

Correlates of physical activity behaviour among nursing professionals: A systematic search and literature review

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Abstract

Introduction: Physical activity (PA) has been shown to protect against adverse health outcomes, and factors influencing physical activity vary among different populations. Previous research suggests nurses have an increased risk of being physically inactive, which may contribute to increased risk of musculoskeletal disorders. The purpose of this investigation was to use a systematic search process to determine previously identified correlates of nurses' physical activity.

Methods: The study utilized a systematic search process to identify studies for the review. The search was performed using three electronic databases: MEDLINE, CINAHL Complete, and Web of Science. The authors extracted and synthesized information regarding physical activity levels, significant correlates of physical activity, and measures of physical activity using a narrative approach.

Results: Twelve articles were included in this review. All had predominately female samples and reported statistically significant findings. The majority determined nurses' physical activity using self-report methods ($n = 11$) and explored the relationship between nurses' physical activity and individual-level variables ($n = 7$). Few studies explored the difference between leisure-time and work-related physical activity, and many did not assess muscle-strengthening physical activity. **Discussion and Conclusions:** Demographic and non-modifiable work-related factors were the most frequently assessed correlates of behaviour. The reviewed studies showed that demographic variables, such as age and BMI, were significantly associated with nursing professional's PA. There is a need for more studies to assess factors influencing nursing professionals' PA beyond the individual level, using theoretical designs, and including objective measures of PA. Future studies should also include assessments of nursing professionals' muscle-strengthening PA and involve adequate representation of the United States nursing population. Practitioners and researchers working to improve nurses' physical activity behaviour should target efforts to those more likely to engage in less physical activity, such as those with greater BMI, older age, and working night shifts, in order to tailor intervention efforts to high-risk groups.

KEY WORDS: Health behavior; health promotion; nursing; occupational health; physical activity; primary health care; review; risk factors.

Riassunto

Introduzione: È stato dimostrato che l'attività fisica svolge un ruolo preventivo nei confronti degli effetti negativi per la salute ed i fattori che influenzano l'attività fisica variano nelle differenti popolazioni. La ricerca suggerisce che gli infermieri hanno un aumentato rischio di essere fisicamente inattivi e ciò può contribuire ad un aumentato rischio di disturbi muscolo-scheletrici. L'obiettivo di questa indagine è stato quello di effettuare una revisione sistematica di letteratura per determinare quali sono i correlati già identificati in letteratura di attività fisica negli infermieri.

Metodi: Lo studio ha utilizzato un processo di ricerca sistematica per identificare gli studi da includere nella revisione. La ricerca è stata effettuata su tre database: MEDLINE, CINAHL Complete, e Web of Science. Gli autori hanno estratto e sintetizzato le informazioni riguardanti i livelli di attività fisica, i correlati significativi di attività fisica e le misure di attività fisica usando un approccio narrativo.

Risultati: Venti ($n = 20$) articoli sono stati inclusi nella revisione. Tutti gli studi inclusi avevano campioni composti da soggetti prevalentemente di sesso femminile e riportavano risultati statisticamente significativi. La maggior parte di essi valutava l'attività fisica degli infermieri con metodi self-report ($n = 11$) ed esplorava la relazione tra l'attività fisica degli infermieri e le variabili di tipo individuale ($n = 7$). Pochi studi hanno esplorato la differenza tra l'attività fisica nel tempo libero e quella lavorativa e molti di essi non hanno valutato l'attività fisica per il potenziamento muscolare.

Discussione e Conclusioni: I fattori demografici e quelli lavorativi non modificabili sono stati i correlati di comportamento più frequentemente considerati. Gli studi rivisti hanno evidenziato che le variabili demografiche come l'età e l'Indice di Peso Corporeo (BMI) risultavano essere associate in modo significativo ai livelli di attività fisica negli infermieri professionali. E' necessario che ulteriori studi valutino i fattori che influenzano l'attività fisica negli infermieri professionali a parte quelli di natura individuale, attraverso disegni teorici ed includendo misure oggettive di attività fisica. In futuro gli studi dovrebbero anche includere le valutazioni dei livelli di attività fisica per il potenziamento muscolare degli infermieri e coinvolgere un'adeguata rappresentanza della popolazione infermieristica statunitense. I clinici ed i ricercatori impegnati nel migliorare il comportamento verso l'attività fisica degli infermieri dovrebbero adoperarsi verso chi ha più probabilità di impegnarsi di meno nell'attività fisica, come i lavoratori con maggiore BMI, i più anziani ed i lavoratori notturni, per adattare gli interventi ai gruppi con livello di rischio più alto.

TAKE-HOME MESSAGE

Researchers and practitioners aiming to change physical activity behaviour among nurses should focus on tailoring activities to specific sub-groups of nurses that are less likely to engage in regular physical activity, such as those working the night shift, with higher BMI and those with greater job stress.

Competing interests - none declared.

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INTRODUCTION

Engaging in regular physical activity (PA) has consistently been shown to decrease risk of chronic diseases, including cardiovascular disease, diabetes, and obesity, as well as increase work productivity and reduce absenteeism from work [1, 2]. Given the clear benefits of regular PA, the World Health Organization (WHO) has set international guidelines that recommend engaging in 150 minutes of moderate-intensity PA or 75 minutes of vigorous-intensity PA each week while concurrently engaging in muscle-strengthening activities involving the major muscle groups on at least two days per week [3]. Despite the benefits of engagement in regular PA and global recommendations to engage in PA, only one in four adults worldwide engages in sufficient PA, and insufficient PA is one of the major risk factors for mortality worldwide [4]. Thus, it is important to develop effective strategies to increase PA levels.

One recommendation to increase PA is to utilize workplaces to engage employees in regular PA [5]. Workplace health promotion programs have shown promise in improving health status, and the workplace is viewed as an important setting to create health behaviour change among working adults [6, 7]. Specifically, in the healthcare setting, nurses comprise almost half (48%) of the healthcare workforce [8]. Currently, licensed nurses are in high demand due to increased turnover rates, job strain, physical demands of the work, and increasing age of patients; however, nurses are also more likely to leave jobs prematurely due to health-related reasons [9, 10]. Thus, to maintain the nursing workforce and meet high demands, it is imperative that nurses maintain a sufficient level of health and remain free of injury and disability [8].

Nursing is a physically demanding job due to nurses being responsible for the direct care of their patients, such as lifting and rotating patients [11]. Due to the nature of their job, research has shown that nurses are at an elevated risk for musculoskeletal injuries [12, 13]. Musculoskeletal injuries not only impact the health of the injured nurse, but also have

an impact on productivity, as nurses suffering from musculoskeletal disorders have difficulty performing job duties [13]. Past research has shown that PA is an effective means of lowering the risk for musculoskeletal injuries; however, research suggests that nurses are not consistently engaging in sufficient PA [13, 14].

Since nurses spend a majority of a patient's stay interacting with the patient, it is imperative for nurses to be role models of health to effectively disseminate health information [11, 15]. However, previous research has shown that nurses may not always engage in health enhancing behaviours [15]. Research has shown that nurses who fail to meet PA guidelines are concurrently less likely to make PA recommendations to patients [16, 17]. Considering research has shown that nurses may not engage in sufficient health-enhancing PA, it is imperative that future health promotion interventions target increasing nurses' PA. To better inform future intervention development and identify intervention targets, it is important to first understand the correlates of nurses' PA. The aim of this review was to analyze the existing literature using a systematic search process to determine previously identified correlates of nurses' PA. The identification of existing correlates may help inform researchers and practitioners to design interventions to increase nurses' PA.

METHODS

Study design

A systematic search was performed in October 2017 using the following databases: Medical Literature Analysis and Retrieval System (MEDLINE), Cumulative Index to Allied and Nursing Health (CINAHL) Complete, and Web of Science (WOS). The following Boolean search logic was used: 'physical+activity AND nurses OR nursing+assistants AND factors'. Filters were set to select only peer-reviewed journal articles published from 2007 to 2017. The initial search yielded 2,731 articles from WOS ($n = 141$), MEDLINE ($n = 1,045$), and CINAHL

Complete ($n = 1,545$).

Search methods

The inclusion criteria for this systematic review were: (1) Cross-sectional studies; (2) including nurses; (3) measuring PA as an outcome; (4) investigating correlates of nurses' PA; (5) indexed in MEDLINE, CINAHL Complete, and WOS; (6) published between January 2007 to December 2017; (7) peer-reviewed; and (8) in English. The following exclusion criteria were applied: (1) Study failed to target nurses; (2) PA was not an outcome; (3) study was the wrong type (i.e. not cross-sectional, quantitative); (4) study was a review; and (5) was published before January 2007.

Search outcomes

The review process encompassed four phases, with two authors (A.H.W and H.O.T) completing the process separately. Figure 1 presents the flow of study selection. In phase I, Boolean search terms were utilized to extract initial articles from the databases ($n = 2,731$). Phase II comprised refinement of the initial articles. In phase III, the two authors read the full text of the remaining articles ($n = 97$) to further refine the articles included in the review. Manuscript assessment during phase III further excluded an additional 87 studies, resulting in 10 qualifying studies. The final phase incorporated a descendant search of references in the 10 articles from phase III. This search yielded two additional studies included in the review ($n = 12$).

The percentage of interobserver agreement was calculated to determine the level of agreement between the two investigators. Identified disagreements were discussed between the two authors and decisions were made regarding inclusion in the review based on consensus among the authors. Cohen's Kappa (K) statistic was also calculated.

Data abstraction and study quality assessment

Information extracted from the reviewed studies is depicted in Table 1. The primary va-

riables of interest were the correlates related to nurses' PA levels. The authors could not use techniques to combine the quantitative data extracted from the studies due to variation in bivariate and multivariable analyses performed and differences in the measurement of PA in the reviewed studies. Thus, a narrative approach was utilized to review the studies. Associations with a p -value less than 0.05 were considered statistically significant. In studies reporting bivariate and multivariable relationships, only findings from multivariable analyses were reported. Study quality was assessed by the research team using a modified version of the Newcastle-Ottawa that was tailored to assess quality of cross-sectional research studies related to the research design, recruitment strategy, sample, response rate, validity and reliability of the outcome measure, power calculation, and statistical analyses performed [18]. Quality scores ranged from 0 to 10 (0 = poor quality, 10 = high quality). The research team discussed any disagreement and came to a consensus to determine the final agreed upon quality score for each studied included in the literature review.

RESULTS

Interobserver agreement was 91.8% ($K=.81$), indicating adequate agreement regarding the included studies, $P < .001$ [19]. Five of the included studies were conducted in the United States [20–24], two in Saudi Arabia [25, 26], one in Thailand [27], one in the United Kingdom [28], one in Poland [29], one in New Zealand [30], and one was conducted in multiple countries [31].

Sample size and characteristics

The combined population of reviewed studies was 147,586, with sample sizes ranging from 44 to 136,592 participants. Participants in these studies were recruited from various settings, with the majority ($n = 7$) from hospitals [21, 23–27, 29]. The remaining studies used data obtained from national surveys [20, 22, 28, 30, 31]. All studies ($n = 12$) had predominantly female samples (45% to 100% of participants) [20–31]. Mean age of the parti-

Participants ranged from 30 to 60 years. Two studies had a mean age from 30 to 35 years [26, 27], four studies had a mean age of 41 to 45 years [21, 23, 30, 31], two studies had a mean age of 46 to 50 [20, 29], and three studies reported proportions of nurses below or above a particular age [22, 24, 25, 28].

Factors related to nurses' physical activity behaviour

Demographic factors

The majority of studies ($n = 10$) analyzed the relationship between demographic factors and PA levels in nurses [20, 22–30]. Age was the most commonly assessed demographic

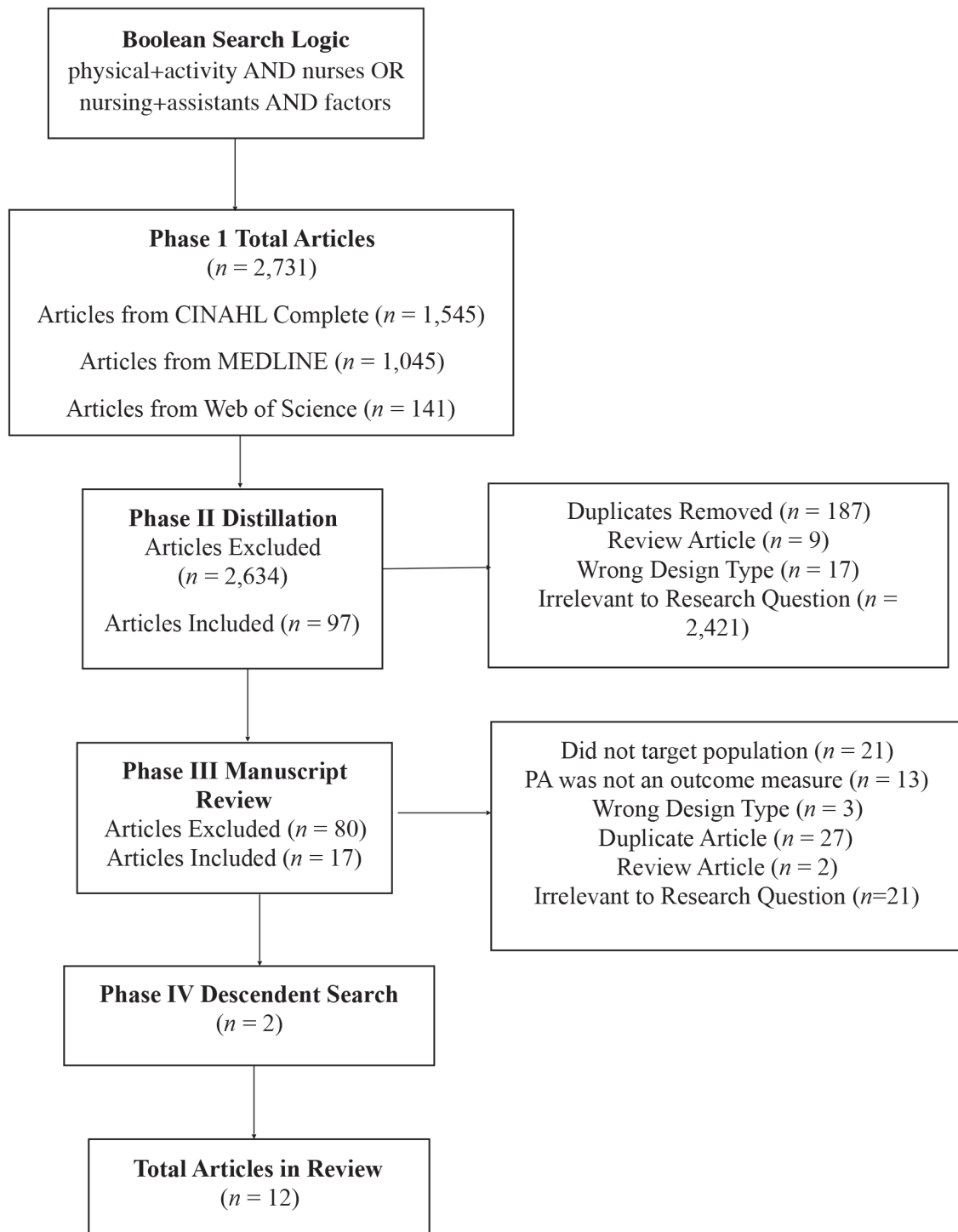


Figure 1. Flowchart of article distillation process.

factor [20, 22, 24–27, 30]. One study showed that nurses over the age of 40 were more likely to engage in PA than their younger counterparts [24]. Almajwal et al [25] showed that nurses over the age of 50 reported engaging in low levels of PA. Jirathananuwat et al [27], reported that nurse clinical practitioners were younger than nurse managers and engaged in significantly more work-related PA. However, when assessing leisure-time PA, both groups engaged in a similar amount of PA [27]. Al-Tannir and colleagues [26], found no significant association between age and PA. Chin et al [20] found no significant association between age and aerobic PA but found that muscle-strengthening PA decreased as nurses aged. Of the reviewed studies, one showed that females engaged in significantly less overall PA than their male counterparts [24]. Of the studies reviewed, two showed that nurses with a higher level of education (i.e., graduate degree or higher) engaged in less PA than nurses with an undergraduate degree or high school diploma (i.e., Certified Nursing Assistant) [24, 25]. Additionally, one of the studies reviewed showed that being married was negatively associated with leisure-time PA levels in nurses [25].

Health-related factors

Of the studies reviewed, five studies assessed the relationship between health-related factors and nurses' PA, specifically anthropometric measures (i.e., body mass index, body weight), smoking status, and overall health status [20, 23, 26, 28, 29]. Three of the reviewed studies showed that a high body mass index (BMI), classified as being overweight or obese (≥ 25 kg/m²), was related to nurses' PA levels [20, 26, 28]. Two of these studies showed that BMI was negatively correlated with PA levels [20, 26]. However, one study showed that actual body weight size was positively associated with PA levels [28]. Al-Tannir and colleagues [26] showed that smoking was negatively associated with overall PA levels. Additionally, another study included in the review showed that nurses' self-reported general health status was positively related to

both aerobic PA and muscle-strengthening activities [23].

Work-related factors

Five studies examined work-related factors (i.e., shift work, job category, hours worked, job demands, job stress, social norms) [20, 24, 25, 27, 29]. Four studies analyzed the effect of shift work on nurses' PA [20, 25, 29, 31]. All four of these studies showed that shift work was significantly associated with PA. Three of the reviewed studies found that working the night shift was negatively correlated with overall PA [20, 25, 31]. Conversely, one study found that working the night shift was positively correlated with overall PA level [29]. One study analyzed the relationship between job category (i.e., nurse manager, auxiliary nurse, nursing technician) and PA and found that nurse clinical practitioners engaged in significantly more work-related PA when compared to nurse managers [27]. However, during non-work periods, nurse clinical practitioners and nurse managers reported similar levels of PA [27]. Additionally, Chin and colleagues [20] showed that nurses with a passive job (i.e., low job demand and job control), engaged in significantly less PA than those without passive jobs. One reviewed study showed that job stress was positively associated with PA levels during work hours [24].

Outcome measure: Physical activity level

The outcome of interest for the present review was nurses' PA level. The PA guidelines from the WHO were used to determine if participants in the reviewed studies engaged in sufficient PA [3]. In six of the studies, a decision could not be made about whether participants met the PA guidelines due to the way PA was operationalized or measured [21, 22, 24, 26, 27, 30]. Of the six studies that effectively operationalized PA, four studies reported that a majority of nurses engaged in enough total PA to meet WHO guidelines [23, 25, 29, 31]. Conversely, Chin and colleagues [20] showed that less than half of their sample engaged in enough total PA to meet WHO guidelines. Regarding muscle-strengthening activity,

only three of the reviewed studies assessed this behaviour [20, 23, 28]. Bakhishi et al [28] reported that less than half of their sample (42%) engaged in muscle-strengthening activities for less than an hour per day. Although there is not a recommendation for the time requirement of muscle-strengthening activity per week, the sample for this study would meet the frequency recommendation for muscle-strengthening activities [3, 28]. Tucker et al [23] showed that less than half (44.56%) of nurses in their sample reported engaging in muscle-strengthening activities at least once per week. However, Chin et al [20] reported that over half of their sample (56.6%) performed muscle-strengthening activities on two or more days per week, meeting the WHO's recommendation for this type of activity [3]. Among the reviewed studies, five assessed both leisure-time and work-related PA [25, 27, 29–31]. Of the remaining seven studies, three assessed total PA without differentiating between leisure-time and work-related PA [21, 23, 28], three assessed only leisure-time PA [20, 22, 26], and one assessed only work-related PA [24]. Chin and colleagues [20], showed that BMI was inversely related to leisure-time PA and that nurses reporting musculoskeletal symptoms engaged in less leisure-time PA than their counterparts. Another study showed that longer night shifts led to nurses engaging in lower leisure-time PA [29], and Almajwal et al [25] showed that leisure-time PA made up roughly 10.2% of nurses total PA levels.

The majority ($n = 11$) of the studies included in the review used self-report measures to assess PA [20–26, 28–31]. Of the 11 studies using self-report measures of PA, four studies used the International Physical Activity Questionnaire (IPAQ) [32] in either its short or long form [24, 29–31]. Only one study included in the review utilized objective measures of nurses' PA by assessing PA levels with an accelerometer [27].

DISCUSSION

The purpose of this study was to systematically review previous research to explore factors

related to PA in the nursing population. Twelve studies analyzing factors related to nurses' PA were analyzed in this review. The results of the studies were condensed into three broad categories of factors related to PA, including demographic, work-related, and health-related factors. Demographic factors were the most commonly assessed correlate of PA within the nursing population. The results gleaned from this review of literature identified gaps in the current literature regarding how PA and the factors related to engagement in regular PA are assessed in the nursing population.

Only three studies assessed leisure-time PA as a separate variable from workplace-related PA [20, 22, 26], while five assessed both leisure-time and work-related PA [25, 27, 29–31]. Two of the studies showed that nurses do not engage in enough leisure-time PA [25, 29]. Although previous research has shown that leisure-time PA may be more beneficial to health than work-related PA [30, 33, 34], Almajwal et al [25], reported that leisure-time PA made up only 10.2% of nurses overall PA. Harvey and colleagues [33] showed that leisure-time PA was inversely related to symptoms of depression but not work-related PA. Other studies support the implication that leisure time PA may be more effective at improving health-related factors than work-related PA [30, 34]. With current research showing that leisure time PA may have more substantial impacts on health indicators and outcomes than work-related PA, future studies should include assessments of leisure-time PA in correlational studies assessing factors related to nurses' PA.

Despite research showing that shift-work impacts nurses' PA [34], shift-work was only assessed in four of the reviewed [20, 25, 29, 31]. Three of the reviewed studies showed that working the night shift was negatively correlated with the overall PA of nurses [20, 25, 31]. In the literature, findings regarding shift-work and PA are mixed. Research from previous studies has shown that shift-work can have either a positive impact on PA or no impact at all [29, 35, 36]. Atkinson and

colleagues [35] suggest that shift workers may be at an advantage when it comes to PA due to the ability to engage in more frequent PA while others are at work. Additionally, in a more recent study conducted by Loprinzi [36], shift-work was shown to have a differential effect on PA. Those working the evening and night shift engaged in significantly less sustained bouts of PA but showed no difference for overall PA when compared to day-shift workers [36]. Considering the mixed findings, it is necessary to further study the relationship between shift-work and PA in the nursing population to better understand the direction of the relationship.

Although research has shown objective measures of PA to be more accurate [37, 38], most of the studies used in this review relied on subjective measures of PA [20–26, 28–31]. It is well established that objective measures of PA are less likely to be affected by responder bias compared to subjective measures. Generally, it is recommended that objective measures of PA should be used in place of subjective measures when measuring PA [38]. Due to the nature of their job, when responding to self-report assessments of PA, nurses may claim that they meet or exceed the PA recommendations when in fact they may not [27]. Based on the overreliance of subjective measurements of PA in this review, it is recommended that future studies assessing nurses' PA should utilize objective measures when possible to increase accuracy and reduce influence of respondent bias.

None of the studies included in this review made use of a theoretical framework when assessing correlates of nurses' PA. Past research has shown that a significant amount of the variance associated with engaging in PA can be explained when using theoretical constructs [39, 40]. In studies assessing PA in other populations, researchers have found theoretical constructs to demonstrate a substantial relationship with participants' PA behaviour [39, 40]. Armitage [39], showed that the theory of planned behavior constructs were significant predictors of PA intentions and PA behaviour. Additionally, Pe-

tosa and colleagues [40] showed that social cognitive theory constructs accounted for a significant proportion of the variance in PA in a sample of college students. Due to the capability of theoretical constructs to further explain nurses' PA behaviour, future studies should utilize relevant theoretical frameworks when exploring nurses' PA behaviour.

Notably, most of the factors assessed in the reviewed studies were demographic (i.e., gender, age) or non-modifiable work-related factors (i.e., shift work, hours worked). Future studies should explore the relationship between modifiable factors and nurses' PA behaviour. Modifiable factors that may influence nurses' PA behaviour include psychosocial factors (i.e., self-efficacy, attitudes, beliefs), social factors (i.e., social support, social norms), and organizational factors (i.e., workplace support, workplace policies) [41]. The identification of modifiable factors will be invaluable to researchers and practitioners planning interventions to increase nurses' PA.

Study limitations

The information presented in this review should be considered in the context of several limitations. First, the samples from the studies included in the review were heterogeneous in terms of location, as the review evaluated studies from several countries. Second, although the authors intended to search for all articles that met the a priori criteria, the search was limited to three databases. Thus, some studies may have been excluded due to the delimitations of the search criteria. A third limitation was the inclusion of only articles published in English, which may have prevented inclusion of articles published in other languages. Fourth, the review only included findings from cross-sectional studies, which limits any interpretation of cause and effect relationships. Fifth, the majority of the studies included in this review utilized self-report methods to assess PA behaviour, which subjects the findings from these studies to self-report biases. Sixth, the different assessments of PA and requirements used to

quantify sufficient PA varied by study, which impacted the interpretation of some findings in the review. Lastly, the authors employed a qualitative synthesis of the findings from the reviewed studies and did not utilize a meta-analysis to determine the quantitative influence of the factors on nurses' PA.

CONCLUSION

This review provided an insight into the factors that affect nurses' PA. The results of this review make it clear that PA is influenced by many factors including both individual and

work-related factors. However, the majority of the findings from the studies indicate that individual and non-modifiable work-related factors were the most commonly assessed and identified correlates of nurses' PA. Future research should also aim to use more objective measures of PA when assessing this lifestyle behaviour in nurses to lower the risk of PA overestimation. Additionally, future research should attempt to identify more modifiable lifestyle factors related to PA in order to effectively change this behaviour in a population of nurses.

Table 1. Summary of studies included in the review ($n=12$).

Study	Participants	Study Purpose	Correlates/Factors	Measurement of PA	Significant Findings/Associations	Quality Assessment
Al-Tannir et al, 2017 [26]	<ul style="list-style-type: none"> • Saudi Arabia • $n= 412$ nurses • 54.4% females • Mean age = 33.50 years 	The purpose of this study was to identify the prevalence and predictors of physical exercise among nurses.	Gender, age, marital status, education level, years of experience, family income, smoking, BMI, chronic disease history	Items were created to assess type of PA, frequency of PA, duration per session, money spent on PA, and motive for PA.	<ul style="list-style-type: none"> • 286 nurses reported being overweight or obese. • 60.2% of nurses reported engaging in PA. • Non-smokers engaged in significantly more PA than smokers (OR = 1.61; 95% CI 1.43 to 2.85, $P < .05$). • Normal weight nurses were 1.83 times more likely to engage in PA compared to obese nurses (OR = 1.83; 95% CI 1.15 to 4.47, $P < .05$) • Walking was the most common form of PA ($n = 164$) 	7/10
Jirathananuwat et al, 2017 [27]	<ul style="list-style-type: none"> • Thailand • $n = 289$ (Nurse clinical practitioner [NCP] & Nurse Manager [NM]) • NCP (136 females, 6 males), NM (147 females) • Mean age = 35.87 years; Mean BMI = 22.48; 70.24% single 	Aimed to compare PA levels between working and nonworking hours and to compare PA level during working hours of NCP's and NM's.	Age, BMI, work experience, marital status, hospital department, 8-h work shift	FeelFit accelerometer to determine total PA and step counts per hour	<ul style="list-style-type: none"> • Average step counts during work hours (774.53 steps/hour) were significantly different ($P < .001$) than non-work hours (940.54 steps/hour) • NCP had similar PA levels to NM (11,611 vs 11,229 steps) • Number of steps/hours during work period significantly higher in NCP than NM (841.77 vs 708.38, $P < .001$) • Average MVPA during work period significantly greater for NCP's than NMs (10.28 vs 6.85, $P < .001$) • Mean overall MVPA (113.12 mins/week) of nurses did not meet WHO guidelines (150 mins/week) 	8/10

<p>Chin et al, 2016 [20]</p>	<ul style="list-style-type: none"> • United States • n= 394 registered nurses • Mean age = 48.4 years • 90.4% female; 61.2% White 	<p>The purpose of this study was to examine the associations of occupational factors with obesity and leisure-time PA among nurses.</p>	<p>BMI, leisure-time PA, Musculoskeletal pain, Gender, education level, age, race/ethnicity, type of work setting, type of workplace, job title, work status, work hours per shift, work hours per week, shift type, physical workload index, job demand, job control, job strain, job satisfaction</p>	<p>Behavioral Risk Factor Surveillance System (BRFSS) PA items [42]</p>	<ul style="list-style-type: none"> • 41.3% of nurses engaged in regular aerobic PA and 56.6% engaged in muscle-strengthening activity at least 2 days a week. • Proportion of obese nurses was significantly higher among nurses not participating in aerobic PA (23.7% vs. 9.5%, P = .004) and in regular muscle strengthening activity (23.6% vs. 13.4%, P = .040) • Nurses in passive jobs (low job demand and low job control) had lowest prevalence of aerobic PA (29.3%, P = .033) • Nurses working night shifts were significantly less likely to perform muscle-strengthening (OR = 0.44, 95% CI 0.25 to 0.77) and aerobic PA (OR = 0.59, 95% CI 0.33 to 1.05) 	<p>5/10</p>
<p>Almajwal, 2015 [25]</p>	<ul style="list-style-type: none"> • Saudi Arabia • n = 362 (non-Saudi female nurses) • 67% age < 40 years • 69% married 	<p>To explore the relationship between physical activity (PA) and barriers, shift duty, elevated body mass index (BMI), and selected eating habits.</p>	<p>Age, height, weight, education level, marital status, years of experience, work schedule, frequency of night shifts, BMI, PA barriers, eating habits, and hours of work per week</p>	<p>PA assessed using a modified survey from several preexisting PA scales.</p>	<ul style="list-style-type: none"> • Most PA attained from work-related activities (50.7%). • Being married significantly associated with PA levels when compared to being single (OR = 1.51, 95% CI 0.13 to 5.48, P = 0.024). • Nurses working night shift duty were less active than those working day shifts (OR = 0.53, 95% CI 0.29 to 3.46, P = 0.019). • Nurses with graduate or advanced education levels were less active than those with undergraduate diplomas (OR = 0.26, 95% CI .04 to 0.85, P = 0.011) 	<p>7/10</p>
<p>Bakhshi et al, 2015 [28]</p>	<ul style="list-style-type: none"> • United Kingdom • n= 623 registered nurses • 89.5% female • 87.7% worked in a hospital • 72% of were 30 years of age or older • 54.8% Caucasian 	<p>Examined registered nurses' personal health behaviours and their relationships with PA-related health-promotion practices</p>	<p>Actual body weight, perceived health status</p>	<p>Personal Physical Activity Scale [43]</p>	<ul style="list-style-type: none"> • 75% reported being physically active • 29% reported doing moderate-intensity exercise for less than one hour/day • 42% reported doing strength exercises for less than one hour/day • 36.7% reported not performing any strength exercises • There was a significant positive association between PA and body weight (P < 0.001). 	<p>7/10</p>

Peplonska et al, 2014 [29]	<ul style="list-style-type: none"> Poland N = 725 (n = 354 working night shift; n = 371 working day shifts) Average age of night shift workers was 48.3 years while day shift was 50.2 years 9% current smokers on night shift and 7% current smokers on day shift 18% of night shift workers and 17% of day shift workers had a BMI > 25 (overweight or obese) 	Aimed to investigate the associations between the rotating night shift work and specific categories of physical activity (occupational and non-occupational)	Night shift or day shift work, age, season of the year, marital status, BMI, giving birth or having children, recreational inactivity, place of work	IPAQ [32] to determine MET hours/week	<ul style="list-style-type: none"> Mean work-related PA (195.2 vs 141.0 MET hours/week) and total PA (262.3 vs 207.3 MET hours/week) were significantly higher night shift nurses than day shift Work-related PA comprised 75% of total PA in night shift and 68% in day shift Total PA and work-related PA were significantly higher in night shift than day shift nurses (236.3 vs. 187.4 and 183.2 vs. 130.8, P < 0.001) Longer night shift work was significantly associated with higher work PA and total PA but lower leisure-time PA and active transportation PA. One-third of night shift and one quarter of day shift nurses reported no leisure-time PA Being inactive was associated with more frequent night shift work (OR = 1.60, 95% CI 0.80 to 3.17, P < .05) PA guidelines of 150 mins of MVPA/week were met by most nurses (92%). 	6/10
James et al, 2013 [22]	<ul style="list-style-type: none"> United States N = 136,592 female registered nurses from Nurses' Health Study (NHS) and NHS 11 Mean age = 66 for NHS and 46 for NHS 11 Mean BMI for NHS nurses was 26.7 and for NHS 11 26.8 	Examine the association between urban sprawl, PA, and BMI among nurses in the NHS and NHS 11.	County sprawl index (measure of residential and street accessibility), BMI	NHS and NHS 11 Physical Activity items	<ul style="list-style-type: none"> A one standard deviation increases in county sprawl index resulted in OR = 0.47, 95% CI 0.34 to 0.59 MET hrs/week of combined walking, cycling, jogging, and running A one standard deviation increases in county sprawl index associated with 5% increase in NHS and 6% increase in NHS 11 odds of meeting PA guidelines by walking A one standard deviation increases in county sprawl index associated with increase in meeting PA guidelines through walking, jogging, running, cycling of 4% in NHS and 7% in NHS 11 	9/10
Esposito and Fitzpatrick, 2011 [21]	<ul style="list-style-type: none"> United States N = 112 nurses Mean age 43.42 ± 11.03 years 93.2% female Mean BMI 25.97 ± 5.57 	Examine relationships of nurses' beliefs of the benefits of exercise, their exercise behaviour and their recommendation of exercise to patients.	Beliefs about benefits of exercise measured using the Exercise Benefits and Barriers Scale (EBBS)	8 PA behaviour items from the Health-Promoting Lifestyles Profile-II questionnaire [44]	<ul style="list-style-type: none"> HPLP-II significantly correlated with EBBS-benefits subscale score (P < 0.001) HPLP-II significantly correlated with statement about teaching for health promotion with patients (P = 0.03) 	5/10
Henwood et al, 2011 [30]	<ul style="list-style-type: none"> New Zealand N = 2,264 nurses and midwives Mean age 42.51 ± 0.21 90.5% were female 	Investigate the PA in nurses and determine whether any health benefits are associated with workplace or leisure-time activity.	Age, BMI, sleep, shift work	<ul style="list-style-type: none"> IPAQ [32] Categorized PA in four groups: high work/high leisure PA; high work/low leisure PA; low work/high leisure PA; and low work/low leisure PA 	<ul style="list-style-type: none"> G1 (high work/high leisure PA) and G2 (High work/low leisure PA) performed significantly greater workplace PA (P < 0.001) G4 (Low work/high leisure PA) reported almost triple total leisure PA expenditure than G2 (P < 0.001) G1 reported the greatest PA levels and G3 (Low work/low leisure PA) reported the least (P < 0.001) 	5/10

<p>Zhao et al, 2011 [31]</p>	<ul style="list-style-type: none"> • Australia, New Zealand, and United States • N = 2494 nurses and midwives • 95.4% female; 67.7% from Australia; 30.3% overweight; 25.7% obese • Mean age was 42.8 years 	<p>The aim of this study was to examine the association between shift work and unhealthy weight among nurses and midwives. The secondary aim was to examine the relationship between shift work and modifiable lifestyle factors.</p>	<p>Shift work (continuous shift work, evening shifts, night shifts only, morning and evening shifts only, evening and night shifts only, day shift only without weekends or day shifts only with weekends)</p>	<p>IPAQ [32]</p>	<ul style="list-style-type: none"> • 9% reported low PA levels, 36.3% reported moderate PA levels, and 50.2% reported high levels of PA • Night shift workers had lower PA levels (P < 0.005) than day shift workers • Night shift workers were 1.15 times more likely to be overweight/obese compared to day workers (OR = 1.15, 95% CI 1.03 to 1.28, P = 0.013). 	<p>8/10</p>
<p>Tucker et al, 2010 [23]</p>	<ul style="list-style-type: none"> • United States • N = 3,132 registered nurses • Mean age = 42.2 years; 92% female; 96% Caucasian 	<p>Examine the relationship between registered nurses' health behaviours, health status, and professional work environments</p>	<p>General health, physical/mental health, number of days health limited PA engagement</p>	<ul style="list-style-type: none"> • Rapid Assessment of Physical Activity Scale [45] 	<ul style="list-style-type: none"> • 44.36% of RNs reported not meeting PA guidelines and 49.82% reported meeting or exceeding PA guidelines • 44.56% of RNs reported performing activities to increase muscle strength one time per week or more; 44.38% reported engaging in activities to increase flexibility one time per week or more • Significant association (P < 0.001) between not exercising and general health • Significant association (P < 0.001) between performing muscle strengthening activities and good general health 	<p>8/10</p>
<p>Zapka et al, 2009 [24]</p>	<ul style="list-style-type: none"> • United States • N = 187 nurses • 64.3% 40 years of age or older • 92.6% females • 93.5% Caucasian 	<p>To describe the weight, weight-related perceptions, and lifestyle behaviour profile of hospital-based nurses</p>	<p>Gender, age, education level, job stress, job classification, body weight</p>	<p>IPAQ [32]</p>	<ul style="list-style-type: none"> • Men reported higher levels of walking stairs were more likely to walk on breaks than women • Nurses over 40 were more likely to walk on breaks than younger women; Nurses with more education were less likely to walk on breaks than those with less education; 89.5% of nurses reported not walking during breaks 	<p>6/10</p>

Note: BMI = Body Mass Index; PA = physical activity; IPAQ = International Physical Activity Questionnaire; MET = metabolic equivalent

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