Work 68 (2021) 461–471
DOI:10.3233/WOR-203386
IOS Press

Nurses' physical activity exploratory study: Caring for you so you can care for others

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Received 21 February 2019
Accepted 19 January 2020

Abstract.
BACKGROUND: Nurses report the greatest stress of all health care workers. Although physical activity (PA) is associated with health benefits among other populations, nurses have stressors that other occupations do not typically encounter. It is important for nurses to identify techniques for stress management since stressors negatively impact their health and patient care.
OBJECTIVE: We aimed to examine the relationship between PA levels and physical, mental, and occupational health among nurses.
METHODS: Nurses (N = 62) completed measures of anthropometrics, demographics, and domains of physical, mental, and occupational health. Pearson correlations determined the relationship between PA and measures health along with the relationship between PA and health among active versus inactive nurses.
RESULTS: Fatigue was significantly correlated with moderate-to-vigorous PA ($r = –0.27$, $p < 0.05$). Relationships were found between mental health and light and moderate intensity PA ($r = 0.40$, $p < 0.001$; $r = 0.30$, $p < 0.05$).
CONCLUSIONS: Stress is prevalent among nurses and negatively impacts a nurse's health along with patient care. Findings suggest health benefits associated with PA among nurses. PA interventions among nurses may be needed to fully see the effects of PA on physical, mental, and occupational health, and ultimately patient health and safety.

Keywords: Compassion fatigue, stress, burnout, physical health

1. Introduction

Nurses face multiple stressors on a daily basis and often report the greatest stress of all health care workers [1–3]. This stress often stems from working long, unpredictable shifts and having multiple duties, conflicting job demands, and heavy workloads [3–5]. The stress associated with the nursing profession can have a negative effect on the physical, mental, and occupational health of nurses. Furthermore, these stressors may affect nurses' health and patient care [6]. Because these stressors may impact patient care negatively by causing poor health outcomes and potential medical errors, it is important to identify self-care techniques that nurses can use to improve their feelings of stress and quality of life to provide greater quality of patient care. Furthermore, not only is it important to identify these strategies, but it is critical for nurses to implement these techniques as well. One such strategy is through engagement of physical activity.

Regular physical activity is associated with enhancements in physical health including improvements in weight management [7], feelings of fatigue [7, 8], and sleep quality [7, 9]. Regular physical activity is also associated with improvements in mental health and occupational health including a decrease

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ISSN 1051-9815/$35.00

in stress [9–12], compassion fatigue [3, 13, 14], and burnout [3, 15–17]. Although research shows that physical activity is associated with multiple health benefits, over 80% of American adults do not meet physical activity guidelines (i.e. at least 150 minutes/week of moderate-intensity aerobic physical activity and at least 2 days/week of full-body muscle-strengthening activities) in 2018 [18].

Nurses may have greater knowledge of healthy behaviors, such as the importance of physical activity, compared to non-nurses [19, 20]. Nurses, however, typically report a lower health status than non-nurses and engage in unhealthy behaviors including physical inactivity, poor dietary habits, and smoking [21–25]. These unhealthy behaviors along with workplace stress and shift work may jeopardize a nurse's health and well-being as well as decrease sleep quality [2, 3, 26, 27]. As a result, fatigue and burnout are not far behind, leading to a decrease in quality of patient care and an increase in staff turnover [2, 27–29].

Previous research reports that those in the nursing profession typically have lower physical and cognitive health statuses than non-nurses[30–32]. As such, there is a need for research on the relationship between physical activity and self-care in nurses. Given the high prevalence of obesity [33], stress [3, 34, 35], compassion fatigue [3, 13, 14], and burnout [3, 36–38] in the nursing profession, more research in this area may lead to a change in programs and policies for nurses. Ultimately, these changes may increase nurses' ability to take time for themselves during the work day. Thus, the purpose of this pilot, exploratory study was to examine the relationships between physical activity levels and measures of physical, mental, and occupational health. Examining the relationship between physical activity and physical, mental, and occupational health may reveal the importance of a nurse's need to take time for self-care as well as an employer's need to provide nurses with the opportunity to take time for themselves during their shift through a worksite physical activity intervention.

2. Methods

2.1. Participants

Participants were at least 18 years old with at least one year of direct patient contact nursing experience. Participants were recruited via word of mouth, listservs, flyers, and email announcements from hospitals, clinics, and physicians' offices in the area.

2.2. Procedures

Participants completed an online demographic questionnaire; anthropometric measures; and self-reported physical health, mental health, and occupational health questionnaires. Participants wore a Fitbit Flex during all waking and sleeping hours for seven consecutive days while maintaining their regular lifestyle and activity levels. This device is similar to a pedometer; however, its additional and more stylish features may make it a greater motivator for physical activity. The Fitbit Flex contains a three-axis accelerometer to measure movement and is worn on the non-dominant wrist. The water resistant wristband is adjustable so that each individual can choose the size that most comfortably fits his/her wrist. It has a rechargeable lithium-polymer battery that lasts up to five days. The device can be recharged using a USB cable. The Fitbit Flex estimates steps, distance, calories burned, and active minutes which are all saved for seven days. Active minutes are earned for activities at or above 3 METs. The device contains a vibration motor which produces a vibration for alarms that are set as well as when daily goals are met. The device also has an LED display with five white indicator lights that show progress towards daily activity goals. The device is also able to monitor how long and how well a person sleeps as well as tell him/her how many times he/she wakes during the night. Conveniently, the device can be instantly synced and viewed on a smartphone, tablet, or computer using Bluetooth® technology. The research protocol was approved by the university's Institutional Review Board.

2.3. Measures

Physical health was measured via the short-forms of PROMIS's Pain Intensity, Pain Interference, Fatigue, and Sleep Disturbance assessments. Evidence of reliability and validity has been demonstrated in each of the PROMIS assessments in the general U.S. population (i.e., mean age of 50 and an age range of 18–65+; [39]. The PROMIS Pain Intensity assessment ($\alpha = 0.85$) asks participants to rate both their pain over the previous seven days as well as their current pain intensity. This assessment asks about participants' overall pain rather than disease-specific pain. The PROMIS Pain Interference assessment ($\alpha = 0.95$) measures the negative effects of pain on social, cognitive, emotional, physical, and recreational activities. This assessment looks at pain interference over the past seven days. The PROMIS

Fatigue instrument ($\alpha = 0.76$) assesses frequency, duration, and intensity of fatigue over the past seven days. This instrument also assesses the impact of fatigue on physical, mental, and social activities. Lastly, the PROMIS Sleep Disturbance instrument ($\alpha = 0.96$) measures perceptions of sleep quality, sleep depth, and feelings of rest associated with sleep over the past seven days [39].

Mental health was measured using the Perceived Stress Scale (PSS; stress) and the SF-12 Short Form Health Survey (satisfaction with life and quality of life). The PSS ($\alpha = 0.86$) is commonly used to assess how stressful an individual finds situations in his/her life over the period of the last month. Scores on the PSS can range from 0 to 40. The higher the score on the PSS, the higher the individual's perceived stress [40, 41]. The SF-12 ($\alpha = 0.89$) includes sections on physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health [42, 43].

The Professional Quality of Life Scale (ProQOL; $\alpha = 0.88$; $\alpha = 0.81$, respectively) [44] was used to measure compassion fatigue. Professional quality of life includes compassion satisfaction (positive component) and compassion fatigue (negative component). Compassion satisfaction involves the pleasure associated with being able to do one's work well while compassion fatigue is broken into two parts: burnout and secondary traumatic stress (STS). Burnout is associated with feelings of hopelessness and difficulties effectively dealing with work, while STS is associated with work-related, secondary exposure to those who have experienced traumatically stressful events [44]. The Maslach Burnout Inventory was used to measure burnout [45]. This questionnaire is split into three subscales: exhaustion ($\alpha = 0.90$), cynicism ($\alpha = 0.79$), and professional efficacy ($\alpha = 0.71$) [45]. Participants were asked to rate how frequently they experienced each response on a scale that ranges from 0 (never) to 6 (daily). Scores from each section were summed, and high scores on exhaustion and cynicism and low scores on professional efficacy indicated burnout.

2.4. Data analysis

Descriptive statistics were calculated on the demographic and health history information. Pearson correlations were calculated to examine the relationship between each of the measures of physical, mental, and occupational health. The relationship between physical activity and each of the measures of physical, mental, and occupational health was estimated using Pearson correlations. Participants were grouped based on their level of activity (i.e., met 2018 PAG or not), using the physical activity data recorded by the Fitbit. Pearson correlations were used to examine the relationship between physical activity and each of the measures of health in each group.

3. Results

Participants (N = 62; 98% RNs; 94% female; 85% Caucasian; 42.2 ± 11.7 years; 28.0 ± 6.7 kg/m^2) worked in a university town in the southeastern US. Over 37% had an Associate's degree ($n = 23$) while 46.8% had a 4-year undergraduate degree and 8.1% earned a graduate degree. Eighty-nine percent ($n = 55$) of nurses surveyed worked full-time, with nearly 70% working in a hospital setting. Of the 32 nurses who reported doing shift work, 22.6% reported switching shifts and 29% reported being required to work overtime. Please refer to Table 1 for additional demographic information.

3.1. Physical activity

According to the Fitbit, participants averaged $9{,}128 \pm 2{,}866$ steps/day over a 7-day period. Participants reported 303.0 ± 58.8 minutes/day of light intensity activity, 10.8 ± 9.0 minutes/day of moderate intensity activity, and 9.6 ± 11.4 minutes/day of high intensity activity. Notably, almost 60% of participants did not meet the 2018 PAGs despite 58.1% of participants reporting that their employer had policies to promote physical activity at the workplace.

3.2. Physical activity and physical health

3.2.1. Physical health

Participants rated their fatigue as 10.1 ± 4.1, sleep quality as 9.5 ± 3.2, pain intensity as 4.8 ± 2.0, and

Table 1
Participant characteristics

Variable	Mean	SD	Minimum	Maximum
Age (years)	42.2	11.7	25.0	62.0
BMI (kg/m^2)	28.0	6.7	19.5	54.0
Waist to hip ratio	0.9	0.1	0.7	1.0
Systolic blood pressure (mm Hg)	111.4	14.7	88.0	159.0
Diastolic blood pressure (mm Hg)	75.6	8.6	60.0	98.0
Aerobic fitness (mL/kg/min)	28.7	7.5	13.3	48.5

pain interference as 5.2 ± 2.7. Significant, moderate positive relationships were found between pain intensity and pain interference ($r = 0.58$; $p < 0.001$) and pain interference and fatigue ($r = 0.43$; $p < 0.001$) while there was a significant weak positive relationship between pain intensity and fatigue ($r = 29$; $p < 0.05$).

3.2.2. *Fitbit physical activity and physical health (Table 2)*

A significant weak, negative relationship was found between average daily steps and BMI ($r = –0.29$; $p < 0.05$) and between average daily steps and waist-to-hip ratio ($r = –0.28$; $p < 0.05$). Furthermore, results demonstrated a significant moderate, negative relationship between average daily vigorous intensity physical activity and BMI ($r = –0.32$; $p < 0.05$). There was also a significant weak, negative relationship between average daily moderate-to-vigorous physical activity and BMI ($r = –0.28$; $p < 0.05$), average daily moderate-to-vigorous physical activity and waist-to-hip ratio ($r = –0.26$; $p < 0.05$, average daily moderate-to-vigorous physical activity and fatigue ($r = –0.27$; $p < 0.05$). No relationships existed between physical activity and pain intensity, pain interference, or sleep quality.

3.2.3. *Activity level and physical health*

Data were split according to activity level using the 2018 PAG. Those who met the guidelines were classified as active individuals ($n = 25$), and those who did not meet the guidelines were classified as inactive individuals ($n = 37$). For individuals who were classified as active, average steps were 11,498.0 ± 2,682.0 steps and moderate-to-vigorous activity minutes/week were 258.0 ± 108.0 minutes. For inactive individuals, average steps were 7527 ± 1608 steps and moderate-to-vigorous activity minutes/week were 66.0 ± 45.0 minutes. No significant relationships were found between physical activity measured by the Fitbit and physical health variables among physically active or inactive individuals

Table 2
Physical activity and physical health correlations

	BMI	W:H	Fatigue
Steps	–0.29*	–0.28*	–0.24
VPA	–0.32*	–0.20	–0.22
MPVA	–0.28*	–0.26*	–0.27*

Note: VPA = vigorous intensity physical activity, MVPA = moderate to vigorous intensity physical activity, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table 3
Physical activity and mental health correlations

	Stress	SF-12
Steps	–0.27*	0.34*
LPA	0.53***	0.46**
MPA	–0.25*	0.40*

Note: LPA = light intensity physical activity, MPA = moderate intensity physical activity, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

3.3. *Physical activity and mental health*

3.3.1. *Mental health*

Using the Perceived Stress Scale, participants reported a score of 22.1 ± 6.7 and 49.8 ± 8.8 for the SF-12. A significant moderate negative relationship was found between stress and mental health measured by the SF-12 ($r = –0.670$; $p < 0.001$.).

3.3.2. *Fitbit physical activity and mental health (Table 3)*

A significant weak negative correlation was found between stress and average daily steps ($r = –0.27$; $p < 0.05$) and between stress and daily time spent in moderate intensity physical activity ($r = –0.25$; $p < 0.05$). There was also a moderate relationship between stress and time spent in light intensity physical activity ($r = 0.53$; $p < 0.001$). A significant weak relationship was found between the SF-12 mental health score and steps ($r = 0.34$; $p < 0.05$). A significant moderate relationship was found between the SF-12 mental health score and light intensity physical activity ($r = 0.46$; $p < 0.01$) and moderate intensity physical activity ($r = 0.40$; $p < 0.05$.), respectively.

3.3.3. *Activity level and mental health*

Individuals ($n = 25$) who met 2018 PAG reported a stress level of 21.4 ± 7.6 and a SF-12 mental health level of 50.9 ± 8.3. A moderate negative relationship was found between average steps and stress ($r = –0.41$; $p < 0.05$). There was a moderate negative relationship between average time spent in light intensity physical activity and stress ($r = 0.56$; $p < 0.001$). Individuals ($n = 37$) not meeting 2018 PAG were categorized as inactive and reported stress levels of 22.6 ± 6.1 and a SF-12 mental health status of 49.0 ± 9.1. A positive moderate relationship was found between mental health and average steps ($r = 0.34$; $p < 0.05$), time spent in light intensity physical activity ($r = 0.46$; $p < 0. 01$), and time spent in moderate intensity physical activity ($r = 0.40$; $p < 0.05$).

3.4. Physical activity and occupational health

3.4.1. Occupational health

On average, the nurses reported 84.2 ± 12.7 for burnout, 44.6 ± 4.2 for compassion satisfaction, 20.2 ± 5.5 for secondary traumatic stress, and 19.4 ± 5.3 (ProQOL) for burnout.

Significant relationships were found between burnout from the Maslach Burnout Inventory and compassion satisfaction ($r = –0.26$; $p < 0.05$), secondary traumatic stress ($r = 0.62$; $p < 0.001$), and burnout measured by the ProQOL ($r = 0.60$; $p < 0.001$). There were also significant relationships between compassion satisfaction and secondary traumatic stress ($r = –0.34$; $p < 0.01$) and ProQOL burnout ($r = –0.70$; $p < 0.001$). Lastly, there was a significant correlation between secondary traumatic stress and ProQOL burnout ($r = 0.72$; $p < 0.001$).

3.4.2. Fitbit physical activity and occupational health (Table 4)

Weak significant relationships were found between average daily steps and secondary traumatic stress ($r = –0.25$; $p < 0.05$) and between average daily steps and ProQOL burnout ($r = –0.25$; $p < 0.05$). A weak significant relationship was also found between light intensity physical activity and burnout measured by the ProQOL ($r = –0.28$; $p < 0.05$).

3.4.3. Activity level and occupational health

In active individuals, a moderate significant relationship was found between time spent in light intensity physical activity and compassion satisfaction ($r = 0.40$; $p < 0.05$) Moderate relationships were also found between burnout measured by the ProQOL and average daily steps ($r = –0.43$; $p < 0.05$) and time spent in light intensity physical activity ($r = –0.45$; $p < 0.05$). No relationships were found between physical activity and occupational health among inactive individuals.

Table 4
Physical activity and occupational health correlations

	STS	Burnout[b]
Steps	–0.25*	–0.25*
LPA	–0.24	–0.28*

Note. LPA = light intensity physical activity, STS = secondary traumatic stress; *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$; [a]From Maslach Burnout Inventory, [b]From ProQOL.

4. Discussion

The most notable finding from this study is that active nurses were less fatigued, had lower levels of stress, better mental health, and lower levels of occupational burnout than inactive nurses. Equally important is that light-intensity physical activity was correlated with improvements in overall quality of life and burnout demonstrating that even some physical activity is better than none. This finding is consistent with 2018 Physical Activity Guidelines, which recommend some physical activity over being sedentary [46]. As such, it is imperative that nurses are encouraged to engage in any intensity and level of physical activity. Furthermore, worksite policies and programs facilitating physical activity would be beneficial to nurses' physical, mental, and occupational health.

Although less than half of participants met the 2018 PAG according to the Fitbit, participants accumulated an average total of 9,128 ± 2,866 steps per day and 303.0 ± 58. minutes of light intensity physical activity per day. This is similar to research conducted by Church et al. [47], which suggested that, on average, those in the health services occupation average 2.5 METs of physical activity throughout the year, which classifies them as participating in light physical activity while at work. These results suggest that despite being active for a total average of over 5 hours a day (i.e., total light, moderate, and high intensity physical activity), or 35 hours a week, the average nurse is not accumulating enough higher intensity physical activity to see health benefits.

Sixty percent of participants of this study were classified as being overweight or obese, which is less than previous research which found a 80% prevalence of overweight or obesity among those nurses [48]. In general, participants with a higher BMI were less active than participants with a lower BMI. Although physical activity alone may not lead to weight loss and a reduction in BMI, regular physical activity has been shown to aid in weight loss and weight maintenance [7, 49–51]. Both active and inactive individuals were classified as being overweight. Although no significant relationships were found between physical activity and BMI among participants when split based on activity level, inactive individuals had a greater average BMI than active individuals.

Scores on PROMIS Fatigue questionnaire demonstrated nurses had a higher level of fatigue than the US population, which is consistent with previous research suggesting that long shifts and required

overtime often increase nurses' fatigue [30, 52]. Active participants, however, were less fatigued than inactive participants. This finding is consistent with previous research suggesting a relationship between physical activity and the prevention and reduction of fatigue [7, 53, 54]. This finding is critical since fatigue can negatively impact quality of patient care, errors made, and the health and safety of nurses [3, 52, 55]. Interestingly, the average fatigue score suggests that active individuals had a similar level of fatigue to the U.S. general population. The average fatigue score for inactive individuals suggests that inactive individuals had a slightly higher level of fatigue than the U.S. general population; thus physical activity may be a suitable intervention for improving feelings of fatigue.

While nurses' average sleep quality score was similar to the US population, this finding is inconsistent with previous research that has suggested that some nurses have a poorer sleep quality than those in other occupations, especially those working late night shifts [27, 56, 57]. This inconsistency may be due to having a low number (18%) of participants currently working the night shift. No correlations reached significance between physical activity and sleep quality in this population. This suggests that, although previous research [58–60] has supported an improvement in sleep quality with an increase in physical activity, in this population there is no relationship between physical activity and sleep quality. This result may be due to greater than expected sleep quality. Due to the negative effect of poor sleep quality on patient outcomes [2, 27, 57], future research should examine other solutions for poor sleep quality among this population. Notably, the average active individual had a slightly greater sleep quality than the U.S. general population while the average inactive individual had a slightly lower sleep quality than the U.S. general population [39]. More research should be done to examine the relationship between physical activity and sleep quality because previous research [61, 62] shows an increase in medical errors due to increases in fatigue that is often associated with lower sleep quality.

From a mental health perspective, there was a moderate negative correlation between stress and light intensity physical activity. In general, more active participants had lower levels of stress than inactive participants. This is consistent with research that has supported a reduction in feelings of stress after physical activity [63, 64]. These results are important because previous research has supported high stress among nurses [2, 65] which can ultimately decrease nurse health [5, 31, 32, 66] and quality of patient care [6, 26, 67]. A moderate negative relationship was found between steps and stress, and a moderate negative relationship was found between time spent in light intensity physical activity and stress among active individuals. This finding suggests that among active participants, a greater accumulation of steps and light intensity physical activity was associated with lower levels of stress. Moderate relationships were found between the quality of life and light intensity physical activity along with quality of life and moderate intensity physical activity. In general, active participants had a better satisfaction with life and quality of life compared to inactive participants, which corresponds with previous findings [68, 69] suggesting that exercise programs may be as useful at preventing negative health effects due to high psychological job demands among nurses. These results are important because previous research [70, 71] has suggested that impairments in mental functioning, especially in newly licensed nurses, is associated with absenteeism among nurses. The average active individual had a slightly higher, but still around average Satisfaction with Life (SWL) and QOL scores when compared to the national norm for those of a similar age [72] and RNs working at least 50% of a full position within the Norwegian Nurses Organization [73]. No significant relationships were found between mental health and physical activity in active individuals. The average inactive individual had a lower SWL and QOL when compared to the national norm for those of a similar age [72] and RNs working at least 50% of a full position within the Norwegian Nurses Organization [73]. This would suggest a below average mental health score among inactive individuals. These results are consistent with previous research [68, 69, 74], which suggests that exercise programs may be beneficial at preventing negative health effects due to high psychological job demands among nurses.

Positive moderate relationships were found between mental health and steps, light intensity physical activity, and moderate intensity physical activity. These results suggest that a greater accumulation of steps, light intensity physical activity, and moderate intensity physical activity are associated with greater mental health (i.e., satisfaction with life and quality of life) among inactive individuals. These findings are consistent with research demonstrating that physical activity may increase quality of life in employees [9].

The final purpose of this study was to examine the relationships between physical activity and

occupational health. Scores on the Burnout Maslach Inventory range from 0 to 132, with higher scores indicating greater burnout. A score of 84.2 suggests that those surveyed have a higher than average burnout score than 13,204 U.S. nurses tested in 1998-1999 (average score of 68.4) [75]. This difference could be attributed to the shift length of nurses in this study as 67% of nurses worked in hospitals and worked shifts of at least 12 hours. Stimpfel et al. [6, 76] reported an increase in the prevalence of burnout as shift length increases. A weak relationship was found between vigorous intensity physical activity and burnout. This suggests that the participants who accumulated the greatest amount of high intensity physical activity also had the greatest feelings of burnout. The average active individual had a higher burnout than the 13,204 U.S. nurse population tested in 1998-1999 [75]. No significant relationships were found between burnout and physical activity in active individuals. The average inactive individual had a higher burnout than the 13,204 U.S. nurse population tested in 1998-1999 [75].

A positive moderate relationship was found between vigorous intensity physical activity and burnout among inactive individuals, suggesting that an increase in vigorous intensity physical activity is associated with an increase in feelings of burnout among inactive individuals. This finding may be the result of it being more difficult for inactive individuals to participate in vigorous intensity physical activity due to a lower aerobic fitness or a higher BMI. Compassion fatigue includes burnout and secondary traumatic stress [44]. A burnout score of 19.4 suggests that those surveyed have a low level of burnout and a similar level of burnout as those included in a similar age group among a data bank of 1,289 cases created from multiple studies [44]. A secondary traumatic stress score of 20.2 suggests that those surveyed have a low level of secondary traumatic stress and a higher than average level of secondary traumatic stress than the members of the data bank [44]. These scores, along with a high average level of compassion satisfaction [44.6], suggest that the average study participant receives positive reinforcement from his or her work, has no significant concerns about the inability to complete his or her work, does not suffer from any noteworthy fears resulting from his or her work, and are probably liked by his or her patients [44]. These scores suggest a low level of compassion fatigue among this population. This is inconsistent with previous research, which has suggested high compassion fatigue among nurses [3, 77]. The low level of compassion fatigue may be a result of nurses using coping mechanisms for compassion fatigue other than physical activity, such as maintaining a work-life balance or taking time for themselves (e.g., meditation or journaling) [78–80]. This low level of compassion fatigue may also be a result of personality traits, such as resliency and hope, that may prevent the development of compassion fatigue among this population [81].

Weak significant relationships were found between average daily steps and secondary traumatic stress and average daily steps and ProQOL burnout. A weak significant relationship was also found between light intensity physical activity and burnout measured by the ProQOL. These results suggest that, in general, active participants had a lower compassion fatigue than inactive participants. More research should be conducted examining this relationship because compassion fatigue has been shown to harm nurses professionally, physically, and mentally while lowering quality of patient care [2, 82, 83].

Active individuals had a similar burnout score and a higher secondary traumatic stress score than members of the data bank [44]. A moderate significant relationship was found between time spent in light intensity physical activity and compassion satisfaction. Moderate relationships were also found between burnout and average daily steps and time spent in light intensity physical activity. These results are consistent with previous research that suggests that physical activity may be associated with a reduction of burnout and an increase in compassion satisfaction [15].

Inactive individuals had similar burnout score and a greater secondary traumatic stress score than members of the data bank [44]. No significant relationships were found between compassion fatigue and physical activity in inactive individuals. More research is needed to see the true effects of physical activity on compassion fatigue and compassion satisfaction.

4.1. Strengths, limitations, and future research

One strength of this study was the objective measurement of physical activity. Although research has shown that the IPAQ has evidence of reliability and validity for measuring physical activity in 18- to 65-year-old adults in diverse settings [84], the use of a self-reported measure of physical activity may result in an overestimation of physical activity due to social desirability [85]. Another strength of this study was the inclusion of nurses with at least one year of experience in the nursing profession. Including nurses with

less than one year of experience may have affected the results of this study due to the additional stressors faced when in a new profession. Although there are significant strengths, there is potential for future research. First, this study was open to all nurses over the age of 18 with at least 1 year of experience and current direct contact with patients. This led to a large range of number of hours worked, time of shift, and stress factors (e.g., working in ICU vs. working in a general practice office). Due to the range of answers on the factors that may affect the variables measured in this study, it is difficult to generalize the results to nurses in a specific setting. In the future, it may be a good idea to focus only on hospital nurses or only on those working in a doctor's office to allow for a better specificity of results.

A major limitation of this pilot, exploratory study was the small sample size (N = 62). While this sample size may be limitation, this was an exploratory study to examine whether relationships existed between physical activity and physical, mental, and occupational health outcomes. Since these relationships did exist, future research should expand sample size to determine if these relationships do exist in larger samples. Furthermore, these relationships can be used to develop physical activity interventions for nurses, a population that may benefit from physical activity.

Another limitation of this study is the underrepresentation of the male nurse population (1.6%), which may limit generalizability. Future studies should target male nurses for better generalizability of findings. Conducting a correlational research study may be another limitation to this study. Because correlational studies do not indicate the direction of the interaction, we do not know if level of physical activity caused the variation in health, if the variation in health caused the level of physical activity among participants, or if another variable caused the variation in health and physical activity. For this reason, future studies should look at the relationship between physical activity and measures of health among nurses over time or through a physical activity intervention to fully see the effects physical activity may have on nurses' health.

This study also had the limitation of self-selection. It is possible that those who were suffering from some of the measured health outcomes (e.g., stress or pain) did not choose to participate in the study. Another limitation was the Fitbit's inability to measure certain aerobic activities (e.g., swimming and biking). Future research should have participants record physical activity completed that is not measured by the Fitbit. Another consideration for future research is examining physical activity and health outcomes after categorizing the participants by age and/or years of experience.

5. Conclusion

Nurses face multiple stressors (e.g., long work hours, shiftwork, conflicting job demands) daily [1–3]. These stressors may have a negative effect on the health and safety of nurses and on the care of their patients [2, 32, 86, 87]. Thus, it is important to determine strategies and techniques to help nurses combat the stress that they face daily.

Results suggest a positive association between participation in physical activity and various measures of health among nurses, demonstrating that increasing daily physical activity, either leisure-time or occupational or combination, may be an effective method for improving health stress, quality of life, and satisfaction with life among this population. To increase occupational physical activity, it may be necessary to educate the healthcare officials of the importance of physical activity and its effects, not only for their employees but their patients.

It is imperative for healthcare organizations to allow nurses the ability to be physically active during the work day. Ultimately, the ability to be active during the work day may help to improve patient care and decrease nurse turnover due to stress, burnout, and compassion fatigue. It is also important to educate nurses more thoroughly on the importance of physical activity [7] and along with their current activity level. Furthermore, these findings demonstrate the need to educate nurses while they are in nursing school to promote self-care techniques prior to developing negative health issues.

Physical activity may be a viable solution for improving multiple health outcomes for both nurses and their patients. For this reason, it is imperative for nurses to find ways to increase their physical activity intensity and the duration of physical activity. Ultimately, this increase in intensity and duration may lead to health benefits for the nurse, improvements of the healthcare organization, and improvements in patient care.

Conflict of interest

None to report.

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