HHS Public Access

Author manuscript

Workplace Health Saf. Author manuscript; available in PMC 2021 May 28.

Published in final edited form as:

Workplace Health Saf. 2018 December ; 66(12): 577–587. doi:10.1177/2165079918771987.

Relationships of Musculoskeletal Symptoms, Sociodemographics, and Body Mass Index With Leisure-Time Physical Activity Among Nurses

Soohyun Nam, PhD, APRN, ANP-BC[1], **MinKyoung Song, PhD, APRN, FNP**[2], **Soo-Jeong Lee, PhD, APRN**[3]

[1]Yale University,

[2]Oregon Health & Science University,

[3]University of California, San Francisco.

Abstract

Nurses have a high prevalence of musculoskeletal symptoms from patient handling tasks such as lifting, transferring, and repositioning. Comorbidities such as musculoskeletal symptoms may negatively affect engagement in leisure-time physical activity (LTPA). However, limited data are available on the relationship between musculoskeletal symptoms and LTPA among nurses. The purpose of this study was to describe musculoskeletal symptoms and LTPA, and to examine the relationships of musculoskeletal symptoms, sociodemographics, and body mass index with LTPA among nurses. Cross-sectional data on sociodemographics, employment characteristics, musculoskeletal symptoms, body mass index, and LTPA were collected from a statewide random sample of 454 California nurses from January to July 2013. Descriptive statistics, bivariate and multiple logistic regressions were performed. We observed that non-White nurses were less likely to engage in regular aerobic physical activity than White nurses (odds ratio [OR] = 0.61; 95% confidence interval [CI] = [0.40, 0.94]). Currently working nurses were less likely to engage in regular aerobic physical activity than their counterparts (OR = 0.48; 95% CI = [0.25, 0.91]). Nurses with higher body mass index were less likely to perform regular aerobic physical activity (OR = 0.93; 95% CI = [0.89, 0.97]) or muscle-strengthening physical activity (OR = 0.92; 95% CI = [0.88, 0.96]). This study found no evidence that musculoskeletal symptoms may interfere with regular engagement in LTPA. Physical activity promotion interventions should address employment-related barriers, and particularly target racial minority nurses and those who have a high body mass index.

Keywords

health promotion; health education; disease prevention; leisure-time physical activity; minority nurses

Address correspondence to: Soohyun Nam, PhD, APRN, ANP-BC, Associate Professor, School of Nursing, Yale University, 400 West Campus Dr., Orange, CT 06477, USA; soohyun.nam@yale.edu.

Conflict of Interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Introduction

Regular physical activity has many health benefits, including the reduced risk of obesity, Type 2 diabetes, and some types of cancer, as well as improving mental health (Centers for Disease Control and Prevention [CDC], 2013; Dunn, Trivedi, & O'Neal, 2001; Kesaniemi et al., 2001). In 2015, however, only 51% of U.S. adults met the 2008 physical activity guidelines for aerobic activity, and 21% met the guidelines for both aerobic and muscle-strengthening activities (CDC, 2016b). A recent study of nurses found that many nurses did not participate in leisure-time physical activity (LTPA) on a regular basis: Only 41% met the recommended level of aerobic physical activity (Chin, Nam, & Lee, 2016). This raises concerns because physical inactivity is a risk factor for obesity, and nurses—the largest healthcare occupational group—have a high obesity rate of 30% to 55% (Chin et al., 2016; Han, Trinkoff, Storr, & Geiger-Brown, 2011). Lack of LTPA may also result in low productivity in the workplace (Goetzel et al., 2010; Tucker, Harris, Pipe, & Stevens, 2010).

Physically demanding nursing jobs which involve long work hours and shift work schedules may contribute to low levels of LTPA among nurses (Chin et al., 2016; Han, Trinkoff, & Geiger-Brown, 2014). Studies suggest that occupational physical activity and LTPA may not provide the same health benefits with mixed results (Allman-Farinelli, Chey, Merom, & Bauman, 2010; Gutiérrez-Fisac et al., 2002; Martin, Nieto, Ruiz, & Jimenez, 2008). Some studies have shown that occupations involving moderate to high levels of physical activity are associated with low body mass index (BMI; Church et al., 2011; G. A. King et al., 2001; Steeves, Bassett, Thompson, & Fitzhugh, 2012), while other studies have shown that high levels of occupational physical activity are associated with a high BMI (Gutiérrez-Fisac et al., 2002; Jang, Kim, Lee, Myong, & Koo, 2014; Kaleta, Makowiec-Dabrowska, & Jegier, 2007; McLaren & Godley, 2009; Singer et al., 2016). The risk of not taking up LTPA was higher among individuals who expended more calories per week on occupational physical activity or individuals with high job strain (Kaleta et al., 2007; Kouvonen et al., 2005).

Nurses have a high prevalence of musculoskeletal symptoms from physically demanding tasks (S. J. Lee, Lee, & Gershon, 2015), which could be a potential barrier for nurses to participate in LTPA. A recent systematic review of 132 studies of nursing workers reported that on average, 55% experienced low back symptoms in the previous year, 44% had low back symptoms in the previous 3 to 6 months, and 35% had current low back symptoms (Davis & Kotowski, 2015). Studies of young nursing students or dentists showed that musculoskeletal symptoms may negatively affect engagement in LTPA (Backaberg, Rask, Brunt, & Gummesson, 2014; Feng, Liang, Wang, Andersen, & Szeto, 2014). Frequent or severe musculoskeletal symptoms can interfere with an individual's LTPA by causing limitation or discomfort related to physical activity (Backaberg et al., 2014). Nonetheless, there is little research on the relationship between musculoskeletal symptoms and LTPA among nurses.

Sociodemographic characteristics have also been shown to be related to LTPA. In a review of physical activity from diverse racial/ethnic groups, women had lower rates of engagement in LTPA than men, and racial/ethnic minority women such as Blacks, Asians, and Hispanics

reported lower rates of LTPA engagement than White women (Eyler et al., 2002). Findings on the relationship between age and LPTA were mixed. An inverse relationship between age and physical activity was found in White and Black women but not among men (Eyler et al., 2002). Another study showed that age was not associated with LPTA in Blacks and Whites (A. C. King et al., 2000).

The relationship between BMI and LTPA in many studies in the general population appears to be bidirectional. In longitudinal studies, individuals who were sedentary or had a lack of LTPA had increased odds of developing obesity than their counterparts (Morseth, Jacobsen, Emaus, Wilsgaard, & Jorgensen, 2016; Su et al., 2017). Also, individuals with high BMI engaged less in LTPA than individuals with normal BMI, in part due to more perceived barriers to LTPA, such as low exercise self-efficacy and comorbid conditions (Morseth et al., 2016; Schutzer & Graves, 2004).

Understanding the relationship between musculoskeletal symptoms and LTPA among nurses, and other risk factors of their LTPA could help guide future workplace wellness programs to improve health among nurses. Therefore, the purpose of this study was twofold: (a) to describe musculoskeletal symptoms and LTPA levels among nurses, and (b) to examine the relationships of musculoskeletal symptoms, sociodemographics, and BMI with LTPA among nurses. Based on our literature review, we hypothesized the following:

Hypothesis 1: Nurses with more musculoskeletal symptoms have lower levels of LTPA engagement.

Hypothesis 2: Non-White nurses and nurses with higher BMI have lower levels of LTPA than their counterparts.

Method

Design, Sample, and Procedures

A statewide cross-sectional survey of registered nurses in California was conducted from January to July 2013. A mail survey was sent to 2,000 nurses randomly selected from a 2012 list of actively licensed nurses by the California Board of Registered Nursing. The survey packet contained an information letter, informed consent, and a study questionnaire. Respondents were also given an alternative response option of online completion following log-in information provided in the study information letter. Postal reminders were sent at 2-week intervals up to 4 times. As a reward for participation, 20 respondents selected through random drawing received a US$50 gift card. All study protocols were approved by the Institutional Review Board of University of California, San Francisco prior to implementation.

Variables and Instruments

Sociodemographics included age, gender, race/ethnicity, and education. Employment status was categorized as working, not working, retired, and student; and then dichotomized into working versus not working, which included retirees and students. Workplace and employment factors included type of workplace (e.g., hospital), job title (e.g., staff nurse),

work status (e.g., full-time), work shift (e.g., day), hours worked per shift, and hours worked per week.

Physical activity variables included leisure-time aerobic physical activity and muscle-strengthening physical activity. The questions were adapted from the Behavioral Risk Factor Surveillance System (CDC, 2016a). *Aerobic physical activity* was measured by the following two questions: "During the past month, other than your regular job, how many times per week did you take part in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?" Those who reported at least 1 day were then asked, "When you took part in this activity, for how many minutes did you usually keep at it?" Using the two questions, the total number of minutes per week of aerobic physical activity was calculated by multiplying the frequency of physical activity per week by the number of minutes spent on physical activity. Based on the 2008 Physical Activity Guidelines for Americans (U.S. Department of Health and Human Services [USDHHS], 2008), regular aerobic physical activity was defined as engaging in at least 150 minutes per week of aerobic physical activity. *Muscle-strengthening physical activity* was measured by asking, "During the past month, other than your regular job, how many times per week or per month did you do physical activities or exercises to strengthen your muscles?" Regular muscle-strengthening physical activity was defined as performing muscle-strengthening physical activity 2 or more days a week (USDHHS, 2008).

BMI was calculated by weight in kilograms divided by height in meters squared (kg/m^2), and categorized as underweight ($<18.5\ kg/m^2$), normal ($18.5–24.9\ kg/m^2$), overweight ($25–29.9\ kg/m^2$), or obese ($\geq 30\ kg/m^2$; CDC, 2012).

Musculoskeletal symptoms were assessed by questions adapted from the validated Nordic Musculoskeletal Questionnaire (Kuorinka et al., 1987; Trinkoff, Lipscomb, Geiger-Brown, & Brady, 2002). Respondents were asked whether they had pain, aching, stiffness, burning, numbness, or tingling in the low back, neck, shoulders, or hands/wrists in the past 12 months. Subsequent questions for reported symptoms included frequency, duration, and severity of symptoms. *Major symptoms* were defined as moderate or severe symptoms that either occurred at least monthly, or lasted for 1 week or longer. This definition was based on the method by Trinkoff et al. (2002). A *musculoskeletal symptom index* was created as an aggregate measure of symptoms in the low back, neck, shoulders, or hands/wrists. One point was assigned for each of the following criteria: (a) the intensity of symptoms was at least moderate, (b) the duration was at least 1 week, and (c) the frequency was at least monthly. The musculoskeletal symptom index was the sum of points for all four body regions, ranging from 0 (*no symptoms*) to 12 (*maximum symptoms*).

Statistical analysis

Descriptive statistics were used to summarize study variables. Values for continuous variables were presented as means and standard deviations (*SD*); categorical variables were summarized by frequencies and percentages. The prevalence of regular LTPA (aerobic and muscle-strengthening physical activities) was described by sociodemographics, musculoskeletal symptoms, and BMI. Logistic regression analyses were conducted to examine the relationships of sociodemographics, musculoskeletal symptoms, and BMI with

aerobic physical activity and muscle-strengthening physical activity. To identify potential confounders and to avoid multicollinearity problems in multivariable analysis, several logistic models were tested and compared. Covariates with $p < .10$ in bivariate analysis were retained in the multivariable models. Correlations of ≥.80 between independent variables, tolerance of ≤0.1, and variance inflation factors (VIFs) of >5 were considered indicative of multicollinearity (Stevens, 2009).

We assessed model fit using the Hosmer–Lemeshow test, and assessed the degree of unique variability accounted for by using Cox and Snell R^2 and Nagelkerke R^2. Categorical variables were dichotomized, considering the distributions and bivariate findings. The odds ratios (ORs) and 95% confidence intervals (CIs) were obtained from the logistic regression models. All hypothesis testing was two sided; Type I error was controlled at the .05 significance level.

Results

Of 2,000 nurses who received a mail survey, 528 actively licensed registered nurses responded (response rate = 26.4%) and 468 nurses answered the physical activity questions. We excluded 14 nurses on disability leave due to pregnancy or other medical conditions because their conditions of disability could confound results on musculoskeletal symptoms and LTPA prevalence. The final sample for this study was 454 nurses.

The majority of participants were women (91.2%) and non-Hispanic White (65.2%) with a mean age of 49.6 years ($SD = 13.1$). Of the participants, 86.8% ($n = 394$) were currently working; of these working nurses, 61.4% worked in hospital settings, 81.7% worked as staff nurses, and 69% worked full-time (Table 1). The principal work schedules were reported as follows: 65.0% day shift, 6.3% evening shift, 18.8% night shift, and about 10% either rotating shift or did not answer. Mean working hours per week was 37.5 hours ($SD = 11.9$). Among not-working nurses ($n = 60$), 39 were retirees, one reported as a student, and 20 reported currently not working. The mean BMI was 25.6 kg/m^2 ($SD = 4.8$); 47.7% were overweight or obese. For physical activity among all nurses, 44.1% engaged in regular aerobic physical activity and 55.8% performed regular muscle-strengthening activity.

Table 2 presents descriptions of musculoskeletal symptoms by body region. Among our participants, low back symptoms were most frequently reported (61.7%), followed by neck symptoms (48.5%), shoulder symptoms (41.9%), and wrist/hand symptoms (41.6%). The mean score of musculoskeletal symptom index was 3.2 ($SD = 3.1$) of 12: 37.7% ($n = 171$) had the symptom index score of 1 to 3, 20.7% ($n = 94$) scored 4 to 6; and 16.3% ($n = 74$) scored greater than 6.

Regular Physical Activity by Sociodemographics, BMI, and Musculoskeletal Symptoms

Nurse characteristics of age ($p < .01$) and race ($p = .03$) were significantly associated with regular aerobic physical activity (Table 3). The prevalence of regular aerobic physical activity was the lowest among nurses 35 to 44 years of age (24.3%) and Asian nurses (30.9%). Currently working nurses were significantly less engaged in regular aerobic physical activity than nonworking nurses (41.0% vs. 65.5%; OR = 0.36; 95% CI = [0.20,

0.65]). Compared with nurses with normal BMI, nurses with BMI ≥30 were significantly less likely to engage in regular aerobic physical activities (46.8% vs. 24.6%; OR = 0.36; 95% CI = [0.20, 0.67]) and muscle strengthening (62.7% vs. 40.3%; OR = 0.42; 95% CI = [0.24, 0.73]). For musculoskeletal symptoms, nurses with a symptom index ranging from 1 to 3 were significantly less likely to engage in regular aerobic physical activity than nurses without any symptoms (39.2% vs. 51.8%; OR = 0.60; 95% CI = [0.37, 0.97]). Nurses with a symptom index ranging from 4 to 12 also showed lower prevalence rates, but the findings were not significant. Nurses with a symptom index ranging from 1 to 3 also showed the lowest prevalence of muscle-strengthening activity (49.1%); the finding was marginally significant (OR = 0.63; 95% CI = [0.38, 1.03]).

Factors Associated With Regular Physical Activity: Multivariable Analysis

Multivariable analyses indicated that non-White nurses (OR = 0.61; 95% CI = [0.40, 0.94]), working nurses (OR = 0.48; 95% CI = [0.25, 0.91]), and nurses with higher BMI (OR = 0.93; 95% CI = [0.89, 0.97]) were significantly less likely to engage in regular aerobic physical activity (Table 4). Nurses with higher BMI (OR = 0.92; 95% CI = [0.88, 0.96]) were also significantly less likely to engage in regular muscle-strengthening physical activity. The musculoskeletal symptom index was not significant in the multivariable model.

Discussion

Nurses are at high risk of musculoskeletal injuries from work; however, the relationship between musculoskeletal symptoms and regular LTPA among nurses has been surprisingly understudied. The majority of working nurses in our sample reported having symptoms in the low back, neck, shoulders, or hands/wrists daily or almost daily, and their regular LTPA levels were far from optimal: a rate of 44% and 56% for aerobic and muscle-strengthening physical activities, respectively. However, different from our hypothesis, musculoskeletal symptoms were not a significant risk factor for LTPA after controlling for other correlates, yet we found significant associations with employment status, race, and BMI.

Although musculoskeletal symptoms were not significant in our multivariable model, in bivariate analysis we found a significantly lower level of regular LTPA among nurses with low musculoskeletal symptom index scores (1–3) than among nurses without any symptoms. Interestingly, nurses with higher symptom index scores tended to show slightly higher LTPA rates than nurses with low symptom index scores. This finding suggests that having musculoskeletal symptoms negatively affects LTPA, but experiencing more or greater symptoms may affect their motivation to perform LTPA to manage their symptoms or prevent further injuries. In fact, some studies have shown that regular LTPA could prevent occupation-related musculoskeletal injury (Feng et al., 2014; Hildebrandt, Bongers, Dul, van Dijk, & Kemper, 2000). For example, in a prospective study of 2,265 workers in the Royal Norwegian Navy, engaging in regular LTPA was significantly associated with fewer musculoskeletal symptoms (Morken, Mageroy, & Moen, 2007). As such, the relationship between LTPA and musculoskeletal symptoms is likely to be bidirectional, and this mixed bidirectional effect may have been present in our study findings. Future research with

prospective study and large samples is needed to elucidate the impact of musculoskeletal symptoms on LTPA.

The novel finding in this study is that employment status, race, and BMI were significant factors for engaging in regular aerobic physical activity among nurses. Among these factors, only BMI was significantly associated with regular muscle-strengthening physical activity. Studies on physical activity showed that employed women were less likely to engage in LTPA, particularly among racial/ethnic minority groups (Eaton et al., 1993; S. H. Lee & Im, 2010; Sternfeld, Cauley, Harlow, Liu, & Lee, 2000), and our study of nurses also showed there to be consistent findings. Also, consistent with other studies of the general population (Taylor, Kimbro, Evans-Hudnall, Haughton McNeill, & Barnes, 2015; Whitt-Glover et al., 2009), minority nurses such as Asian nurses showed significantly lower levels of LTPA than White nurses. Previous studies showed that racial-specific correlates of LTPA among minority women were often health beliefs, social support, and time constraints due to family responsibilities (Cassetta, Boden-Albala, Sciacca, & Giardina, 2007; Sweet et al., 2009; Trost, Owen, Bauman, Sallis, & Brown, 2002). Along the same lines, we found that working nurses and middle-aged groups (34–54 years) who may have many competing jobs and family responsibilities were less likely to engage in LTPA.

Last, consistent with most studies of the general population (Donnelly et al., 2009), nurses with higher BMI in our study engaged in less LTPA, both aerobic and muscle-strengthening physical activities. Although most working nurses perform work-related physical activities, the biological effects of different types of physical activities (i.e., LTPA vs. occupational physical activity) on obesity and health might be different (Gutiérrez-Fisac et al., 2002; Koenig, Sund, Döring, & Ernst, 1997). Studies have shown that energy expenditures from occupational physical activity were not associated with lower BMI, waist/hip ratio, body fat composition, or cardiovascular disease risk (Gutiérrez-Fisac et al., 2002; Koenig et al., 1997). Moreover, a job requiring a demanding level of physical tasks can have a negative influence on mental health such as depression, stress, and anxiety, and in turn, negatively influences LTPA engagement (Feng et al., 2014; Fransson et al., 2012; Han et al., 2014; Lallukka, Lahelma, et al., 2008; Lallukka, Sarlio-Lahteenkorva, et al., 2008). Also, the energy expenditure derived from occupational physical activity could be neutralized by higher dietary intake in individuals who are more active at work (Gutiérrez-Fisac et al., 2002; Paeratakul, Popkin, Keyou, Adair, & Stevens, 1998). In fact, individuals with greater occupational physical activity reported higher caloric intake than those whose occupation required less physical activity (Paeratakul et al., 1998). Although our study cannot provide a definitive explanation— without controlling for the effect of diet and a level of occupational physical activity—the findings of the high obesity rate and low LTPA rate may be partially explained by our sample whose jobs often require physically demanding work. More research is needed to understand LTPA and occupational physical activity along with other lifestyle risk factors such as unhealthy eating or disrupted sleep cycles.

Limitations of this study include the use of self-report measures, which are subject to recall or reporting bias in physical activity levels, BMI, and musculoskeletal symptoms. Our study may have underestimated the prevalence of obesity and overestimated the prevalence of LTPA. The nature of this cross-sectional study made it impossible to infer causality. In

addition, nurses were recruited from one geographical area where the obesity rate was relatively low than in other states (CDC, 2017); this may limit the generalizability of our study findings. All participants had an active California nursing license to be included in the study, but a small number of nurses belonged to the nonworking group and about half of them were retirees. As such, with a heterogeneous sample, we did not include occupational physical activity in this study, which may affect LTPA engagement. In addition, we included only musculoskeletal symptoms in the upper body, commonly reported among nurses, and thus our findings are limited to explain the relationship between LTPA and overall musculoskeletal symptoms. To better understand the relationships, future research needs to further examine both occupational and leisure-time physical activities in relation to musculoskeletal symptoms. Last, potential confounders such as income, neighborhood environment, sleep patterns, social support, and health beliefs may be associated with LTPA levels among nurses but were not evaluated in our study. This might have influenced our findings on nurses' LTPA.

Implications for Occupational Health Nurse Practice

Workplace health-promotion or wellness programs have evolved to promote workers' health and well-being, and physical activity is one of the main components in wellness programs. Our study findings suggest that nurses also need education and better support in the workplace for personal health behavior change for their own health as well as for their patients. As shown in other worker populations, worksite physical activity interventions would be beneficial for nurses to improve their physical and mental health, and job productivity (Anderson et al., 2009; Flannery, Resnick, & McMullen, 2012; Kobayashi, Kaneyoshi, Yokota, & Kawakami, 2008; Nam & Whittemore, 2014).

In particular, nurses are in a key position to promote regular physical activity and to endorse prevention of obesity. In a review of healthcare providers' LTPA habits and their health-promotion practices, higher LTPA levels among physicians and nurses were associated with higher physical-activity-promoting practices for their patients (Abramson, Stein, Schaufele, Frates, & Rogan, 2000; Fie, Norman, & While, 2013). A majority of patients reported that they received physical activity consultations more from nurses than from physicians (Fie et al., 2013; Puig Ribera, McKenna, & Riddoch, 2005). In another study, nurses reported positive views about health promotion in general, but the study patients recalled very low levels of lifestyle counseling advice delivered by nurses, including physical activity promotion (Duaso & Cheung, 2002).

Occupational health nurses play a central role in designing and providing workplace wellness programs. In designing the program, occupational health nurses should be aware that health disparities exist among healthcare workers (Chou & Johnson, 2008; Mawn et al., 2010; Nam & Whittemore, 2014). Particularly, Black, Hispanic, and Asian healthcare workers are less likely to report their general health status as excellent than White healthcare workers, and tend to report more job-related injuries, burnouts, and physical inactivity (Caban-Martinez et al., 2007; Chou & Johnson, 2008; Luckhaupt, Cohen, Li, & Calvert, 2014). Special efforts to reduce health disparities should be made in providing workplace wellness programs.

Conclusion

In summary, our study sample of registered nurses— who are well poised to promote physical activity— reported low engagement in LTPA, and the majority did not meet the recommended level of aerobic physical activity. In particular, currently working and Asian nurses were less likely to engage in regular aerobic physical activity. Nurses with higher BMI engaged less in regular aerobic and muscle-strengthening physical activity. Future research to understand the relationship of LTPA with musculoskeletal symptoms and job-related factors including occupational physical activity is needed. It is also important to identify barriers and facilitators to physical activity among nurses, and improve health disparities within the healthcare workforce by developing appropriate health interventions. Promoting the health of healthcare workers should be an important priority to deliver quality healthcare and improve the overall health status of the nation.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was supported by grants from the Southern California National Institute for Occupational Safety and Health (NIOSH) Education and Research Center Pilot Project Research Training Grant (Grant No. 2 T42 OH008412-08) and the National Institute of Nursing Research (K23NR014661).

Author Biographies

Soohyun Nam is an associate professor in the School of Nursing at Yale University, Orange, Connecticut.

MinKyoung Song is an assistant professor in the School of Nursing at Oregon Health & Science University, Portland, Oregon.

Soo-Jeong Lee is an associate professor in the School of Nursing at University of California, San Francisco (UCSF).

References

Abramson S, Stein J, Schaufele M, Frates E, & Rogan S (2000). Personal exercise habits and counseling practices of primary care physicians: A national survey. Clinical Journal of Sport Medicine: Official Journal of the Canadian Academy of Sport Medicine, 10, 40–48. [PubMed: 10695849]

Allman-Farinelli MA, Chey T, Merom D, & Bauman AE (2010). Occupational risk of overweight and obesity: An analysis of the Australian health survey. Journal of Occupational Medicine and Toxicology, 5, Article 14. doi:10.1186/1745-6673-5-14

Anderson LM, Quinn TA, Glanz K, Ramirez G, Kahwati LC, & Johnson DB, … Task Force on Community Preventive Services. (2009). The effectiveness of worksite nutrition and physical activity interventions for controlling employee overweight and obesity: A systematic review. American Journal of Preventive Medicine, 37, 340–357. doi:10.1016/j.amepre.2009.07.003 [PubMed: 19765507]

Backaberg S, Rask M, Brunt D, & Gummesson C (2014). Impact of musculoskeletal symptoms on general physical activity during nursing education. Nurse Education in Practice, 14, 385–390. doi:10.1016/j.nepr.2014.02.003 [PubMed: 24594281]

Caban-Martinez AJ, Lee DJ, Fleming LE, LeBlanc WG, Arheart KL, Chung-Bridges K, … Pitman T (2007). Leisure-time physical activity levels of the US workforce. Preventive Medicine, 44, 432–436. [PubMed: 17321584]

Cassetta JA, Boden-Albala B, Sciacca RR, & Giardina EV (2007). Association of education and race/ethnicity with physical activity in insured urban women. Journal of Women's Health, 16, 902–908. doi:10.1089/jwh.2006.0141

Centers for Disease Control and Prevention. (2012). Adult overweight and obesity: Defining adult overweight and obesity. Retrieved from https://www.cdc.gov/obesity/adult/defining.html

Centers for Disease Control and Prevention. (2013). Adult participation in aerobic and muscle-strengthening physical activities—United States, 2011. Morbidity and Mortality Weekly Report, 62, 326–330. [PubMed: 23636025]

Centers for Disease Control and Prevention. (2016a). Behavioral Risk Factor Surveillance System Questionnaires. Retrieved from https://www.cdc.gov/brfss/questionnaires/index.htm

Centers for Disease Control and Prevention. (2016b). Early release of selected estimates based on data from the 2016 National Health Interview survey: Leisure-time physical activity. Retrieved from https://www.cdc.gov/nchs/fastats/exercise.htm

Centers for Disease Control and Prevention. (2017). Adult obesity prevalence maps. Retrieved from https://www.cdc.gov/obesity/data/prevalence-maps.html

Chin DL, Nam S, & Lee SJ (2016). Occupational factors associated with obesity and leisure-time physical activity among nurses: A cross sectional study. International Journal of Nursing Studies, 57, 60–69. doi:10.1016/j.ijnurstu.2016.01.009 [PubMed: 27045565]

Chou CF, & Johnson PJ (2008). Health disparities among America's health care providers: Evidence from the integrated health interview series, 1982 to 2004. Journal of Occupational and Environmental Medicine, 50, 696–704. doi:10.1097/JOM.0b013e31816515b5 [PubMed: 18545097]

Church TS, Thomas DM, Tudor-Locke C, Katzmarzyk PT, Earnest CP, Rodarte RQ, … Bouchard C (2011). Trends over 5 decades in U.S. occupation-related physical activity and their associations with obesity. PLoS ONE, 6, Article e19657. doi:10.1371/journal.pone.0019657

Davis KG, & Kotowski SE (2015). Prevalence of musculoskeletal disorders for nurses in hospitals, long-term care facilities, and home health care: A comprehensive review. Human Factors, 57, 754–792. doi:10.1177/0018720815581933 [PubMed: 25899249]

Donnelly JE, Blair SN, Jakicic JM, Manore MM, Rankin JW, & Smith BK, & American College of Sports Medicine. (2009). American college of sports medicine position stand: Appropriate physical activity intervention strategies for weight loss and prevention of weight regain for adults. Medicine & Science in Sports & Exercise, 41, 459–471. doi:10.1249/MSS.0b013e3181949333 [PubMed: 19127177]

Duaso MJ, & Cheung P (2002). Health promotion and lifestyle advice in a general practice: What do patients think? Journal of Advanced Nursing, 39, 472–479. [PubMed: 12175356]

Dunn AL, Trivedi MH, & O'Neal HA (2001). Physical activity dose-response effects on outcomes of depression and anxiety. Medicine & Science in Sports & Exercise, 33(Suppl. 6), S587–S597. [PubMed: 11427783]

Eaton CB, Reynes J, Assaf AR, Feldman H, Lasater T, & Carleton RA (1993). Predicting physical activity change in men and women in two New England communities. American Journal of Preventive Medicine, 9, 209–219. [PubMed: 8398220]

Eyler AE, Wilcox S, Matson-Koffman D, Evenson KR, Sanderson B, Thompson J, … Rohm-Young D (2002). Correlates of physical activity among women from diverse racial/ethnic groups. Journal of Women's Health & Gender-based Medicine, 11, 239–253. doi:10.1089/152460902753668448

Feng B, Liang Q, Wang Y, Andersen LL, & Szeto G (2014). Prevalence of work-related musculoskeletal symptoms of the neck and upper extremity among dentists in China. BMJ Open, 4, Article e006451. doi:10.1136/bmjopen-2014-006451

Fie S, Norman IJ, & While AE (2013). The relationship between physicians' and nurses' personal physical activity habits and their health-promotion practice: A systematic review. Health Education Journal, 72, 102–119. doi:10.1177/0017896911430763

Flannery K, Resnick B, & McMullen TL (2012). The impact of the worksite heart health improvement project on work ability: A pilot study. Journal of Occupational and Environmental Medicine, 54, 1406–1412. doi:10.1097/JOM.0b013e3182619053 [PubMed: 23135301]

Fransson EI, Heikkila K, Nyberg ST, Zins M, Westerlund H, Westerholm P, … Kivimaki M (2012). Job strain as a risk factor for leisure-time physical inactivity: An individual-participant meta-analysis of up to 170,000 men and women: The IPD-work consortium. American Journal of Epidemiology, 176, 1078–1089. doi:10.1093/aje/kws336 [PubMed: 23144364]

Goetzel RZ, Gibson TB, Short ME, Chu B, Waddell J, Bowen J, … DeJoy DM (2010). A multi-worksite analysis of the relationships among body mass index, medical utilization, and worker productivity. Journal of Occupational and Environmental Medicine, 52(Suppl. 1), S52–S58. doi:10.1097/JOM.0b013e3181c95b84 [PubMed: 20061888]

Gutiérrez-Fisac JL, Guallar-Castillón P, Díez-Gañán L, López García E, Banegas Banegas JR, & Rodríguez Artalejo F (2002). Work-related physical activity is not associated with body mass index and obesity. Obesity Research, 10, 270–276. [PubMed: 11943836]

Han K, Trinkoff AM, & Geiger-Brown J (2014). Factors associated with work-related fatigue and recovery in hospital nurses working 12-hour shifts. Workplace Health & Safety, 62, 409–414. doi:10.3928/21650799-20140826-01 [PubMed: 25199168]

Han K, Trinkoff AM, Storr CL, & Geiger-Brown J (2011). Job stress and work schedules in relation to nurse obesity. The Journal of Nursing Administration, 41, 488–495. doi:10.1097/NNA.0b013e3182346fff [PubMed: 22033319]

Hildebrandt VH, Bongers PM, Dul J, van Dijk FJ, & Kemper HC (2000). The relationship between leisure time, physical activities and musculoskeletal symptoms and disability in worker populations. International Archives of Occupational and Environmental Health, 73, 507–518. [PubMed: 11100945]

Jang TW, Kim HR, Lee HE, Myong JP, & Koo JW (2014). Long work hours and obesity in Korean adult workers. Journal of Occupational Health, 55, 359–366. [PubMed: 23892643]

Kaleta D, Makowiec-Dabrowska T, & Jegier A (2007). Occupational and leisure-time energy expenditure and body mass index. International Journal of Occupational Medicine and Environmental Health, 20, 9–16. [PubMed: 17509966]

Kesaniemi YK, Danforth E Jr., Jensen MD, Kopelman PG, Lefebvre P, & Reeder BA (2001). Dose-response issues concerning physical activity and health: An evidence-based symposium. Medicine & Science in Sports & Exercise, 33(Suppl. 6), S351–S358. [PubMed: 11427759]

King AC, Castro C, Wilcox S, Eyler AA, Sallis JF, & Brownson RC (2000). Personal and environmental factors associated with physical inactivity among different racial-ethnic groups of U.S. middle-aged and older-aged women. Health Psychology, 19, 354–364. [PubMed: 10907654]

King GA, Fitzhugh EC, Bassett DR Jr., McLaughlin JE, Strath SJ, Swartz AM, & Thompson DL (2001). Relationship of leisure-time physical activity and occupational activity to the prevalence of obesity. International Journal of Obesity and Related Metabolic Disorders, 25, 606–612. doi:10.1038/sj.ijo.0801583 [PubMed: 11360141]

Kobayashi Y, Kaneyoshi A, Yokota A, & Kawakami N (2008). Effects of a worker participatory program for improving work environments on job stressors and mental health among workers: A controlled trial. Journal of Occupational Health, 50, 455–470. doi:10.1539/joh.L7166 [PubMed: 19023175]

Koenig W, Sund M, Döring A, & Ernst E (1997). Leisure-time physical activity but not work-related physical activity is associated with decreased plasma viscosity: Results from a large population sample. Circulation, 95, 335–341. [PubMed: 9008446]

Kouvonen A, Kivimaki M, Elovainio M, Virtanen M, Linna A, & Vahtera J (2005). Job strain and leisure-time physical activity in female and male public sector employees. Preventive Medicine, 41, 532–539. [PubMed: 15917049]

Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sorensen F, Andersson G, & Jorgensen K (1987). Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Applied Ergonomics, 18, 233–237. [PubMed: 15676628]

Lallukka T, Lahelma E, Rahkonen O, Roos E, Laaksonen E, Martikainen P, … Kagamimori S (2008). Associations of job strain and working overtime with adverse health behaviors and obesity:

Evidence from the Whitehall II Study, Helsinki Health Study, and the Japanese Civil Servants Study. Social Science & Medicine, 66, 1681–1698. [PubMed: 18261833]

Lallukka T, Sarlio-Lahteenkorva S, Kaila-Kangas L, Pitkaniemi J, Luukkonen R, & Leino-Arjas P (2008). Working conditions and weight gain: A 28-year follow-up study of industrial employees. European Journal of Epidemiology, 23, 303–310. doi:10.1007/s10654-008-9233-7 [PubMed: 18322807]

Lee SH, & Im E (2010). Ethnic differences in exercise and leisure time physical activity among midlife women. Journal of Advanced Nursing, 66, 814–827. doi:10.1111/j.1365-2648.2009.05242.x [PubMed: 20423369]

Lee SJ, Lee JH, & Gershon RR (2015). Musculoskeletal symptoms in nurses in the early implementation phase of California's safe patient handling legislation. Research in Nursing & Health, 38, 183–193. doi:10.1002/nur.21657 [PubMed: 25914203]

Luckhaupt SE, Cohen MA, Li J, & Calvert GM (2014). Prevalence of obesity among U.S. workers and associations with occupational factors. American Journal of Preventive Medicine, 46, 237–248. doi:10.1016/j.amepre.2013.11.002 [PubMed: 24512862]

Martin AR, Nieto JM, Ruiz JP, & Jimenez LE (2008). Overweight and obesity: The role of education, employment and income in Spanish adults. Appetite, 51, 266–272. doi:10.1016/j.appet.2008.02.021 [PubMed: 18406494]

Mawn B, Siqueira E, Koren A, Slatin C, Devereaux Melillo K, Pearce C, & Hoff LA (2010). Health disparities among health care workers. Qualitative Health Research, 20, 68–80. doi:10.1177/1049732309355590 [PubMed: 19940090]

McLaren L, & Godley J (2009). Social class and BMI among Canadian adults: A focus on occupational prestige. Obesity, 17, 290–299. doi:10.1038/oby.2008.539 [PubMed: 19039314]

Morken T, Mageroy N, & Moen BE (2007). Physical activity is associated with a low prevalence of musculoskeletal disorders in the royal Norwegian navy: A cross sectional study. BMC Musculoskeletal Disorder, 8, Article 56.

Morseth B, Jacobsen BK, Emaus N, Wilsgaard T, & Jorgensen L (2016). Secular trends and correlates of physical activity: The Tromso Study 1979–2008. BMC Public Health, 16, Article 1215. 10.1186/s12889-016

Nam S, & Whittemore R (2014). Future directions for worksite cardiovascular risk factor reduction programs to reduce health disparities. Heart & Lung: The Journal of Acute and Critical Care, 43, 173–174. doi:10.1016/j.hrtlng.2014.03.006 [PubMed: 24685395]

Paeratakul S, Popkin BM, Keyou G, Adair LS, & Stevens J (1998). Changes in diet and physical activity affect the body mass index of Chinese adults. International Journal of Obesity and Related Metabolic, 22, 424–431.

Puig Ribera A, McKenna J, & Riddoch C (2005). Attitudes and practices of physicians and nurses regarding physical activity promotion in the Catalan primary health-care system. European Journal of Public Health, 15, 569–575. [PubMed: 16051654]

Schutzer KA, & Graves BS (2004). Barriers and motivations to exercise in older adults. Preventive Medicine, 39, 1056–1061. [PubMed: 15475041]

Singer RH, Stoutenberg M, Gellman MD, Archer E, Davis SM, Gotman N, … Zambrana RE (2016). Occupational physical activity and body mass index: Results from the Hispanic community health study/study of Latinos. PLoS ONE, 11, Article e0152339. doi:10.1371/journal.pone.0152339

Steeves JA, Bassett DR Jr., Thompson DL, & Fitzhugh EC (2012). Relationships of occupational and non-occupational physical activity to abdominal obesity. International Journal of Obesity and Related Metabolic, 36, 100–106. doi:10.1038/ijo.2011.50

Sternfeld B, Cauley J, Harlow S, Liu G, & Lee M (2000). Assessment of physical activity with a single global question in a large, multiethnic sample of midlife women. American Journal of Epidemiology, 152, 678–687. 10.1093/aje/152.7.678 [PubMed: 11032164]

Stevens J (2009). Applied multivariate statistics for the social sciences (5th ed.). New York, NY: Routledge.

Su C, Jia XF, Wang ZH, Wang HJ, Ouyang YF, & Zhang B (2017). Longitudinal association of leisure time physical activity and sedentary behaviors with body weight among Chinese adults from China

Health and Nutrition Survey 2004–2011. European Journal of Clinical Nutrition, 71, 383–388. doi:10.1038/ejcn.2016.262 [PubMed: 28074890]

Sweet SN, Fortier MS, Guérin E, Tulloch H, Sigal RJ, Kenny GP, & Reid RD (2009). Understanding physical activity in adults with type 2 diabetes after completing an exercise intervention trial: A mediation model of self-efficacy and autonomous motivation. Psychology, Health & Medicine, 14, 419–429. doi:10.1080/13548500903111806

Taylor WC, Kimbro RT, Evans-Hudnall G, Haughton McNeill L, & Barnes AS (2015). Sedentary behavior, body mass index, and weight loss maintenance among African American women. Ethnicity & Disease, 25, 38–45. [PubMed: 25812250]

Trinkoff AM, Lipscomb JA, Geiger-Brown J, & Brady B (2002). Musculoskeletal problems of the neck, shoulder, and back and functional consequences in nurses. American Journal of Industrial Medicine, 41, 170–178. [PubMed: 11920961]

Trost SG, Owen N, Bauman AE, Sallis JF, & Brown W (2002). Correlates of adults' participation in physical activity: Review and update. Medicine & Science in Sports & Exercise, 34, 1996–2001. [PubMed: 12471307]

Tucker SJ, Harris MR, Pipe TB, & Stevens SR (2010). Nurses' ratings of their health and professional work environments. AAOHN Journal: Official Journal of the American Association of Occupational Health Nurses, 58, 253–267. [PubMed: 20677722]

U.S. Department of Health and Human Services. (2008). 2008 physical activity guidelines for Americans. Retrieved from https://health.gov/paguidelines/pdf/paguide.pdf

Whitt-Glover MC, Taylor WC, Floyd MF, Yore MM, Yancey AK, & Matthews CE (2009). Disparities in physical activity and sedentary behaviors among US children and adolescents: Prevalence, correlates, and intervention implications. Journal of Public Health Policy, 30(Suppl. 1), S309–S334. doi:10.1057/jphp.2008.46 [PubMed: 19190581]

Applying Research to Practice

Nurses are in a key position to promote regular physical activity and to endorse prevention of obesity. However, nurses, the largest health care occupation group, have a high obesity rate and low leisure-time physical activity (LTPA). Frequent or severe musculoskeletal symptoms can interfere with individual's LTPA by experiencing limitation or discomfort related to physical activity. Nurses have a high prevalence of musculoskeletal symptoms from physically demanding tasks. There is a dearth of research examining factors affecting nurses' LTPA levels including both aerobic and muscle strengthening physical activity. Understanding the relationship between musculoskeletal symptoms and LTPA among nurses and potential correlates with their LTPA would help guide future workplace wellness programs to improve health among nurses and workplace productivity.

Table 1.

Sample Characteristics of California Nurses (n = 454)

	***M* ± *SD* or *n* (%)**		
Characteristics	**Working (*n* = 394)**	**Not working (*n* = 60)**	**Total (*n* = 454)**
Gender			
Women	355 (90.1)	59 (98.3)	414 (91.2)
Men	39 (9.9)	1 (1.7)	40 (8.8)
Age (years)	47.8 ± 12.2	61.8 ± 12.1	49.6 ± 13.1
Education			
Diploma or associate	134 (34.0)	13(21.7)	147 (32.6)
Bachelor	178 (45.2)	31 (51.7)	209 (46.0)
Master or doctoral	79 (20.1)	13 (21.7)	92 (20.2)
Other	3 (0.7)	3 (4.9)	6 (1.2)
Race/ethnicity (n = 445)			
Hispanic	29 (7.5)	1 (1.7)	30 (6.7)
Non-Hispanic, White	239 (61.8)	43 (74.1)	282 (63.4)
Non-Hispanic, African American	11 (2.8)	1 (1.7)	12 (2.8)
Non-Hispanic, Asian	88 (22.7)	11 (19.0)	99 (22.2)
Non-Hispanic, Other	20 (5.2)	2 (3.5)	22 (4.9)
Body mass index, kg/m^2 (n = 442)	25.7 (±4.8)	24.9 (±4.4)	25.6 (±4.8)
Underweight (<18.5)	6 (1.6)	1 (1.8)	7 (1.6)
Normal (18.5–24.9)	193 (50.1)	31 (54.4)	224 (50.7)
Overweight (25–29.9)	121 (31.4)	21 (36.8)	142 (32.1)
Obese (≥30)	65 (16.9)	4 (7.0)	69 (15.6)
Aerobic physical activity (n = 446)			
No activity	34 (8.8)	3 (5.2)	37 (8.3)
Less than 150 minutes/week	195 (50.3)	17 (29.3)	212 (47.5)
150 to less than 300 minutes/week	108 (27.8)	22 (37.9)	130 (29.1)
300 minutes or more than 300 minutes/week	51 (13.1)	16 (27.6)	67 (15.0)
Muscle-strengthening physical activity (n = 437)			

Workplace Health Saf. Author manuscript; available in PMC 2021 May 28.

	$M \pm SD$ or n (%)		
Characteristics	**Working (n = 394)**	**Not working (n = 60)**	**Total (n = 454)**
No activity	117 (30.7)	15 (26.8)	132 (30.2)
Less than 2 days/week	55 (14.4)	6 (10.7)	61 (14.0)
2–4 days/week	175 (45.9)	27 (48.2)	202 (46.2)
More than 4 days/week	34 (8.9)	8 (14.3)	42 (9.6)

Note. Race, other included American Indian, Alaskan Native, and mixed.

Table 2.

Musculoskeletal Pain Symptoms in the Past 12 Months by Body Region Among California Nurses ($n = 454$)

	Musculoskeletal symptoms by body region			
Characteristics	**Low back, *n* = 280 (%)**	**Neck, *n* = 221 (%)**	**Shoulder, *n* = 190 (%)**	**Hands/wrists, *n* = 189 (%)**
Pain symptoms over the past 12 months				
No	174 (38.3)	234 (51.5)	264 (58.1)	265 (58.4)
Yes	280 (61.7)	221 (48.5)	190 (41.9)	189 (41.6)
Symptoms frequency				
Daily	51 (18.2)	49 (22.2)	48 (25.4)	48 (25.4)
Almost daily	66 (23.6)	63 (28.5)	41 (21.7)	41 (21.7)
Weekly	53 (18.9)	49 (22.2)	43 (22.8)	43 (22.8)
Monthly	31 (11.1)	19 (8.6)	23 (12.2)	23 (12.2)
Every 2–3 months	38 (13.6)	17 (7.7)	11 (5.8)	11 (5.8)
Every 4–6 months	29 (10.4)	16 (7.2)	13 (6.9)	13 (6.9)
One time only	12 (4.3)	8 (3.6)	10 (5.3)	10 (5.3)
Symptom duration				
<1 day	89 (31.9)	57 (26.3)	46 (24.5)	46 (24.5)
<1 week (1–6 days)	104 (37.3)	72 (33.2)	59 (31.4)	59 (31.4)
<2 weeks (7–13 days)	21 (7.5)	12 (5.5)	14 (7.4)	14 (7.4)
2 weeks to less than 1 month	13 (4.7)	13 (6.0)	18 (9.6)	18 (9.6)
1–3 months	12 (4.3)	9 (4.1)	8 (4.3)	8 (4.3)
>3 months	40 (14.3)	54 (24.9)	43 (22.9)	43 (22.9)
Symptoms intensity				
Mild/minimal	139 (49.8)	99 (45.4)	86 (45.5)	86 (45.5)
Moderate	124 (44.4)	101 (46.3)	83 (43.9)	83 (43.9)
Severe	15 (5.4)	17 (7.8)	18 (9.5)	18 (9.5)
Worst ever in life	1 (0.4)	1 (0.5)	2 (1.1)	2 (1.1)

Note. The total numbers for frequency, duration, and intensity can vary due to missing data.

Table 3.

Prevalence (%) and Bivariate Analyses of Aerobic PA and Muscle-Strengthening PA Among California Nurses ($n = 454$)

	Aerobic PA > 150 minutes/week			Muscle-strengthening PA (>2 days/week)		
Characteristics	**%**	**OR (95% CI)**	***p***	**%**	**OR (95% CI)**	***p***
Age (years)			<.01**	63.2		.58
<34	48.7	1			1	
35–44	24.3	0.33 [0.17, 0.68]	<.01**	54.1	0.68 [0.35, 1.31]	.25
45–54	41.5	0.74 [0.41, 1.35]	.33	58.1	0.81 [0.44, 1.48]	.49
55–64	52.3	1.15 [0.65, 2.04]	.61	51.6	0.62 [0.34, 1.16]	.11
>65	51.9	1.13 [0.56, 2.30]	.71	55.1	0.76 [0.34, 1.48]	.37
Gender						
Women	43.9	1		55.6	1	
Men	47.4	1.15 [0.59, 2.24]	.68	57.9	1.10 [0.56, 2.15]	.79
Race			.03*			.72
White	47.8	1		56.9	1	
African American	50.0	1.00 [0.34, 3.46]	.88	66.7	1.51 [0.44, 5.13]	.50
Asian or Pacific Islander	30.9	0.48 [0.30, 0.79]	<.01**	52.1	0.82 [0.51, 1.31]	.41
Other	47.7	0.99 [0.52, 1.88]	.99	53.5	0.87 [0.45, 1.65]	.67
Education			.92			.93
Diploma or associate	42.1	1		33.7	1	
Bachelor	45.9	1.16 [0.75,1.79]	.48	44.9	0.87 [0.56, 1.34]	.53
Master or doctoral	44.0	1.08 [0.63, 1.83]	.77	20.6	0.97 [0.57, 1.67]	.93
Body mass Index (kg/m^2)			.35			.001**
Underweight (<18.5)	50.0	1.12 [0.22, 5.70]	.88	33.3	0.31 [0.05, 1.74]	.18
Normal (18.5–24.9)	46.8	1		62.7	1	
Overweight (25–29.9)	48.9	1.08 [0.71, 1.64]	.71	55.1	0.76 [0.49, 1.17]	.22
Obese (>30)	24.6	0.36 [0.20, 0.67]	.001**	40.3	0.42 [0.24, 0.73]	.002**
Employment status						
Not working	65.5	1		62.5	1	

	Aerobic PA > 150 minutes/week			Muscle-strengthening PA (>2 days/week)		
Characteristics	**%**	**OR (95% CI)**	***p***	**%**	**OR (95% CI)**	***p***
Working	41.0	0.36 [0.20, 0.65]	<.001**	54.9	0.72 [0.40, 1.29]	.28
Major low back symptom						
No	44.8	1		54.7	1	
Yes	42.4	0.90 [0.59, 1.38]	.64	59.1	1.20 [0.77, 1.84]	.40
Major neck symptom						
No	43.7	1		57.4	1	
Yes	45.7	1.08 [0.69, 1.68]	.71	50.5	0.75 [0.48,1.18]	.21
Major shoulder symptom						
No	43.9	1		54.9	1	
Yes	45.2	1.05 [0.66, 1.66]	.82	59.1	1.18 [0.74, 1.88]	.47
Major hand/wrist symptom						
No	44.3	1		55.9	1	
Yes	43.5	0.97 [0.56, 1.66]	.91	55.7	0.99 [0.57, 1.71]	.98
Musculoskeletal symptom index			.35			.18
0	51.8	1		60.4	1	
1–3	39.2	0.60 [0.37, 0.97]	.03*	49.1	0.63 [0.38,1.03]	.06
4–6	44.6	0.74 [0.43, 1.30]	.35	57.0	0.87 [0.49, 1.52]	.62
7–9	42.9	0.69 [0.35, 1.37]	.29	59.2	0.95 [0.48, 1.89]	.88
10–12	45.5	0.77 [0.31, 1.94]	.58	71.4	1.64 [0.59, 4.55]	.34

Note. Race—Other consists of American Indian, Alaskan Native, and mixed; major low back neck, shoulder, and hand/wrist pain were symptoms with at least moderate intensity that occurred at least monthly or lasted at least 1 week; musculoskeletal symptom index (range = 0–12) is a composite score for symptoms in the low back, neck, shoulders, and hands/wrists. One point was assigned for each of the following criteria: (a) the intensity of symptoms was at least moderate, (b) the duration was at least 1 week, and (c) the frequency was at least monthly. PA = physical activity; OR = odds ratio; CI = confidence interval.

*$p < .05$.

**$p < .01$.

Table 4.

Multivariable Logistic Regression Models of Aerobic PA and Muscle-Strengthening PA Among California Nurses (n = 454)

	Aerobic PA > 150 minutes/week		Muscle-strengthening PA (>2 days/week)	
Characteristics	**OR (95% CI)**	***p***	**OR (95% CI)**	***p***
Age	1.01 [0.99, 1.03]	.23	0.99 [0.97, 1.00]	.12
Race		.02*		.26
White	1		1	
Non-White	0.61 [0.40, 0.94]		0.78 [0.51, 1.20]	
Employment status		.02*		.29
Not working	1		1	
Working	0.48 [0.25, 0.91]		0.69 [0.36, 1.35]	
Body mass index (kg/m^2)	0.93 [0.89, 0.97]	<.001**	0.92 [0.88, 0.96]	<.001**
Musculoskeletal symptom index (Score 0–12)	0.99 [0.93, 1.05]	.69	1.03 [0.97, 1.10]	.35

Note. Race was categorized into White versus African American, Asian, American Indian, Alaskan Native, or mixed. Musculoskeletal symptom index is a composite score for symptoms in the lower back, neck, shoulders, and hands/wrists. One point was assigned for each of the following criteria: (a) the intensity of symptoms was at least moderate, (b) the duration was at least 1 week, and (c) the frequency was at least monthly. PA = physical activity; OR = odds ratio; CI = confidence interval.

*$p < .05$.

**$p < .01$.