of social support domains for	67	Female: 44 (65.7%) Male: 23 (34.3%)	Cancer	Spain	Tool: Questionnaire Physical and sports activity:	Longitudinal	Low

	emotional well-being in cancer carers, six months post their partner's diagnosis.		Mean age (SD): 51.63 (13.25)			None: 27.3% Monthly: 36.4% Weekly: 27.3% Daily: 9.1%		
Haley, K., et al., 2020 [99]	To examine the balance and preference among home/work, leisure, and social activities for informal carers for people with aphasia.	70	61.4 years Female: 77.1%	Aphasia	USA	Tool: The Life Interests and Values questionnaire. Participants required to answer yes or no to 'do you do this activity now?' for a list of activities. Hiking: 4.9% Walking/running: 60.7% Group exercise: 23% 85.7% of carers wanted to do more walking/running.	Cross sectional	Low
Heathcote, K., et al. 2019 [100]	To investigate the association of resilience on carer burden and quality of life in informal carers of patients with severe traumatic musculoskeletal injuries.	53	Female: 38 (72%) Male: 25 (28%) Mean age (SD): 50.35 (16.14)	Severe traumatic injury	Australia	Tool: Interview Baseline Mean exercise (days per week): Gentle exercise (SD): 5.0 (2.5) Moderate exercise (SD): 4.14 (2.63) Vigorous exercise (SD): 2.03 (2.80) 3-month follow up questionnaire (post discharge of the care recipient from the trauma centre):	Prospective cohort study	Low

						Mean exercise (days per week): Gentle exercise (SD): 3.7 (2.48) Moderate exercise (SD): 3.05 (2.36) Vigorous exercise (SD): 1.62 (2.33)		
Hirano, A., et al. 2011 [101]	Identify factors associated with lower PA in elderly carers of dementia patients.	50	Age (SD): 73.3 (4.2) Male: 18 Female: 32	Dementia	Japan	Tool: PA questionnaire (QS) for the elderly Total QS score: 3.9 ± 2.7 Household activity scores: 2.1 ± 0.5 Sport activity scores: 1.2 ± 2.4 Leisure activity scores: 0.6 ± 1.6	Cross-sectional	Low
Hirsch, M. A., et al 2014 [18]	To assess Parkinson's disease patients' beliefs about exercising with either their spouse or another Parkinson's disease patient.	9	Age (SD): 61.8 (11.2) Female: 63% Male: 37% Mean age (SD): 61.8 (11.2)	Parkinson's disease	USA	Tool: Questionnaire Exercise amount (min/week), mean ± SD (range): 90±112 (0–270)	Cross sectional	Low
Lee C. J. et al. 2009 [102]	To identify and compare the health promotion behaviors used by older rural and urban women providing spousal care.	72	Female: All participants Mean age (SD): 71.4 (7.4)	Dependent in one or more basic activities of daily living or not able to be alone for safety reasons.	USA	Tool: Health promoting lifestyle profile (HPLP-II) questionnaire. Take part in leisure time PA often and routinely: 9.7% of the sample. Participate in light to moderate PA 30-40	Cross sectional	Low

						minutes, 5 times a week: 27.7% Do stretching exercises at least 3 times a week: 29.1% Exercise at least 20 minutes or more at least three times per week: 29.1%		
Loi, S. M., et al. 2016 [103]	To identify previously unexplored factors associated with depression among older carers.	202	Female: 74.3% Male: 25.7% Mean age (SD): 70.8 (8.5)	Not specified	Australia	Tool: Questionnaire Mean total PA (minutes) (SD): 155.0 (57.5–360.0) Mean Leisure-PA MET hours (SD): 7.0 (1.1–15.5) Mean domestic-PA MET hours (SD): 0.0 (0.0–5.0)	Cross-sectional	Medium
Moreira, R. et al. 2016 [17]	To understand the perspective of carers and people with down syndrome about their quality of life.	10	Male: 2 (20%) Female: 8 (80%) 25-29: 3 (30%) 30-35: 3 (30%) 36 or older: 4 (40%)	Down syndrome	Brazil	Tool: Semi structured interviews PA and leisure practices: Light: n=3 (30%) Moderate: n=3 (30%) Heavy: n=0 Don't participate/practice: n=4 (40%)	Cross sectional	Low
Navarro, S., et al. 2018 [104]	To identify sleep characteristics and habits in the carers of children needing	82	Female: 79 Male: 3	Invasive and non invasive ventilatory assistance	Chile	Tool: Interview 80.5% did not engage in scheduled PA (exercise)	Cross sectional	Low

	invasive and non-invasive ventilator assistance.		Age (SD): 41.5 (9.4)			beyond their daily activities.		
Norris, J. M., et al. 2010 [105]	To examine PA levels within young families of paediatric cancer survivors and the relationship between PA and health-related quality of life.	33	Female: 20 (60.6) Male: 13 (39.4) Age: Not reported	Cancer	Canada	Tool: GLTEQ 57% of parents did 30 minutes of moderate physical activity most days of the week and Mean METs (SD): 17.95 (12.47)	Cross sectional	Medium
O'Connell, M. E., et al. 2015 [73]	To understand the PA and exercise levels and attitudes towards PA and exercise among patients and carers at a memory clinic.	43	Gender: not reported Mean age of carers (SD): 63.59 (10.61)	Patients at memory clinic	Canada	Tool: Questionnaire Engaging in no weekly PA and exercise (n): 16 (43%) Engaging in some PA and exercise but below recommended weekly guidelines (n): 18 (41%) Engaging in PA and exercise that meets or exceeds weekly guidelines (n): 9 (16%)	Cross sectional	Low
Osaki, T., et al. 2016 [106]	To examine chronic fatigue among carers for people with dementia.	44	Female: 77% Male: 33% Age: 69.0 (60.0–75.0)	Dementia	Japan	Tool: PASE PASE median (interquartile range) PASE total: 29.6 (93.6–161.9) PASE-L (leisure time PA): 14.9 (5.0–25.8) PASE-H (Household PA): 85.0 (85.0–121.0)	Cross sectional	Medium

						PASE-W (Work-related PA): 0.0 (0.0- 0.0)		
Rokicka, M., & Zajkowska, O. 2020 [107]	To examine the risk of time poverty defined as leisure participation among informal carers of adults and older people.	1682	Female mean (SD): 0.77 (0.42) Mean age (SD): 55.34 (14.47)	Any informal care provider	Poland	Tool: Diary record Sport and exercise mean daily minutes (SD), range: 17.55 (37.95), 0-350	Cross sectional	Medium
Ross, A et al. 2020 [108]	To describe cancer carers participation in health promoting activities and to identify factors associated with participation.	129	Female: 87 (67%) Male: 42 (33%) Mean age (SD): 48.6 (11.8)	Cancer	USA	Tool: Health-promoting lifestyle profile-II "Never=1," "Sometimes=2," "Often=3," or "Routinely=4" Mean PA score (SD), range: 2.3 (0.8), 0-4	Cross sectional	Low
Tapia, S.N. et al. 2018 [109]	To identify sleep characteristics and habits in the carers of children belonging to the National Program of Invasive and Non-Invasive Ventilatory Assistance at Home of the Ministry of Health of Chile.	82	Age (SD): 41.5 (9.4) Male: 3 Female: 79	Invasive and non-invasive mechanical ventilation.	Chile	Tool: Interview Did not practice scheduled PA beyond their daily activities: 66 (80.5%) Did practice scheduled PA beyond their daily lives: 16 (19.5%)	Cross sectional	Low
Son, K.Y., et al. 2011 [110]	To compare the status of lifestyle behavior and use of preventive services in spousal carers of cancer patients and controls.	100	Female: 63% Male: 37% Mean age (SD): 54.58 (9.82)	Cancer	Korea	Tool: Interview guided by a structured questionnaire. 76.9% were classified as inactive (Persons who did not exercise regularly more than three times per week).	Cross sectional	Low

Yamashita. T., et al. 2018 [111]	To identify differences in leisure time use between such carers and non-carers.	128 carers reported their leisure time use for a single weekday 142 carers reported leisure time use for one weekend day	Carers who reported weekday PA: Female: 64.84% Male: 35.16% Mean age (SD): 72.23 (6.03) Carers who reported weekend day PA: Female: 59.52% Male: 40.48% Mean age (SD): 73.99 (6.49)	Caring for at least one older adult with aging-related complications more than once a week in the last three months.	USA	Tool: Participants asked to recall how much time they spent in sports, exercise, or recreation in the last 24 hours. PA during weekdays mean (SD): 16.95 (54.40) minutes 78.9% reported 0 minutes of PA. PA on one weekend day mean (SD): 7.21 (33.73) minutes 88.73% reported 0 minutes of PA.	Cross sectional	Medium

Table 4: Objectively measured PA

Author	Aim of study	Sample size of carers	Gender and age of participants	Condition of care recipient	Country	Tool used to measure PA an PA levels reported.	Study design	Quality of studies
Ayvazoglu, N. R., et al., 2015 [112]	To examine factors affecting PA of children with high-functioning autism spectrum disorders and their family members.	6	Female: all participants Mean age: 35.16 (7.96)	Autism spectrum disorders	USA	Tool: Accelerometer Mean minutes of PA (SD): 26.16 (18.9)	Cross sectional	Low
Bailey, RR. et al., 2018 [113]	To examine the PA of older veterans with functional disability and their carers.	33	Female: all participants Median age (IQR): 67 (13.0)	Functional disability (i.e., required assistance from a carer for 1 basic ADL or 3 instrumental ADLs)	USA	Tool: Accelerometer Duration, median (IQR): 12.8 (1.9) hours	Cross sectional	Medium
Carpenter, C. A., et al., 2020 [47]	To characterize the weight status, sedentary behavior, and PA of carers of individuals with Alzheimer's disease.	47	Female: 87% Male: 13% Mean age (SD): 57.5 (7.9)	Alzheimer's disease	USA	A subset of individuals (N = 14) wore an armband accelerometer: On average carers engaged in 2.9 ± 1.2 hours per day in light PA and 0.6 ± 0.6 hours per day in moderate-to-vigorous PA	Cross sectional	Medium
Fakolade, A., et al., 2018 [114]	To examine interdependence in the PA patterns of	14	54.1 (13.5) Male: 10 (71.4) Female: 4 (28.6)	Multiple sclerosis	Canada	Tool: Accelerometer as	Cross sectional	Low

	dyads affected by moderate to severe MS disability.					well as a PA log book Mean step count (SD): 6,160.2 (1,653.0) Mean % of the day spent in light PA (SD): 25.4 (7.7) Mean % of the day spent in moderate-vigorous PA (SD): 2.8 (2.4) 4 caregivers met PA guidelines (28.6%), and 10 caregivers did not meet PA guidelines (71.4%).		
Post, D et al. 2021 [115]	To understand how movement behaviour and health behaviours of carers of veterans relate to carers' physical and psychological well-being.	The study included 28 participants, 18 of which provided accelerometer data.	Female: 96.4% Mean age (SD): 61.6 (12.7)	Veterans	Australia	Tool: Accelerometer Average minutes per day (SD) Sedentary:546.4 (126.9) Light: 237.4 (67.8) Moderate:121.0 (80.8) MVPA (moderate plus	Cross sectional	Low

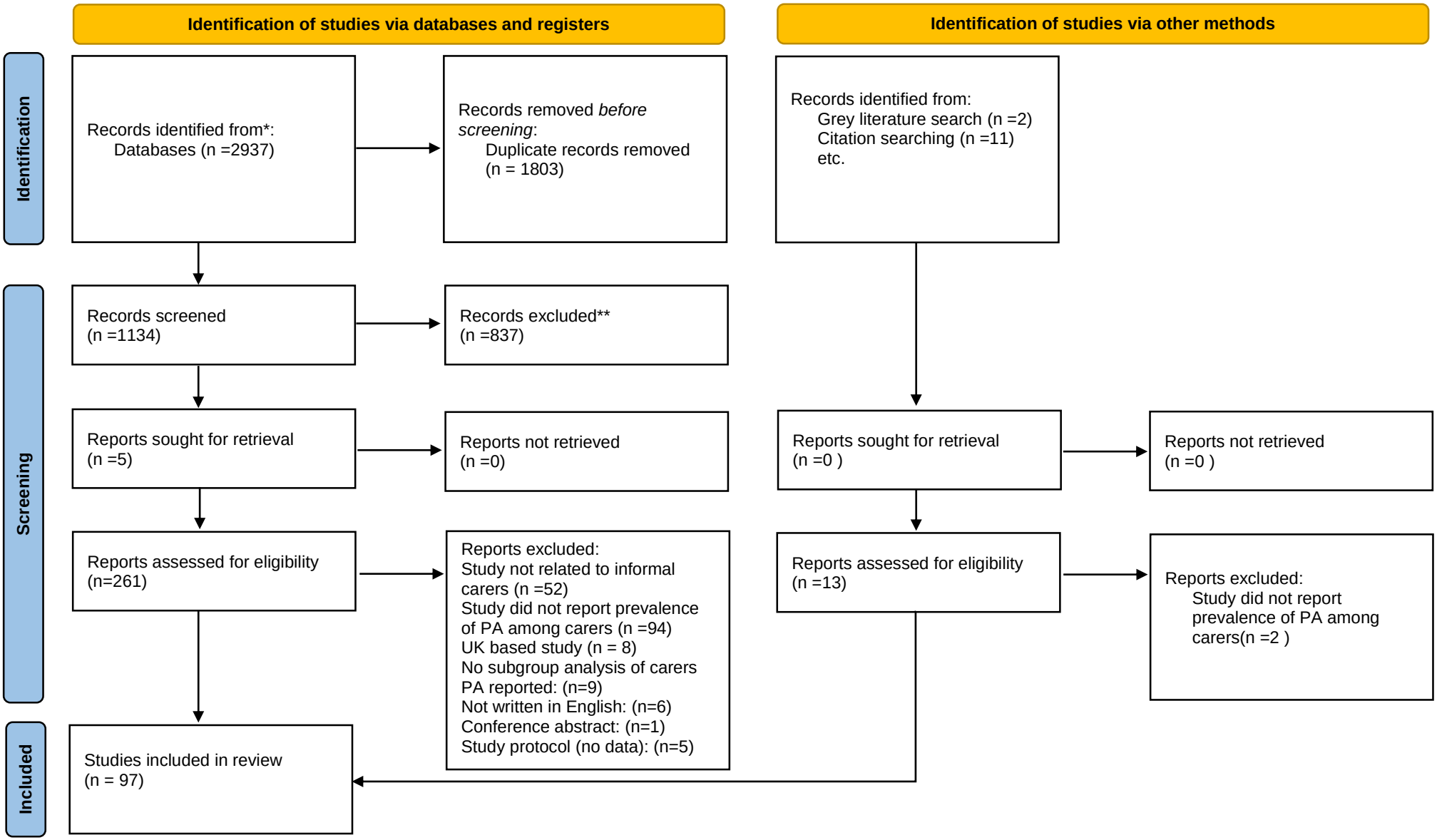
						vigorous)123.7 (82.1)		
Schulz, P et al. 2014 [116]	To compare cardiovascular (CV) risk factors and PA levels and identify any change in PA patterns in care recipient's after cardiac surgery.	28	Female: 26 (92.9%) Male: 2 (7.1%) Mean age (SD): 68.5 (6.6)	Cardiac surgery patients	USA	Tool: Accelerometer worn at 3 and 6 weeks and 3 and 6 months post care recipients surgery. Carers givers spent approximately 2-2.5 hours in light/lifestyle activity, and averaged 11-16 minutes of moderate-vigorous PA per day. Carers mean minutes of MVPA per day did not change significantly over time (15.8 ± 20.8 to 12.7 ± 11.7).	Longitudinal	Medium
Marquez, D. X., et al., 2012 [117]	To examine and compare PA, PA preferences, psychosocial determinants of PA, and mental health indicators between older non-exercising	24	Mean age (SD): 68.6 (9.1) Female: 75%	Alzheimer's disease or another form of dementia.	USA	Tool: ActiGraph accelerometer: Mean minutes of daily light intensity activity (SD): 259.3 (71.6)	Cross sectional	Medium

	carers and non-carers.					Mean minutes of daily moderate intensity activity (SD):8.3 (11.9)		

Figure

PRISMA 2020 flow diagram for new systematic reviews which included searches of databases, registers and other sources

Figure 1: PRISMA 2020 flow diagram.



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PRISMA 2020 flow diagram for new systematic reviews which included searches of databases, registers and other sources
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