Lifestyles and Health-Related Outcomes of U.S. Hospital Nurses: A Systematic Review

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ABSTRACT

Background: Nurses' modifiable lifestyles have important health-related consequences.
Purpose: To examine the literature on U.S. hospital nurses' activity, diet, and health outcomes of cardiovascular disease (CVD) risks and health-related quality of life (HRQOL).
Method: A systematic review using of the literature from June 2006 to June 2016 resulted in 13 studies on U.S. hospital nurses' diet, physical activity and CVD and HRQOL outcomes. Methodological rigor was assessed using Cummings et al., adapted quality rating tool.
Discussion: Nurses are at risk for poor health outcomes due to inadequate physical activity (60%–74%) and eating a poor quality diet (53%–61%). Fewer than 5% of U.S. nurses engage in five healthy lifestyle behaviors (diet, activity, no tobacco, alcohol, and weight). Adequate physical activity contributes to better HRQOL and a healthy diet reduces CVD risks (hypertension, diabetes mellitus, obesity, stroke).
Conclusions: Nurses' inactivity and poor diet increases risks for CVD and diminished HRQOL.

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With more than 4.1 million nurses in the United States, nursing is the nation's largest health care profession (Budden, Zhong, Moulton, & Cimiotti, 2013). Nurses' lifestyle practices have important consequences for their health—consequences that can affect risk for cardiovascular disease (CVD) and health-related quality of life (HRQOL). In addition, nurses' well-being and health may directly impact the health of the population as well as patient care (Blake & Harrison, 2013; Carlson & Warne, 2006; Gillen, 2014).

State of Research on Lifestyle Science

Internationally, research on nurses' health has focused primarily on the role of district (or public health) nurses in community health settings while a few exploratory studies have investigated the health behaviors of hospital nurses in the United Kingdom's National Health Service (Blake & Lee, 2007; Irvine, 2005). Health promotion studies have focused primarily on nurses' clinical

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skills using health promotion with patients, but a few have investigated nurses' personal lifestyle practices (Carlson & Warne, 2006; Kemppainen, Tossavainen, & Turunen, 2013). Although these studies have added to our knowledge of nurses' healthy lifestyle practices, few of the studies have been conducted on nurses in U.S. hospitals. To our best knowledge, no study has systematically reviewed lifestyle practices among nurses and the impact of these healthy practices on nurses' health. Examining individual lifestyle behaviors or practices will provide insight into which behaviors are most challenging to maintain to improve nurses' health.

### Effect of Lifestyle on CVD and HRQOL

Unhealthy lifestyle practices are related to an increase in morbidity, earlier mortality, and diminished HRQOL (Ford, Bergmann, Boeing, Li, & Capewell, 2012; Ford et al., 2010; Loef & Walach, 2012; Mokdad, Marks, Stroup, & Gerberding, 2000; World Health Organization, 2011). In fact, studies based on the Nurses' Health Study (NHS, n.d.)—the longest and largest study on nurses' health—reveal that 3% or fewer nurses practice healthy lifestyles: eating a healthy diet, getting regular exercise, maintaining a healthy weight, and not smoking (Ford et al., 2012; Nurses' Health Study (n.d.); Stampfer, Hu, Manson, Rimm, & Willett, 2000; van Dam, Li, Spiegelman, Franco, & Hu, 2008). Although nurses' role is to improve, support, and maintain the health of those they serve, through engagement in unhealthy health lifestyles nurses may be neglecting their own health and putting themselves at higher risk for greater morbidity and mortality (Rockhill et al., 2001; Stampfer et al., 2000; van Dam et al., 2008).

Effects of Nurse Lifestyle on Patient Care

Nurses' healthy lifestyle choices have positive effects in caring for patient populations (Miller, Alpert, & Cross, 2008; Zhu, Norman, & While, 2011). Nurses with healthy lifestyle practices are more apt to discuss and recommend preventive behaviors such as smoking cessation, getting physical activity, and eating a healthier diet to the people under their care (Esposito & Fitzpatrick, 2011; Frank, Bhat, Schobert, & Elon, 2003). Nurses who practice healthy lifestyles of daily physical activity, healthy diet, and adequate sleep may be better able to prevent workplace injury and avoid errors related to fatigue (Geiger-Brown et al., 2012). Thus, improving the health and healthy lifestyles of nurses may improve patient care.

Goal and Aims of This Review

The goal of this systematic review of the literature is to better understand U.S. hospital nurses' lifestyle practices and the impact of these lifestyle practices on nurses' CVD risk and HRQOL. The specific aims of the review are to (a) describe nurses' lifestyle practices, specifically physical activity and diet, and (b) to examine
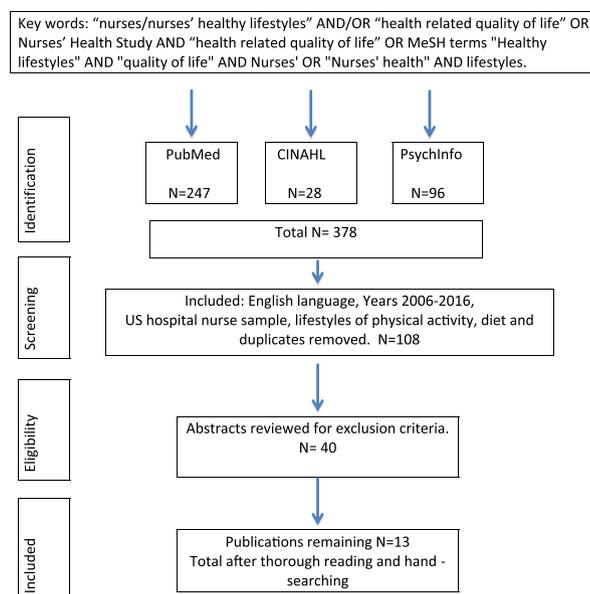
Figure 1 – Publication selection flow chart.Source: Moher, Liberati, Tetzlaff, Altman, & The PRISMA Group (2009).

the relationship between lifestyle practices and health outcomes of CVD and HRQOL.

Methods

Search Strategy and Data Sources

Systematic searches of studies pertaining to U.S. hospital nurses' lifestyles—physical activity, diet, and nurses' HRQOL were conducted using the PubMed, Cumulative Index of Nursing and Allied Health Literature, and PsychInfo databases. The databases were searched for articles published from June 2006 to June 2016 using keyword expressions *nurses/nurses' healthy lifestyles* OR *nurses' health-related quality of life* AND *diet* OR *physical activity*. In addition, search terms *Nurses' Health Study* AND *health-related quality of life* OR medical subject headings (MeSH) *Healthy lifestyles* AND *quality of life* AND *Nurses'* OR *Nurses' health* AND *lifestyles* were queried. These search terms were identified using PubMed and MeSH aided by a specialized nursing librarian (Figure 1). Examination of publications associated with data from the NHS, manually searching texts, and bibliographies resulted in one additional study. Duplicates were removed while publication titles were reviewed resulting in 378 studies. Abstract examination that applied inclusion and exclusion criteria reduced the number of potential candidate studies to 40; reading of the full text of these articles further reduced the number of candidate studies to 13 articles.

Inclusion and Exclusion Criteria

The inclusion criteria were as follows: (a) study population included U.S. hospital registered nurses; (b) variables included nurse lifestyle practices of physical activity or diet; (c) health outcomes of lifestyles included nurses' HRQOL and CVD clinical risk factors including hypertension, obesity, and stroke; (d) articles were peer reviewed and published between June 2006 and June 2016; and (e) published in English. In this systematic review, nurses' unhealthy weight, increased adiposity, or body mass index (BMI) greater than 30 are treated as an outcome of unhealthy lifestyle practices rather than a modifiable factor. Smoking has been thoroughly studied in relation to health outcomes and therefore not a focus of this review (Colditz et al., 1988; U.S. Department of Health and Human Services, 2001; Myers et al. 1987; Sarna et al., 2008). Measuring the effects of combined lifestyle factors (most commonly smoking, physical activity, diet, alcohol use, and BMI) were included if data were given for physical activity and diet. The literature search's exclusion criteria were (a) registered nurses identified as nonhospital (i.e., community, public health, school, clinics, research academia, or administrative), (b) student nurses, and (c) unpublished manuscripts and dissertations, editorials, and opinions.

Methodological Rigor Assessment

Two members of the research team (identified here as "JC" and "SP") independently rated each study for methodological rigor using an instrument designed and adapted by Cummings et al. (2010). Discrepancies in rigor assessment scores were resolved by consensus. Standard research critique qualifiers were listed in a matrix using four categories: design, sample, measurement, and statistical reliability. In this adapted version, rigor was judged as *being met* (1) or *not being met* (0). For the nine factors evaluated, a total score of nine points signified use of the highest quality methods. The studies were categorized into three divisions of methodological quality: *low* (0–3), *medium* (4–6), and *strong* (7–9, Table 1). Of the 13 studies, 12 used data from the NHS that (a) used a prospective cohort, (b) justified their sample size, (c) used multisite sampling, and (d) used a validated instrument to measure adherence to the lifestyle practices.

Search Results

The initial search yielded 378 potentially relevant articles. After an initial review of abstracts, many articles were eliminated for not meeting the inclusion criteria. The remaining 40 articles were examined thoroughly for relevance of the study topic. A repeated review of these articles clarifying the directionality of lifestyle practices to health outcomes eliminated all but 13 studies. Through data abstraction and synthesis, an additional

Table 1 – Methods Quality Grid*

Study/Author	Design: Prospective Study	Sample: Sample Size Justified or Appropriate	Sample: Multisite	Sample: Anonymity Protected	Measurement: Response Rate Greater Than 60%?	Measurement: Lifestyle Measured Reliably?	Statistical Reliability: Instrument Validity	Statistical Reliability: Theoretical Framework	Statistical Reliability: If Multiple Outcomes Studied Was the Analysis Adequate?	Total Score 0–9
Bazzano et al. (2008)	1	1	1	Not reported	1	1	1	0	1	7
Bes-Rastrollo et al. (2008)	1	1	Not reported	1	1	1	1	0	1	7
Chiuve et al. (2008)	1	1	Not reported	1	Not reported	1	1	0	1	6
Chomistek et al. (2015)	1	1	Not reported	1	Not reported	1	1	0	1	6
Forman et al. (2009)	1	1	1	1	1	1	1	0	1	8
Fung and Pan (2015)	1	1	Not reported	1	Not reported	1	1	0	1	6
Kroenke et al. (2008)	1	1	Not reported	Not reported	Not reported	1	1	0	1	5
Nahm et al. (2012)	0	0	0	1	0	0	1	0	1	3
Samieri et al. (2014a)	1	1	1	1	1	1	1	0	1	8
Samieri et al. (2014b)	1	1	1	1	1	1	1	0	1	8
Schulze et al. (2006)	1	1	Not reported	Not reported	1	1	1	0	1	6
Sotos-Prieto et al. (2016)	1	1	Not reported	1	Not reported	1	1	0	1	6
Wolin et al. (2007)	1	1	Not reported	1	Not reported	1	1	0	1	6

* Quality assessment tool adapted from Cummings et al. (2010).

study was eliminated for failing to measure a lifestyle factor against an outcome, and another study was added by hand searching (Figure 1).

Data Abstraction and Synthesis

Five of the 13 studies were rated *strong*, seven as *medium*, and one as *low* for methodological rigor. All the studies rated *strong* were based on the NHS, in which their instrument's reliability and validity were confirmed and reported (Table 1). Assessment of methodological rigor determined that all studies used valid instruments and that the studies' statistical reliability was substantiated by adequate analysis. Differences in quality assessment were most marked in smaller studies unrelated to the NHS or used instruments that were adapted without validation and reliability. Adequate analysis was provided for all outcomes. None of the studies reported the use of a theoretical framework.

Characteristics of the Included Studies

The original NHS included more than 121,700 nurses with a response rate of 70%, followed by NHSII cohort enrolling 116, 430 nurses with a response rate of 85% to 90%. All the included studies defined their inclusion and exclusion criteria resulting in sample sizes ranging from 10,670 to 123,098 participants (response rate 90%) from either one of both cohorts. Whereas, Nahm, Warren, Zhu, An, and Brown (2012) was the only study not using NHS participants, it had a sample size of 164 and a response rate of 21%. A brief summary of the included studies can be found in Table 2.

Physical Activity
Of the 12 studies with data on physical activity, 3 different measurement methods were applied to classify participants into risk groups based on acceptable levels of activity. When physical activity was measured as *time spent per week*, two studies found a range of 72% to 74% of nurses at high risk, meaning they did not adhere to the recommended physical activity level—that is, 30 minutes of moderate physical activity per day or 150 minutes per week (Chiuve et al., 2008; Nahm et al., 2012; Physical Activity Guidelines Advisory Committee, 2008). Of the eight studies that used metabolic equivalent time (MET) hours per week as measure of physical activity level, seven studies found nurses were not at risk of meeting a minimum 8.3 MET hours per week criteria with a range of 7.8 to 27.9 MET hours per week. However, the only score that was lower than the cutoff (7.8 MET hours per week) was recorded in 1986 as a series of biannual physical activity scores that trended upward to 12.7 MET hours per week in 1994 (Wolin, Glynn, Colditz, Lee, & Kawachi, 2007). In addition, when the criterion of 18 MET hours per week was used as the cut-off, 60%–74% of nurses were at high risk for poor health outcomes for not getting enough physical activity (Bes-Rastrollo et al., 2008; Kroenke, Kubzansky, Adler, & Kawachi, 2008).

Dietary Practices
Of the 12 studies that provided data on nurses' dietary practices in relation to health outcomes, 10 studies ranked diets as low or high risk, one measured alcohol as a component of diet, and one measured mealtime regularity. Studies that ranked diet scores, where a healthy diet was defined as scoring in the upper 2/5, found that 53% to 61% of nurses were at high risk for a poor diet (Bazzano, Li, Joshipura, & Hu, 2008; Chiuve et al., 2008). Yet, when the cutoff for a healthy diet was in the upper 1/5th or 20th percentile, 86% of nurses were at high risk for a poor diet (Forman et al., 2009). Alternatively, measuring meal regularity as a healthy diet indicator, 54% of nurses were high risk for not eating regularly (Nahm et al., 2012).

Combined Lifestyle
Studies that measured lifestyles singly or as a summary score for combined lifestyle practices show nurse adherence to healthy lifestyles decreases as the number of healthy lifestyle practices increases. Nurses (11%) adhered to three low-risk lifestyles (not smoking, diet score in the top 40th percentile, and daily exercise equal to or greater than 30 minutes per day); 8% adhered to four healthy lifestyles (add weight as BMI <25 kg/m²); and 2% of nurses were in accordance with five lifestyle low-risk factors (add alcohol 5–15 g/day, Chiuve et al., 2008; Forman et al., 2009).

Healthy Lifestyle and Health Outcomes

HRQOL
Significant improvement in HRQOL was attributed to nurses' adherence to recommended levels of physical activity, dietary quality, and higher intake of dietary flavonoids (i.e., oranges, berries, onions, and apples) (Kroenke et al., 2008; Samieri et al., 2014a, 2014b; Wolin et al., 2007). Women who increased their physical activity, over 4- and 10-year periods, had improved HRQOL scores with the greatest improvements seen in the physical activity subscore signifying improvements in being able to improve their role functioning and ability to carry out their usual daily activities (Kroenke et al., 2008; Wolin et al., 2007). Increased consumption of dietary flavonoids and a higher diet quality contributed to factors of healthy aging: lower levels of chronic disease, improved cognitive function and better health, and wellbeing among aging female nurses (Samieri et al., 2014a, 2014b). As women age and their health declines, improvements in HRQOL and functioning may delay mortality (Kroenke et al., 2008).

Cardiovascular Disease
Three studies looked at nurses' healthy lifestyles in relation to their effect on cardiovascular clinical risk factors of diabetes, hypertension, obesity, and stroke. Women who were unable to meet the recommendations for diet, BMI, smoking, alcohol, or physical activity had a greater association with each individual clinical CVD risk factor

Table 2 – Summary Literature Review

Author (Year)	Dataset(s)	Sample Characteristics	Variables/Measures	Results
Bazzano et al. (2008)	Nurses' Health Study (NHS).	$n = 71{,}346$. Female nurses age 38–63 years.	Diet and morbidity—fruit, vegetable, and fruit juice and diabetes.	Increase of three servings/day in total fruit and vegetable consumption was not associated with development of diabetes (multivariate-adjusted hazard ratio (HR) 0.99 [95% CI 0.94–1.05]). The same increase in whole fruit consumption was associated with a lower hazard of diabetes (0.82 [0.72–0.94]). An increase of one serving/day in green leafy vegetable consumption was associated with a modestly lower hazard of diabetes (0.91 [0.84–0.98]). The same change in fruit juice intake was associated with an increased hazard of diabetes (1.18 [1.10–1.26]).
Bes-Rastrollo et al. (2008)	Nurses' Health Study II	$n = 50{,}026$. Women age 36.5 M ± 4.6 years.	Diet and morbidity—food energy density (ED) and weight gain	Dietary ED was positively correlated with saturated fat ($r = 0.16$), trans fat ($r = 0.15$), and the glycemic index ($r = 0.16$), but was inversely correlated with vegetable protein ($r = -0.30$), vegetables ($r = -0.27$), and fruit ($r = -0.17$). ED was not significantly correlated with total fat intake as a percentage of energy ($r = 0.08$).
Chiuve et al. (2008)	Nurses' Health Study and Health Professionals Follow-Up Study (HPFS).	$n = 71{,}243$	Combined (5) and morbidity—tobacco, body mass index (BMI), physical activity, alcohol, diet score, and stroke.	Low risk (24%) exercising at least 30 minutes/day for 5 days per week of moderate–vigorous activity. Not or former smoker (84%), optimal weight (58%), daily exercise (24%), moderate alcohol (19%). Diet scores: Alternative Healthy Eating Index (AHEI) 40%, Dietary Approaches to Stop Hypertension (DASH) 47%, healthy 6 nutrient 42%.
Chomistek et al. (2015)	Nurses' Health Study II	$n = 69{,}247$. Women ages 27–44 years at baseline.	Combined (4) and mortality. Tobacco, BMI, physical activity, diet, and coronary heart disease (CHD).	Compared with women with no healthy lifestyle factors, the hazard ratio (HR) for CHD for women with six lifestyle factors was 0.08 (95% confidence interval [CI]: 0.03–0.22). Approximately 73% (95% CI: 39%–89%) of CHD cases were attributable to poor adherence to a healthy lifestyle. Similarly, 46% (95% CI: 43%–49%) of clinical cardiovascular disease (CVD) risk factor cases were attributable to a poor lifestyle.
Forman et al. (2009)	Nurses' Health Study II	$n = 83{,}882$. Women aged 27–44 years.	Combined lifestyles (6). physical activity, diet, BMI, alcohol, nonnarcotic analgesic, folic acid—incident hypertension and mortality.	The six low-risk factors for hypertension (HTN) were a BMI < 25 kg/m^2, a daily mean of 30 minutes of vigorous exercise—population attributable ratio (PAR) = 14% (95% CI: 9%–19%). Diet in upper 1/5—14% (95% CI: 10%–17%) for not following a DASH style diet. BMI alone was the most powerful predictor of HTN, with a BMI of 25 or greater having an adjusted PAR of 40% (95% CI: 38%–41%) compared with a BMI of less than 25.
Fung and Pan (2015)	Nurses' Health Study Nurses' Health Study II (NHS II) and Health Professionals Follow-Up Study (HPFS).	$n = 123{,}098$ NHS. $n = 72{,}495$ NHS II, $n = 22{,}973$ HPFS.	Diet and morbidity—diet quality and weight change (BMI). Alternative Healthy Eating Index 2010, DASH, alternative Mediterranean diet.	Significantly less weight gain over 4-year periods with each *standard deviation* (SD) increase of each diet quality score in both men and women. Results were significantly stronger in the younger cohort (NHS II) than in the older cohorts (e.g., 20.67 kg less weight gain in NHS II vs. 20.39 kg in NHS for each SD increase in AHEI 2010; *p* heterogeneity: <.001). Improvement of any of the diet scores benefited overweight (20.27–21.08 kg less weight gain for each *SD* increase in score) more than normal-weight individuals (20.10–20.40 kg, *p* interaction: <.001).

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Table 2 – (*Continued*)

Author (Year)	Dataset(s)	Sample Characteristics	Variables/Measures	Results
Kroenke et al. (2008)	Nurses' Health Study	$n = 40{,}337$. Women aged 46–71 years baseline in 1992.	Health-related quality of life (HRQOL)— Mortality	Change in physical activity subscore (PCS) predicted mortality across the range of 4-year change: severe decline (Relative risk = 3.32; 95% confidence interval [CI] = 2.45, 4.50), moderate decline (RR = 1.44; 95% CI = 1.16, 1.79), slight decline (RR = 1.35; 95% CI = 1.12, 1.63), no change (reference category), improvement (RR = 0.72; 95% CI = 0.56, 0.91; continuous $p<.001$). Mental component subscore (MCS) similar results.
Nahm et al. (2012)	Perceived Stress Scale	$n = 183$ Nurses from an urban teaching hospital.	Combined (3) lifestyles and morbidity—physical activity, diet, BMI, and stress.	Nurses (72.2%) stated they were not getting enough exercise. Irregular meal pattern (53.8%). The average BMI was 28.3 kg/m², and 59.2% were either overweight or obese.
Samieri et al. (2014a)	Nurses' Health Study	$n = 10{,}670$. Women with dietary data and no major chronic diseases between 1984 and 1986, when they were in their late 50s and early 60s (median age, 59 years).	Diet and morbidity. Diet and healthy aging, alternative Mediterranean diet, Alternative Healthy Eating Index 2010 (AHEI 2010).	Greater adherence to the AHEI 2010 (upper vs. lower quintiles) in midlife was related to 34% greater odds of healthy vs. usual aging. Greater adherence to Alternate Mediterranean diet was related to 46% greater odds of healthy aging.
Samieri et al. (2014b)	Nurses' Health Study	$n = 13{,}818$. Women with no major chronic diseases in 1984–1986 when they were aged in their late 50s (median age: 59 years).	Diet and morbidity. Dietary flavonoids (oranges, berries, onions, and apples) and healthy aging (free from chronic disease). FFQs and Medical Outcomes Short Form 36 (SF-36).	Of women who survived until 70 years of age (11.0%) healthy aging. Compared with women in the lowest quintile of intake, women in the highest quintile of intake of several flavonoid subclasses at midlife had greater odds of healthy aging. Odds ratio (OR): flavones, 1.32 (95% CI: 1.10, 1.58); flavanone, 1.28 (95% CI: 1.08, 1.53); anthocyanin, 1.25 (95% CI: 1.04, 1.50); and flavonol, 1.18 (95% CI: 0.98, 1.42) (all p trend = .02).
Schulze et al. (2006)	Nurses' Health Study II	$n = 51{,}670$. Women 26–46 years old.	Diet and morbidity. Western vs. prudent diet and weight change. Food frequency questionnaire (FFQ).	Women who increased their Western pattern score had greater weight gain (multivariate adjusted means, 4.55 kg for 1991–1995 and 2.86 kg for 1995–1999) than women who decreased their Western pattern score (2.70 and 1.37 kg for the two time periods). Women who increased their prudent pattern score, weight gain was smaller (multivariate-adjusted means, 1.93 kg for 1991–1995 and 0.66 kg for 1995–1999) than among women who decreased their prudent pattern score (4.83 and 3.35 kg for the two time periods) ($p < .001$). The largest weight gain between 1991 and 1995 and between 1995 and 1999 was observed among women who decreased their prudent pattern score while increasing their Western pattern score (multivariate adjusted means, 6.80 and 4.99 kg), whereas it was smallest for the opposite change in patterns (0.87 and –0.64 kg) ($p < .001$).

Table 2 – (Continued)

Author (Year)	Dataset(s)	Sample Characteristics	Variables/Measures	Results
Sotos-Prieto et al. (2016)	Nurses' Health Study II	n = 69,505	Combined lifestyles and morbidity. Healthy heart score: tobacco, weight, physical activity, alcohol, and diet. Clinical cardiovascular risk factors (diabetes mellitus, hypertension, hypercholesterolemia).	Women with higher predicted CVD risk based on the healthy heart score (highest quintile vs. lowest quintile) had significantly greater risk of each clinical risk factor individually (HR: 18.1 [95% confidence interval, 14.4–22.7] for diabetes mellitus, 5.10 [4.66–5.57] for hypertension, and 2.57 [2.40–2.75] for hypercholesterolemia). The HR for developing the high-CVD profile was 52.5 (33.6–82.1).
Wolin et al. (2007)	Nurses' Health Study	n = 63,152	Physical activity and HRQOL. Medical Outcomes Study SF-36.	Among women with an increase in physical activity, the increase in quality-of-life scores ranged from 2.23 (95% confidence intervals [CI] = 1.94–2.52) for mental health to 8.23 (95% CI = 7.49–8.97) for role limitations due to physical problems. Increasing physical activity also was associated with greater increases in quality-of-life scores from 1996 to 2000 compared with women whose physical activity level was stable. The strongest association was for role limitations due to physical problems, where women with a clear increase in physical activity had a significant improvement (1.81, 95% CI = 1.09–2.53) in the outcome.

with a hazard ratio (HR) of 18.8 for diabetes (diabetes mellitus [DM]), 5.10 for hypertension, 2.57 for hypercholesterolemia, and 52.5 for developing the high CVD profile (Sotos-Prieto et al., 2016). Chomistek et al. (2015) found 73% of CHD cases were associated with unhealthy lifestyles and nearly 46% of CVD risk factor cases (DM, hypertension [HTN], and high lipids) were attributed to an unhealthy lifestyle. Forman et al. (2009) also found six lifestyle factors to be independently associated with risk of developing HTN and an unhealthy weight (physical activity of 30 minutes per day, BMI <25 kg/m^2, a high score on the dietary approaches to stop hypertension [DASH], alcohol intake up to 10 g per day, non-narcotic analgesics [less than once per week], and supplemental folic acid [400 µg/day]). BMI (<25 kg/m^2) alone was the single-most important predictor of incident HTN and when combined with other healthy lifestyles did not reduce the risk of HTN.

Diabetes. Bazzano et al. (2008) examined the effect of the dietary impact of fruit and vegetable consumption in relation to DM and found that whole fruit and vegetable consumption prevents against DM. Yet, replacing whole fruit with fruit juice increased the risk of DM in adult female nurse participants.

Obesity. Risk for obesity as a lifestyle outcome was measured in three studies. Increased weight gain with aging was associated with a Western style diet (high risk—red and processed meats, refined grains, sweets and desserts, and potatoes), diets that had an increase in high energy-dense foods, and for persons who were unable to eat at regular mealtimes (Bes-Rastrollo et al., 2008; Nahm et al., 2012; Schulze, Fung, Manson, Willett, & Hu, 2006). Conversely, women maintained or lowered their weight when they decreased their dietary energy density, ate at regular mealtimes, and adopted a "prudent" diet (i.e., a dietary pattern with a higher intake of fruits, vegetables, whole grains, poultry, and salad dressing; Bes-Rastrollo et al., 2008; Nahm et al., 2012; Schulze et al., 2006). Whereas 54% of the nurses had an irregular meal pattern, 59.2% of the participants were overweight (BMI >25 kg/mg^2) or obese (BMI >30 kg/mg^2) influenced in part by reported low levels of physical activity (Nahm et al., 2012).

Stroke. Not smoking, maintaining a healthy BMI (less than 24.9 kg/m^2), daily exercise (at least 30 minutes per day), moderate alcohol consumption (5–15 g per day), and a better diet quality (ranked in top 40th percentile of alternate healthy eating index, DASH, and the 6-nutrient diet) were significantly associated with a lower risk of ischemic and total stroke in women (Chiuve et al., 2008). Evaluated against individual lifestyle practices, the combined effect of multiple positive health behaviors showed an incremental reduction of stroke risk the greater the number of healthy lifestyles practiced (Chiuve et al., 2008). In addition, individual factors varied in risk severity and strength. It was noted that midlife BMI was more strongly associated with stroke than current BMI

and light alcohol consumption (≤4.5 g per day) was associated with a lower risk of stroke vs. heavy use (≥ 15 g per day, Chiuve et al., 2008).

Discussion

This systematic review found that many nurses do not practice healthy lifestyles, and these unhealthy lifestyle practices increased their risk for CVD and diminished their HRQOL. This review found that 72% to 74% of U.S. hospital nurses did not engage in aerobic physical activity measured as minutes per week or 60% to 74% when averaged with MET per week. Poor dietary practices were equally concerning with 53% to 61% of nurses not consuming a healthy diet. Fewer than 5% of nurses were engaged in five combined healthy lifestyle behaviors—and the overwhelming majority had a lifestyle pattern associated with diminished HRQOL—and a high risk for developing cardiovascular clinical risk factors (e.g., hypertension, obesity, and stroke).

Although several studies reviewed found that the majority of nurses were not physically active as measured by minutes of exercise per week or the higher 18 MET hours per week criterion, seven studies found nurses had met the required physical activity level using the minimum 8.3 MET hours per week measurement. This marked discrepancy may be related to measurement issues such as the type and intensity of activities performed and self-report bias. Nevertheless, in comparison with the U.S. population activity levels, nurses in these studies reported lower levels of physical activity than in a general population of U.S. women. Specifically, 42.6% of the nurses were physically active in comparison with 48% of a general sample of U.S. physically active women (National Health Interview Survey, 2015). This low level of physical activity reported by nurses may be due to work-related muscular–skeletal injuries and long work hours with few days off—factors that may have impinged on the nurses' ability to engage in personal leisure exercise (Geiger-Brown et al., 2004). Given that an appropriate level of physical activity is crucial for decreasing risk for CVD and other health issues, future studies should investigate factors that impede nurses' engagement in adequate levels of physical activity and ways to improve nurses' participation in physical activity (Fletcher et al., 1996; Physical Activity Guidelines Advisory Committee, 2008; USDHHS, 1996).

On average, approximately 39% to 47% of nurses reported a healthy diet in studies from the NHS that used food frequency questionnaires. However, 54% of nurses did not engage in regular mealtime routines (Nahm et al., 2012). Also given that a healthy diet in part includes consuming an average of five fruits and vegetables per day, the same percentage (39%–47%) of nurses who eat a healthy diet are also consuming their daily recommended number of fruit and vegetables (Forman et al., 2009; Fung & Pan, 2015; Samieri et al., 2014b; U.S. DA & USHHS, 2010). Unlike physical activity, nurses in the

reviewed studies were eating on average more fruits and vegetables than women in the general population. In the United States, 33% of adult women consumed fruit two or more times per day and 27% consumed vegetables three or more times per day (CDC, 2010). The results of this systematic review of the literature are consistent with the characteristics of those women who typically consume more fruits and vegetables, which includes women who are college educated, older, and of higher socioeconomic status (CDC, 2010). However, more than half of nurses in this study still did not meet the recommendations for daily fruit and vegetable intake. Barriers to healthy eating among nurses may include lack of time, prohibitive cost, and the lack of availability of healthy foods at the workplace (Faugier, Lancaster, Pickles, & Dobson, 2001). Nurses have also cited family "gifts" (sweets) brought to the workplace as a factor that undermines healthy food choices (Cheung, 2003). A broader perspective that examines the challenges and responsibilities of working women may be useful in supporting nurses' dietary practices.

Combined Lifestyle Practices

This systematic review suggests that nurses reported a lower degree of participation in healthy behaviors compared with U.S. females when measuring adherence to combinations of modifiable practices such as abstinence from smoking, engagement in adequate physical activity, eating a healthy diet, and avoidance of excessive alcohol consumption (Chiuve et al., 2008). For comparison, a study by Ford et al. (2012) using the National Health and Nutrition Examination Survey data found 16% of U.S. females practiced three lifestyle behaviors (abstinence from smoking, consumption of a healthy diet, and engagement in adequate physical activity), 37% practiced two of these behaviors, 35% practiced one of these behaviors, and 13% of participants practiced none of these healthy behaviors. It seems that regardless of the knowledge that healthy lifestyles are valuable to reduce cancer health risks few women seemed to be able to adhere to such practices (Vidrine et al., 2013). Considering these findings, the need to further educate nurses on lifestyle recommendations may not be enough, but understanding why nurses do not put their knowledge to practice may be critical to improve nurses' health (Fair, Gulanick, & Braun, 2009; Miller et al. 2008).

Impact of Lifestyles on HRQOL and CVD Risk

In this systematic review, the results of the studies were consistent across all domains regarding the beneficial outcomes of healthy lifestyle practices. That is, eating a healthy diet and getting the recommended daily physical activity will decrease risks for CVD and improve ones' HRQOL. Clinical cardiovascular risks of obesity, hypertension, and stroke may be attributed to inadequate physical activity, an unhealthy weight (BMI >25), irregular meals, and a poor-quality diet (energy-dense foods,

high intakes of red and processed meats, refined grains, sweets, desserts, and potatoes) (Bazzano et al., 2008; Chiuve et al., 2008; Chomistek et al., 2015; Forman et al., 2009; Fung and Pan, 2015; Nahm et al., 2012; Schulze et al., 2006; Samieri et al., 2014a; Sotos-Prieto et al., 2016). Findings regarding the positive benefits of recommended physical activity and its subsequent improvement on HRQOL are consistent with earlier research involving the general population across age, gender, race/ethnicity, education level, smoking status, BMI, and among persons with chronic disease (Bize, Johnson, & Plotnikoff, 2007; Brown et al., 2003). Likewise, earlier studies based on the NHS data have found the risk of CVD decreases 57% to 83% with adherence to recommended healthy lifestyles of diet, exercise, and abstinence from smoking and overall is associated with a very low risk of coronary heart disease (Stampfer et al., 2000). Notably, nurses who specialize in cardiovascular care may be better equipped to model CVD health protective lifestyles better than national samples of women in the Nurses' Health Study II (NHSII) and Behavioral Risk Factor Surveillance System in diet, activity, and nonsmoking (Fair et al., 2009). In summary, engaging in unhealthy lifestyle practices may trigger increased risks for CVD and poor HRQOL.

Strengths and Limitations

This systematic review has both strengths and limitations. The majority of the studies uses data from the NHS, which had a large sample size representing 11 U.S. states, and have moderate to strong methodological rigor. Yet, as Letvak posits, we do not know how many NHS nurses were actively working or were still in the profession when participating in the NHS or NHSII (2013). Although every attempt was made to limit the studies to samples of hospital nurses, we could only assume a majority of the sample were hospital nurses. U.S. hospital nurses comprise 63% of the total U.S. working nurse population; therefore, an assumption that the majority of nurses were hospital nurses was made when using the NHS data. Furthermore, standard measures of physical activity are limited to leisure time and do not account for the daily physical activities included in personal, work, or household responsibilities. Also, the studies in this review relied on self-report and thus were subject to recall error and social desirability bias.

Conclusions

This systematic review provides evidence that many U.S. hospital nurses are not getting adequate physical activity and not eating a healthy diet—placing them at risk for CVD and lower HRQOL. The importance of nurses' health cannot be underestimated as it directly affects patient outcomes, specifically in productivity,

absenteeism, quality of care, and nurse-initiated health promotion (Blake & Harrison, 2013; Carlson & Warne, 2006; Gillen, 2014). Knowledge of lifestyle practices of U.S. hospital nurses could potentially help to ameliorate, reduce, or eliminate deficits and barriers to achieving a healthier workforce.

The importance of nurses' health has not been overlooked by the American Nursing Association HealthyNurse health risk appraisal recent survey on the state of nurses' health, lifestyles, and workplace environment. This effort has culminated in the ANA Healthy Nurse Healthy Nation (HNHN) Grand Challenge, which continues to push the envelope in order to encourage nurses to lead healthy lifestyles. The Healthy Nurse Healthy Nation offers nurses a virtual community to share their experiences in physical activity, sleep, nutrition, quality of life, and safety. In addition, the Nurses' Health Study III is currently recruiting a younger cohort of nurses, including students and male nurses to learn how new generations of nurses are practicing healthy lifestyles.

The research generated by these studies will help to identify and address the state of nurses' health in personal and professional domains. Future qualitative research may shed light on the barriers and facilitators of healthy lifestyle practices. Invariably, the hospital work environment impacts nurses' health, therefore mandating that hospitals strive to create healthier workplaces. This could conceivably result in improvements in nurses' overall health. Some regulations are in place, but certainly not universal due to a mixture of private and public health care models in the United States. Nurses can lead the public as healthy role models by setting a standard for themselves while modeling healthier lifestyles for their patients. Dossey (2005, p. 41) cites Nightingale's exhortation to nurses to teach "not by preaching, but by example, by being it ourselves." Nurses have the power, the potential, and the means to improve health for all by embracing and endorsing healthy lifestyle practices.

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