Occupational Health Across Generationally-defined Age Groups in a Cohort of Hospital Nurses:

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OCCUPATIONAL HEALTH ACROSS GENERATIONALLY-DEFINED AGE GROUPS IN A COHORT OF HOSPITAL NURSES

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ABSTRACT

OCCUPATIONAL HEALTH ACROSS GENERATIONALLY-DEFINED AGE GROUPS IN A COHORT OF HOSPITAL NURSES
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In the popular press and in the public imagination there has been much interest in the concept of generational differences—the idea that one's experiences might vary as a function of the timing of one's birth and other key life events relative to historical markers or periods. While research findings on generational differences in the workplace, including occupational health, have been limited and inconsistent, nurse administrators have noted important occupational health differences in work-related experiences of the nurses they supervise. This secondary analysis of cross-sectional data on 1,146 direct care staff registered nurses in non-administrative roles enrolled in the Boston Hospital Workers Health Study (BHWHS) in 2014 examined the relationships between being a member of one of three generationally-defined age groups (Baby Boomers, Generation X and Millennials) and indicators of three major categories of health. *Physical* (measured by body mass index, pain presence and severity, absences and limitations related to pain, and occupational injury), *psychological* (measured by psychological distress), and *overall work-related* (measured by work limitations) health variables were analyzed using regression modeling controlling for individual and work-related characteristics. Overall, this sample of nurses from two major teaching hospitals in a single city, which was relatively homogeneous in terms of gender, race, and ethnicity, reported generally good health and serious symptoms or limitations were rare. With a few notable exceptions, poor physical health was more common in older age groups and psychological symptoms were worse in the younger age groups in this cohort. However, the findings should be interpreted cautiously and may reflect a number of selection and survivor biases. Further research is needed to replicate these findings

before drawing broader conclusions about age or generation as influences on nurse occupational health. As the empirical literature stands, it appears that energy would best be focused on nurturing a culture of health, emphasizing risk factors for various health problems, across all age groups, rather than in tailoring health promotion efforts for nurses by age or generation.

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Chapter 1: Statement of the Problem

Background and Significance

Perhaps in part because of the nature and conditions of their work, hospital nurses face distinct health risks. Workers in hospitals, including nurses, report occupational injury rates in excess of workers in other risk-prone industries including construction and manufacturing (Occupational Safety and Health Administration (OSHA), 2013). Nurses also appear more likely to experience high levels of psychological distress than other classes of workers. In one study of 1,171 U.S. nurses working in hospital settings in North Carolina, nurses reported a rate of elevated depressive symptoms (18%) twice as high as that of the general adult population (9.4%) (Letvak, Ruhm, & McCoy, 2012). One review of the literature on nurses' health concluded that nurses were at a greater risk of tuberculosis, breast cancer, occupational allergies such as dermatitis, and musculoskeletal disease than other types of workers (Fronteira & Ferrinho, 2011).

Insalubrious lifestyle behaviors in tandem with individual and job factors may explain poorer physical health outcomes in nurses. A systematic review of 13 studies found fewer than five percent of U.S. hospital nurses reported adhering to all five of the recommended lifestyle behaviors including a healthy diet, weight, physical activity, tobacco restriction, and limiting alcohol use (Priano, Hong, & Chen, 2018), and several other studies have found that over one half of nurses report body mass indexes (BMI) in the overweight or obese range (Han, Trinkoff, Storr, & Geiger-Brown, 2011; Letvak, Ruhm, & McCoy, 2012; Zapka, Lemon, Magner, & Hale, 2009).

The implications of poor health in nurses are potentially serious for many different stakeholder groups, given that nurses form the largest category of healthcare workers and play essential roles in health care delivery. According to Occupational Safety and Health

Administration (OSHA) data, the costs of workplace injuries and illnesses in U.S. hospitals exceeded $6.1 billion in 2011 (Harris, 2013). Furthermore, the occupational health of nurses has many impacts on hospital and health system function and profitability. Costs include those related to the treatment, repair, and rehabilitation of injuries to nurses in addition to the costs of lost or restricted hours.

Poor worker psychological health taking forms such as depression and depressive symptoms, may have less obvious but equally serious impacts on healthcare organizations. A systematic review indicates that depression in registered nurses is linked to unfavorable and costly outcomes such as sickness absenteeism and presenteeism, short-term disability, and decreased productivity (Brandford & Reed, 2016). Presenteeism, or choosing to go to work when at less than one's best instead of resting at home (Rainbow & Steege, 2017) leading to potentially less efficient and/or impaired performance, is an increasing concern in hospitals (Brborović, Daka, Dakaj, & Brborović, 2017). Presenteeism in nursing, sometimes known in workplaces as belonging to the "walking wounded," has been associated with difficulties meeting job demands, as well as burnout and exhaustion (Brborović et al., 2017).

Additionally, nurses' workplace-related health problems can affect healthcare systems' ability to deliver high-quality care to patients. There is an increasing emphasis in the patient safety movement on the importance of a healthy nursing workforce as a critical precondition for providing quality patient care (Kemppainen, Tossavainen, & Turunen, 2013), and achieving optimal patient safety outcomes (Gärtner, Nieuwenhuijsen, van Dijk, & Sluiter, 2010; Melnyk et al., 2018; Pousette, Larsman, Eklöf, & Törner, 2017). Many healthcare quality and patient safety experts have declared that worker health and experience should be targeted by healthcare quality improvement efforts in addition to patient-oriented indicators. Some experts have gone so far as

recommend the inclusion of a fourth aim related to worker well-being to the Institute for Healthcare Improvement Triple Aim of reducing the per capita costs of health care, improving health of populations, and improving the patient experience of care, including quality and satisfaction (Berwick, Nolan, & Whittington, 2008; Bodenheimer & Sinsky, 2014; Sikka, Morath, & Leape, 2015). Addressing work life and meaning for healthcare providers in tandem with improvement of patient care and outcomes (Adams, Zimmermann, Cipriano, Pappas, & Batcheller, 2018; National Academy of Medicine, 2016) reflects an increasing recognition of the important associations between occupational health and patient safety (Pousette et al., 2017).

Rapid technological innovations, increasing regulatory pressures, decreasing reimbursement levels, and the globalization of the economy have caused turbulence and instability in U.S. healthcare organizations (Geiger-Brown & Lipscomb, 2010). Hospitals and health systems that once changed infrequently and often in a planned manner are now forced to continuously adapt to respond to market forces in order to remain viable. Unpredictability in the healthcare industry has created pressures to restructure, reorganize, implement alternative staffing models, downsize units and organizations, shorten lengths of stays for patients, tighten patient-nurse staffing ratios, and decrease supports for professional nursing practice. Hospitals also face challenges of changing characteristics and demographics in the nursing workforce. Registered nurses, who are involved in almost every aspect of healthcare delivery, are deeply affected by these trends. Further, the oldest generations of nurses are expected to retire in large numbers between now and 2030 with younger generations forecasted to become the dominant age group in the nursing workforce (Buerhaus, Skinner, Auerbach, & Staiger, 2017).

Often without specific data to support their impressions, nurses and nurse leaders have noted differences in workplace behaviors and occupational health outcomes across nurses of

various ages (Clipper, 2012). Anecdotally, younger workers appear to have more sickness-related absences (Bates, 2011), report more occupational injuries (Breslin & Smith, 2006), intentions to leave their positions (Brunetto et al., 2013a; Tourigny & Baba, 2016), need for training and coaching (Lavoie-Tremblay, Leclerc, Marchionni, & Drevniok, 2010), feelings of agitation and burnout (Erickson & Grove, 2007), and use of antidepressants (Iarovici, 2014) than older workers. One systematic review with an international scope found increased age was related to better mental health in nurses (Oyama & Fukahori, 2015), while Brandford and Reed (2016) specifically found in their systematic review that younger nurses demonstrated higher rates of depression than older nurses.

In the popular press and higher education literature, there are reports of greater psychological distress and rising use of mental health services in college and university students in the last decade (Denizet-Lewis, 2017; Thielking, 2017). One recent study found students majoring in nursing are also reporting higher stress levels in college than their non-nursing colleagues (Bartlett, Taylor, & Nelson, 2016). In the 2010's, reports of increasing psychological distress in adolescents began appearing, with young women appearing to be markedly more affected. Longitudinal data from the Monitoring the Future, a survey of United States youth, found that, adolescents reported 33% higher levels of depressive symptoms from 2010 to 2015, with levels among young women accounting for nearly all of this change (Twenge, Joiner, Rogers, & Martin, 2018).

Nurses may share experiences and life events related to their work as members of common generations. Generational cohorts are defined as groups of "individuals who have grown up in the same historical and social context, whose shared formative experiences instill in them beliefs, values, and general dispositions that differ from those of others born and raised in

different contexts and time periods" (Woodward, Vongswasdi, & More, 2015, p. 9). Examples of generational cohorts in the current workforce include from oldest to youngest: the Silent Generation (i.e. Matures, Veterans, and Traditionalists); the Baby Boomers (i.e. Sandwich Generation); the Generation X/Xers (i.e. Thirteenth Generation, Baby Busters, and the Lost Generation); Millennials (i.e. Generation Y, Nexters, and the Echo Boomers); and the newly emerging generation currently in their formative years, Generation Z (i.e. post-Millennial, iGeneration) (Raphelson, 2014).

However, despite the great popular appeal of identifying commonalities among members of the same generations, and contrasts in the experiences or perspectives across different generational cohorts as an explanation for workplace conflicts (Leiter, Jackson, & Shaughnessy, 2009; Leiter, Price, & Laschinger, 2010), generational research does not have strong, coherent theoretical underpinnings (Costanza, Badger, Fraser, Severt, & Gade, 2012; Lyons & Kuron, 2014). The majority of generational research studies do not (and cannot) distinguish generational differences including cohort, period, and life-cycle/aging effects (Parry & Urwin, 2011; Pew Research Center, 2015) from age-related effects. Cohort effects relate to the historical circumstances that members of a group experience together. Period effects are the impacts of distinct events on individuals regardless of age. Finally, life-cycle/aging effects relate to an individual's position in the life cycle (Elder & George, 2016; Parry & Urwin, 2011; Pew Research Center, 2015). Despite empirical and methodological criticisms of the existing literature on generations and lingering questions about how to interpret age group differences, some experts believe strongly that generational influences may still be important for nurse leaders to consider to improve the recruitment and retention of nurses (Stevanin, Palese, Bressan, Vehvilainen-Julkunen, & Kvist, 2018).

The purpose of this cross-sectional study was to identify whether significant differences exist between generationally defined age groups and the occupational health of registered nurses in a large cohort of registered nurses from two academic medical centers. This secondary analysis examined a subset of data collected in 2014 on licensed nurses enrolled in the Boston Hospital Workers Health Study (BHWHS), a National Institute for Occupational Safety and Health (NIOSH)-funded initiative that, over the whole course of the grant, has assembled data on approximately 15,000 patient care workers in two large hospitals. The intent of this study was to inform strategies used by nursing leaders and researchers to create healthier workplaces and improve nurses' health. Longitudinal follow-up, which was beyond the scope of this study, would offer the possibility to determine if any patterns suggestive of generational differences persist. However, given the limited findings in this literature to date, it is worthwhile to examine patterns of health outcomes by age in carefully collected cross-sectional data from a large cohort of nurses grouped by generational categories.

Summary

This first chapter has laid out the main ideas or problem addressed in this study. The second chapter presents a review of relevant literature and culminates in a discussion of the theoretical framework for the study and the research questions. The third presents the methods used in this study. The fourth and fifth chapters provide both the results and a discussion of these results. In the next chapter, relevant literature is reviewed and the conceptual basis for the study is outlined.

Chapter 2: Literature Review

Chapter 2 provides a summary of literature relevant to this study of age differences in occupational health in hospital nurses. It begins with two sections corresponding to the major variables studied: nurse occupational health and generationally-defined age groups of nurses. This chapter concludes with a brief overview of the conceptual model and framework guiding this study and a presentation of the research questions.

Nurse Occupational Health

This section reviews nurse occupational health, the outcome (and dependent) variable in this study. This section proceeds variable by variable and in each case defines the concept, identifies its subtypes, contrasts it with related concepts, and provides an overview of current findings related to nurses' health.

Definitions

The literature contains no consensus definition of 'nurse occupational health.' For the purposes of this study, nurse occupational health will be defined as a relative state of physical, psychological, social and spiritual well-being in nurses given their experiences of work and work demands. Several different approaches to defining health have been described: pathogenic (i.e. absence of health) and salutogenic (i.e. positive state of health) definitions and the complete state approach (i.e. holistic range of health levels) (Keyes, 2014). A complete-state approach to health, where the nurse possesses a range of self-management and adaptive responses to physical, social, and emotional challenges (Huber et al. 2011) guided this study.

According to the American Nurses Association, nurses are charged with "the protection, promotion, and optimization of health and abilities, prevention of illness and injury, facilitation of healing, alleviation of suffering through the diagnosis and treatment of human response, and

advocacy in the care of individuals, families, groups, communities, and populations" ("What is Nursing?," n.d.). As one aspect of nurses' overall health, occupational health relates specifically to experiences and outcomes influenced by how and where nurses carry out this work.

Concepts related to nurse occupational health include: healthy nurses, occupational well-being, employee wellness, and professional quality of life. These concepts relate more broadly to overall well-being of nurses as individuals, not just aspects of health that are primarily impacted by the nature of their work or their work environments. Several of these concepts are also influenced by forces and variables outside the direct scope of research on work-related health such as pay, job satisfaction, and work-family issues. Additionally, fitness for duty, personal safety for nurses, and occupational safety are concepts that share many of the same correlates; however, nurse occupational health is perhaps the broadest term encompassing more than just physical function and hazards in healthcare settings.

Occupational health nursing (OHN) is a specialty within professional nursing that involves "provid[ing] for and deliver[ing] health and safety programs and services to workers, worker populations, and community groups. The practice of OHN focuses on promotion and restoration of health, prevention of illness and injury, and protection from work-related and environmental hazards" ("What is Occupational and Environmental Health Nursing?," n.d.). It could certainly be assumed occupational health nursing practice in healthcare settings would address the occupational health of nurses, but occupational health of nurses and occupational health nursing are indeed distinct.

Subtypes

Overall nurse occupational health can be broken down into four subtypes: physical, psychological, social, and spiritual (Greenberg, 1985). Physical health is measured not only by

the presence or absence of physical disease; it is the physiological fitness to engage in work, recreational activities, and activities of daily living (Huber et al., 2011). Physical health outcomes studied in the context of nurse occupational health have included weight, dietary habits, physical activity levels, and work-related injuries. Other indicators in studies of nurses have included physiological measures such as heart rate, blood pressure, blood sugar, cortisol levels, pain, cholesterol, and gastrointestinal symptoms (Danna & Griffin, 1999; Perry, Gallagher, & Duffield, 2015).

Psychological health is defined as "a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community" ("WHO | Mental health: a state of well-being," 2014). While mental health is a closely related term, some might consider it to highlight psychopathology and risk factors in a narrower sense. Empirical referents of psychological health include a broad range of both wellness and illness concepts: psychiatric illnesses, sleep quality and duration, fatigue, levels of resilience, coping, psychological distress, burnout, and anxiety.

Social and spiritual health are two other subtypes of nurse occupational health not included in this study because examining them would require different measures and data than were available. Social health is the ability to interact and actively engage and connect with others in the work environment, including having satisfying interpersonal relationships (Greenberg, 1985; Sherman et al., 2015). While some of the measures of psychological health in the dataset used in this study touch upon it, there were no direct measures of social health available. Spiritual health is defined as a dynamic state of being demonstrated by the quality, meaning and purpose of the nurse's relationships with self, others, the environment, and transcendentally

(Fisher, 2011). While also an important component of nurse occupational health, spiritual health cannot be explored with the same conceptual, practical, clinical, or research approaches as physical and psychological health.

Health Status of Nurses

Literature describing the health of nurses is reviewed in this section. Major concepts or variables are defined and described, measurement issues are reviewed, data describing nurses' health on each dimension are reviewed, and data regarding correlates of nurse health are presented. When available, the results of relevant systematic literature reviews are cited.

Overall measures of health. Self-rated health is defined as an individual's perceptions of their state of health (Andersen, Bak, Vangsgaard, Dokkedal, & Larsen, 2011). As a reasonable proxy for overall health status across a variety of populations, the self-rated general health of nurses is commonly measured using a single item with Likert-type response options such as ‘‘Would you say your health in general is excellent, very good, good, fair, or poor?’’ (The (Krause & Jay, 1994; Salomon, Nordhagen, Oza, & Murray, 2009). As a group, nurses generally report positive overall health (Dellve, Hadzibajramovic, & Ahlborg, 2011; Perry, Gallagher, et al., 2015; Perry, Lamont, Brunero, Gallagher, & Duffield, 2015; Shields & Wilkins, 2006). Shields and Wilkins (2006) summarized findings from a 2005 nationally representative sample of licensed nurses in Canada. Authors found nurses' self-rated health was not significantly different from non-nurse employed individuals outside of health care although differences have been identified across caregiving professions and over the course of nursing careers (Shields & Wilkins, 2006). A demographic variable correlated with self-rated general health in a number of studies is age: in the general population, it appears that as age increases, self-rated health decreases in both the general population (Badley, Canizares, Perruccio, Hogg-Johnson, &

Gignac, 2015) and in nurses (Malinauskiene, Leisyte, Malinauskas, & Kirtiklyte, 2011).

The healthy worker survivor effect might influence self-reports of general health in nurses. The healthy worker survivor effect refers to a form of selection bias where overall health ratings of workers appear higher than the general population due in part to unhealthy individuals being excluded because they are unable to perform their job duties and drop out of the workforce (Chowdhury, Shah, & Payal, 2017). This becomes is a particular problem when examining differences in health status by worker age and assuming an ability to extrapolate to the population at large. Unhealthy nurses who couldn't handle their work from a physical or psychological standpoint may well have chosen to leave the profession, leaving an older group in study cohorts that shows (or "is selected for") disproportionately good health—such selection would presumably be less common in younger workers.

The relationship between length of professional experience, often correlated with age of the nurse, and general health in nurses seems somewhat less straightforward. This will be discussed more thoroughly later in this literature review. In a study of U.K. based nursing students, self-rated health of the nursing students (n=325) was significantly worse than that of licensed nurses (n=551) (Malik, Blake, & Batt, 2011). Another study found self-rated health of Swedish nurses (n=842) significantly decreased in the first three years of nursing employment, especially in younger nurses transitioning from the student to the professional role (Hasson, Lindfors, & Gustavsson, 2010). Mirrored in several other human services professions, the transition from student to professional appears to potentially influence the perception of self-rated health as a consequence of this disillusionment and burnout entering the workforce (Cherniss, 1995; Montez, Zhang, Zajacova, & Hamilton, 2018). 'Reality shock', a term referring to the difficulties nurses experience when transitioning from the ideal (or idealized) practice

setting discussed and experienced during nursing education to the sometimes stark realities of "real-world" nursing practice after graduation (Kim, Yeo, Park, Sin, & Jones, 2018), may influence self-rated health described by nurses.

Person-level health variables associated with poorer self-rated general health of nurses in the literature include inactivity and alcohol use (Malinauskiene et al., 2011; Perry, Lamont, et al., 2015; Silva-Costa, Griep, & Rotenberg, 2015). Work-related variables have also been found to be significantly associated with self-rated health. Workplace bullying, low social support at work, high job demands/low job control, job dissatisfaction (Malinauskiene et al., 2011), a job with high effort and low reward, and a combination of greater work commitment, high job demand and low rewards were all associated with poorer self-rated health reported by nurses (Weyers, Peter, Boggild, Jeppesen, & Siegrist, 2006). Nurses employed in long-term care facilities also reported poorer health compared to those in other healthcare settings such as hospitals (Shields & Wilkins, 2006). Conversely, in a cohort of U.S. nurses (n=3,132) across multiple states, variables related the professional work environment including job satisfaction, perceived productivity, and a high-quality nursing care environment were not associated with nurses' health ratings (Tucker, Harris, Pipe, & Stevens, 2010).

Health-related quality of life (HRQOL), another related concept, is measured by several different self-administered or structured interview instruments capturing various dimensions of what is important to nurses or others' self-reported health including: general health, physical health, mental health, social functioning, role functioning, vitality, pain, physical mobility, emotional reaction, energy level, sleep, and outlook (Cieza & Stucki, 2005). Two recent systematic reviews examined correlates of HRQOL (Oyama & Fukahori, 2015; Priano et al., 2018) in nurses. In their systematic review of 22 studies exploring HRQOL, authors concluded

age and occupational stress played a key role in the HRQOL reported by nurses (Oyama & Fukahori, 2015). Older nurses with fewer reported chronic diseases and improved cognitive functioning reported more positive levels of HRQOL (Priano et al., 2018). This second systematic review of 13 studies also found the level of adherence to lifestyle behaviors such as physical activity, healthy dietary intake was significantly associated with HRQOL in nurses (Priano et al., 2018).

Summary. In general, nurses appear to report good levels of self-rated health and health-related quality of life, although there are significant predictors associated with poorer self-rated general health including age and conditions of nursing work such as increased occupational stress. As expected, general health measures are associated with indicators of physical, psychological, and work-specific health that will be discussed in more detail in the next sections.

Physical health. ***Obesity.*** Obesity affects large numbers of nurses. It results from the interaction of genetic predispositions with lifestyle habits and social and environmental conditions, and is an important risk factor for a variety of adverse health conditions and illnesses (WHO, 2000). Overweight and obesity are often operationalized in research as body mass indices (BMI) derived from self-reported height and weight and can be used to classify adults into underweight, normal, overweight and obesity categories (WHO, 2000). Three recent studies exploring obesity rates in nurses found over half of the U.S. nurse respondents had BMIs in the overweight or obese range (Han et al., 2011; Letvak, Ruhm, & Gupta, 2012; Zapka et al., 2009). Specifically, in the most representative sample of U.S. nurses (n= 2,103) the prevalence of obese nurses (not including overweight BMIs) was 27.1% (Han et al., 2011), slightly lower than the U.S. population rate of 34.9% (Ogden, Carroll, Kit, & Flegal, 2014). Some literature is also emerging that suggests nurses are more likely to be obese than non-nurses (Kelly & Wills, 2018).

Body mass index (BMI) classifications have been studied both as a predictor and as an outcome variable. As a predictor of health outcomes, in a recent meta-analysis of 97 studies with a combined sample size of more than 2.88 million individuals, researchers found that relative to normal weight, obesity was associated with significantly higher rates of all-cause mortality (Flegal, Kit, & Orpana, 2013).

Several work and individual factors contributing to obesity have been identified in the general population and have been isolated as risk factors in nurses as well. Working long hours, overtime, and working in positions requiring less physical exertion and movement were significantly associated with heavier body weights in nurses (Han et al., 2011; Solovieva, Lallukka, Virtanen, & Viikari-Juntura, 2013). Older age, African American race, depressive symptoms, perceived health, exercise frequency, and less education have also been significantly associated with obesity among nurses (Han et al., 2011; Solovieva et al., 2013). At least one review failed to identify consistent role-related (i.e. staff nurse, manager) or setting-specific (i.e. hospitals versus non-hospital settings) differences in BMIs in nurses (Han et al., 2011).

Physical symptoms. Physical symptoms are unpleasant sensations or similar experiences that are potentially linked to organic or psychiatric illnesses or disease entities with known pathological mechanisms (Melville, 1987). Physical symptoms commonly reported by nurses in the literature include gastrointestinal symptoms, headaches, fatigue, and musculoskeletal pain. In this study we restricted our attention to musculoskeletal pain and focus our attention on the literature dealing with it.

Musculoskeletal pain, a result of illnesses or injuries affecting the bones, cartilage, ligaments and muscles, is common in nurses. Overall, it has been reported that nearly 85% of nurses experience musculoskeletal symptoms in their lifetimes (Geiger-Brown & Lipscomb,

2010). A review of research on nurses and nursing aides working primarily in acute care settings in North America suggests that self-reported musculoskeletal pain is most common in the following body regions: lower back (51-57%), followed by neck (37%), and shoulder (35%) (Davis & Kotowski, 2015). In a systematic review of work-related low back pain, authors found nurses had a significantly higher incidence of musculoskeletal pain compared to the general population (Yassi & Lockhart, 2013). In a survey-based study, nurses reported a significantly higher annual incidence rate of back pain (14.7%) compared to an age-gender matched sample of non-nurses (11.5%) (Leighton & Reilly, 1995). Reported pain in the lower extremities also appears quite common. A recent study of Finnish registered and practical nurses (n=411) found that eight to 25% experienced for foot, knee, or ankle pain (Stolt, Suhonen, Kielo, Katajisto, & Leino-Kilpi, 2017).

Pain can be thought of as a marker of potential disease, as well as an indicator of disability, and inability of a nurse to work (Denis, Shannon, Wessel, Stratford, & Weller, 2007). A study of patient care workers in two large Massachusetts hospitals revealed 72% of patient care workers reported musculoskeletal symptoms in the last three months, with 32% reporting the pain had interfered with work tasks (Dennerlein et al., 2012). Foot pain may be a presentation of other chronic diseases such as diabetes, arthritis, and circulatory problems (Stolt et al., 2017). Like obesity, pain is both a predictor or risk factor and an outcome of physical health in and of itself: pain can affect sleep and poor sleep can increase pain levels (Buxton et al., 2012). In a systematic review, pain was found to be associated with work limitations and was a strong predictor of absenteeism and lost work time (Johns, 2008).

Diagnosed physical diseases and illnesses (and proxies). Compared to other healthcare workers and the general population, nurses show higher rates of the following illnesses and

diseases: breast cancer, tuberculosis, hepatitis B virus, and occupational allergies, specifically dermatitis (Fronteira & Ferrinho, 2011). Small or non-significant differences were found for incidence and prevalence of hypertension, cardiovascular disease and most other cancer types (Fronteira & Ferrinho, 2011). Fronteira and Ferrinho (2011) concluded there was insufficient evidence to draw conclusions regarding differences in sleep disorders or diabetes in nurses relative to the general population.

Occupational injuries and illnesses. Occupational illnesses and injuries appear to disproportionately impact nurses compared to other healthcare workers and workers in other sectors of the economy (Fronteira & Ferrinho, 2011; Geiger-Brown et al., 2012; Han et al., 2011; Letvak, Ruhm, & McCoy, 2012; Zapka et al., 2009). Most data about the occupational health of nurses has been derived from self-report surveys and government collected occupational injury and illness data. OSHA defines a recordable occupational injury or illness as one that is work-related and results in death, loss of consciousness, days away from work, restricted work, transfer to another job, or requires medical treatment beyond first aid (OSHA, 2013).

From 2017 data, the annual incidence of occupational injuries for non-governmental health care workers, including all hospital workers, is 5.7 cases per 100 full-time workers (Bureau of Labor Statistics, 2017a). Injury and illness rates per 100 full-time equivalent employees (FTEs) are higher in private hospitals than in manufacturing (3.5), construction (3.1), or the average from all other U.S. private industry settings (2.8) (Bureau of Labor Statistics, 2017a). Within the healthcare industry, the only settings with more injuries than hospitals are nursing and residential care facilities (6.3) (Bureau of Labor Statistics, 2017a). With the exception of nursing assistants, nurses had the highest rates of injuries and illnesses among all types of hospital/healthcare workers (Gomaa et al., 2015). It is hypothesized that these rates

might well be underestimates, given that nurses may underreport occupational injuries because they feel the injuries are trivial or are just "part of the job," or feel that they are simply too busy to report them (de Castro, Cabrera, Gee, Fujishiro, & Tagalog, 2009).

Summary. Nurses face several major types of risks to their physical health. Based primarily on government-mandated tracking of occupational injuries, data suggest nurses experience several diseases and injury types at higher rates than the general population and most other healthcare occupations, with the possible exception of nursing assistants. Additionally, there is growing evidence that certain organizational, job-related, and individual characteristics such as gender and age appear to play key roles in nurses' physical health outcomes. Overall, findings in the literature are consistent with certain types of work environments and conditions of nursing work as risk factors for negative physical health outcomes.

Psychological health. Psychological health was the second major subtype of nurse occupational health addressed in this study. Challenging social, economic, and environmental circumstances interconnected with an individual's gender and life stage appear to place subgroups of the population at increased risk for mental health disorders (World Health Organization (WHO), 2014). Workplaces place yet additional demands on individuals. Due perhaps to what some characterize as an increasingly demanding work environment with heavy patient care needs and complex technologies, hospital nurses appear more likely to report adverse psychological health than the general population or other healthcare workers. Gershon et al. (2007) summarized literature from the 1990s and concluded that nurses are ranked as one of the health professions showing the highest rates of depression, anxiety, somatization, and burnout among the health professions and occupations. Similarly, Calnan, Wainwright, Forsythe, Wall, and Almond (2001) reported that 27% of U.K. general practice office and healthcare

workers reported ill mental health compared to only 14-18% of the general population. Data regarding mental health of nurses is limited and the majority of even the most recent studies were carried out more than a decade ago.

Stress/stressors. Many researchers and experts view stressors as common in nursing and believe stress plays an important role in nurses' psychological health. Jordan, Khubchandani, and Wiblishauser (2016) also believe that nurses experience a special clustering of stressors. They state:

> Nurses have many competing demands for their time, energy, and attention. Nurses must focus on the health of their patients, the needs of patients' family members, the demands of physicians and supervisors, their own needs, and the concerns of their own family members. The increasing demands faced by nurses impact all areas of nurses' personal and professional lives and increase their risks of chronic stress, work-family conflict, and unhealthy behaviors. (p. 1)

Heavy demands in many dimensions of their lives might explain why nurses may perceive high levels of occupational stress in the workplace and may experience poorer levels of psychological health compared to other workers. In an Internet-based Health Appraisal Assessment conducted by the American Nurses Association, 82% of nurses reported workplace stressors to be their most prominent health and safety concern (American Nurses Association, 2017).

In a recent literature review on stressors specific to nursing practice, a multitude of nursing work environment factors contributing to negative outcomes were identified: lack of autonomy and discretion, limited access to support and learning, high levels of emotional exhaustion and burnout among colleagues, frequent workplace stress, high workloads and low reward, rotating shifts (and associated health impacts), workplace violence, role conflict, and high patient acuity and the need to deal with patient death (Perry, et al., 2015).

In the literature, stress has been conceptualized as both an outcome and a predictor of

nurse health outcomes (Orly, Rivka, Rivka, & Dorit, 2012). Nurses experience a wide range of life and workplace stressors, as just discussed. A widely-cited systematic review of studies on work-related stress across different sectors including health care identified working in the healthcare industry and being a woman as predictive of higher stress (Nowrouzi et al., 2015). Additionally, in a study of Swiss healthcare workers, nurses showed worse coping with stressful events than physicians (Cullati et al., 2017). Systematic reviews have shown that higher stress levels predicted poorer levels of physical and mental health outcomes (Oyama & Fukahori, 2015) as well as higher psychological distress and burnout (Geiger-Brown & Lipscomb, 2010; Khamisa, Peltzer, & Oldenburg, 2013; Tucker et al., 2010) among nurses.

However, the literature on stress in nurses does not deal exclusively with its deleterious effects. Eustress, a positive psychological response to a stressor, has been shown to lead to the active engagement in nursing work (Simmons & Nelson, 2001). Furthermore, coping strategies appear to have an influence on outcomes. A study of Swiss hospital nurses (n=158) using the State Hope Scale found one response to stress, hope, was associated with better self-reported health in nurses (Simmons & Nelson, 2001).

Nonetheless, most researchers and theorists consider there to be a link between exposure to cumulative and prolonged stressors coupled with certain personal characteristics (i.e. age, life stage, personality traits, and coping skills) and the development of negative psychological health outcomes. Research suggests that mismatches between demands on nurses and nurse capacity for managing stress lead to psychological distress, anxiety, depression, and burnout (Gershon et al., 2007; Kushner & Ruffin, 2015; Salvagioni et al., 2017).

Psychological distress. Psychological distress is defined as negative emotional or mental symptoms such as anxiety, irritability, sadness, and cognitive impairment, experienced mostly in

relation to stress (Massé et al., 1998). Symptom checklists or mood scales are usually screening tools for clinically serious disturbances with the potential to affect function and/or require treatment—and have found wide use in survey research. In contrast, psychiatric disorders, defined clusters of symptoms of sufficiently high severity and duration to warrant a diagnosis (and presumably merit treatment), will be discussed in a later section. High scores on self-administered questionnaires may or may not indicate a clinically important disturbance, but nonetheless suggest potential alterations in psychological health and wellbeing that are important influences on quality of life as well as risk factors for psychiatric disorders, particularly if persistent.

Psychological distress appears high in the nursing workforce compared to other professions and the general population. In one study comparing nurses and salespeople, hospital nurses reported significantly higher levels of psychological distress as measured by the 12-item General Health Questionnaire (GHQ-12) (Goldberg & Williams, 1988; Kato, 2014). Bourbonnais et al. (2006), using the Psychiatric Symptom Index (PSI) (Ilfeld, 1976), found high psychological distress in 22% of a Canadian sample of healthcare workers (n=618), although researchers did not compare this rate to a reference population.

Other studies have examined the rates of both anxiety and depressive symptomatology in different cohorts of nurses. Using a self-reported depression scale in a cross-sectional survey of 1,171 hospital nurses, Letvak, Ruhm, and McCoy (2012) found a rate of elevated depression symptoms (18%), nearly double the U.S. general population rate (9.4%). Calnan et al. (2001) found 27% of hospital staff suffered from stress and mental ill health compared to 14-18% of the general population. Using the Hospital Anxiety and Depression Scale (HADS) developed by Zigmond and Snaith (1983) in a diverse sample of U.K. nurses (n=870), similarly elevated self-

reported anxiety and depression rates of 26.3% and 5.9%, were identified respectively (Mark & Smith, 2012). Mealer et al. (2012), also used the HADS scale and found elevated prevalence of anxiety (18%) and depression symptoms (11%) in a sample of U.S. critical care nurses (n=744).

Psychological distress appears especially prevalent in nurses new to practice. High levels of distress self-reported as measured by the PSI (Ilfeld, 1976) were found in 43.4% of a Canadian sample of 309 new nurses (24 years or younger), nearly double the rate seen in a comparison sample of workers in the general population (21%) (Lavoie-Tremblay et al., 2008). Similarly, in a longitudinal study of nursing students and newly licensed nurses (n=192) assessed with the General Health Questionnaire-28 (Goldberg & Williams, 1988), researchers concluded that younger age and more life events in the transition to practice led to higher levels of psychological distress in new nurses that diminished over the subsequent four-year period (Watson et al., 2009).

As noted earlier, psychological distress can be both an outcome of stressful circumstances and an antecedent of other nurse occupational health outcomes. In a sample of U.K. healthcare workers (n=645), psychological distress, as measured with the General Health Questionnaire (Goldberg & Williams, 1988), was found to be a mediator of the relationship between work-family conflict and occupational injuries (Turner, Hershcovis, Reich, & Totterdell, 2014). Decker (1997) found psychological distress, measured with a researcher-developed tool, was significantly associated with job security and the quality of interprofessional relationships in a sample of nurses in a U.S. urban university teaching hospital.

Burnout. Nurse burnout is another outcome related to stress, especially work-related stress. Burnout is defined as a weakened physical and emotional state resulting from cumulative work-related stressors (Khamisa, Oldenburg, Peltzer, & Ilic, 2015) and a depletion of coping

mechanisms and psychological reserves needed to meet work demands (Adriaenssens, De Gucht, & Maes, 2015). Burnout is commonly associated with education, human services, and health service occupations, which are all characterized by intense, challenging interactions with clients/students/patients and difficult work and organizational conditions. Following Maslach and others, it is often measured in terms of three dimensions: emotional exhaustion (i.e. depletion of physical and emotional energy and strength), depersonalization (i.e. cynicism and negativism of behavior and thought), and a lack of personal accomplishment (i.e. feelings of competence towards job and personal goals) (Adriaenssens et al., 2015; Khamisa et al., 2015; Maslach, Jackson, & Leiter, 1997). Emotional exhaustion is the burnout dimension most often emphasized in research (Adriaenssens et al., 2015).

Burnout is a widely described and studied phenomenon in connection with nurses. The prevalence of burnout in general working populations in industrialized countries ranges from 13% to 27% compared to levels in nurses ranging from 30-50% (Adriaenssens et al., 2015). Burnout also appears related to other health outcomes in nurses. A systematic review of burnout found that nurses with higher levels of occupational stress reported more adverse health outcomes such as headaches and other somatic health complaints (Khamisa et al., 2013). Self-reports of burnout were related to risk for occupational injury (McCaughey et al., 2016). Other adverse organizational consequences of burnout include increased absenteeism rates, intention to leave their jobs (Geiger-Brown & Lipscomb, 2010), and job dissatisfaction.

Psychiatric illnesses/disorders. A diagnosable psychiatric illness is present when an individual experiences signs and symptoms of sufficient breadth and severity to meet predetermined criteria. For instance, a generalized anxiety disorder involves persistent and excessive worry, with or without physical manifestations, that interferes with daily activities

(“What are Anxiety Disorders?,” 2017). A major depressive episode or disorder is marked by at least two weeks of feeling discouraged, sad, hopeless, unmotivated or disinterested in life decreasing a person’s ability to function at work and at home (“What is Depression?”, 2017). By definition, these disorders are serious enough to significantly impair functioning and in many cases are considered to warrant treatment with medications, psychotherapy or both to restore functioning, relieve suffering, and prevent complications.

Major depressive episodes or disorders appear to be significantly more common in nurses than in the general population. Brandford and Reed (2016) systematically reviewed 36 published studies on depression in registered nurses, the majority of which used validated self-report depression symptom scales or checklists (Brandford & Reed, 2016). Although the authors identified a paucity of rigorous longitudinal studies, female nurses appear to experience higher rates of depression than the general population (Brandford & Reed, 2016). Additionally, as found in other studies, younger nurses had higher rates of depression than older nurses. Some have attributed this to an adjustment to shift work for new nurses (Brandford & Reed, 2016) and inexperience dealing with everyday situations in the workplace (Silva et al., 2015). Finally, in a cohort of Australian nurses (n=381) completing a checklist of common chronic diseases, 13% reported living with anxiety or depression (Perry, et al., 2015). Of those, six percent reported that their distress was severe enough that they sought psychiatric help within the past year (Perry, et al., 2015). These studies draw primarily on questionnaires rather than provider diagnoses or diagnostic interview schedules designed for psychiatric epidemiological research.

Factors contributing to depression among nursing professionals identified in a review of 20 studies included: stress at work and in the home environments, interpersonal conflicts at work and at home, low professional autonomy, work overload, younger age, higher education level,

and night shifts (Silva et al., 2015). It is notable that many of the 20 studies reviewed by Silva and colleagues (2015) were reported in Spanish and used survey self-reports of depressive symptoms rather than standardized diagnostic interviews or clinical diagnoses.

Summary. Many believe challenging work conditions, resource constraints, and work-related demands affect psychological health outcomes in nurses. Unanswered questions remain regarding whether nurses truly experience worse overall mental health compared to the general population and other healthcare professionals or whether nurses simply perceive and report more distress given their health-related knowledge and awareness of mental health issues.

Work-related health. Overall work-related health, which is similar to the concept of occupational health, is defined as wellness or fitness to engage in work (Larsson, 2011; Tearle, 2000). Analogous concepts include workplace or occupational well-being, professional quality of life and the antithesis of work-related health, work-related ill health. Workplace well-being is generally comprised of three components: the psychological, physical, and social state of health at work; these parallel the domains separated in research on nurse occupational health. Yet another concept measuring overall work-related health is professional quality of life (ProQOL). ProQOL is defined as the positive and negative aspects perceived by workers in the helping professions (Stamm, 2010). The positive end of ProQOL can be framed as compassion satisfaction and the negative pole is compassion fatigue. Work-related ill health is defined as physical or mental illness, disability, or other health problems that are caused or made exacerbated by work and result in ability to participate in work (Tearle, 2000).

The limited studies on the overall work-related health of nurses have primarily explored the phenomenon as workplace well-being. A sample of American and Australian nurses (n=1,228) in 2010-2012, consisting primarily of women, reported strongly positive workplace

well-being (Brunetto, et al., 2013b). In a systematic review exploring the links between occupational well-being, teamwork, and patient safety, perceived quality of teamwork was as a significant predictor of reported levels of well-being, with well-being also seen across studies as a significant predictor of patient safety (Welp & Manser, 2016). In a separate study, workplace well-being was found to significantly predict turnover intentions in a cohort of U.S. and Australian nurses (Brunetto et al., 2013b). Finally, researchers found an association between nurses' self-reported professional quality of life and their perceived caring ability (i.e. knowledge, courage, and caring) towards patients in intensive care units in a study of Iranian nurses (Mohammadi, Peyrovi, & Mahmoodi, 2017).

Absenteeism A specific manifestation of work-related health that has been particularly well-studied is absenteeism, the failure to report to work when scheduled (Johns, 2008). High levels of absenteeism are linked with adverse work-related injuries and risk factor exposures, diminished levels of productivity and performance, and/or poor health and limited work ability (Davey, Cummings, Newburn-Cook, & Lo, 2009; Dellve et al., 2011). However, absenteeism is a complex phenomenon, the reasons for which go beyond health issues, since employees may unexpectedly work fewer hours than scheduled due not only to illness, injury, or medical problems, but also child care problems, other family or personal obligations, civic or military duty, and maternity or paternity leave. However, definitions of absenteeism usually exclude time away from work due to holidays/vacation or personal days (Bureau of Labor Statistics, 2018). An additional distinction is that an extended absence from work due to disease, illnesses, and injury may be considered a leave of absence. Leaves of absence can be further categorized into short-term disability (i.e. generally less than six months), long-term disability (i.e. generally greater than one year), and workers' compensation cases, depending on how a worker's salary is

paid during the leave.

Nurses appear to have a higher number of absences from work compared to other categories of workers, with the exception of non-health related service/support occupations (Bureau of Labor Statistics, 2018; Davey et al., 2009; Lamont et al., 2017). Healthcare professionals in Canada were one and half times more likely to be absent from work as a result of illness or injury than other workers (Davey et al., 2009). In a cohort of Swiss nurses and physicians, physicians (1.7%) used significantly less prolonged sick leave (≥10 days) compared to nurses (6.3%) (Cullati et al., 2017).

Two systematic reviews have explored correlates of nurse absenteeism (Brborović et al., 2017; Davey et al., 2009). Across a range of study designs and varied measures of absenteeism, predictors of increased absenteeism have been identified: female gender, smoking, previous sickness absences, receiving influenza vaccination, physical fatigue, at least two previous episodes of low back pain, low self-reported physical capacity, burnout and stress (Brborović et al., 2017; Davey et al., 2009). Additionally, improved job satisfaction, reduced psychological work demands, and organizational commitment are associated with lower absenteeism in nurses (Brborović et al., 2017; Davey et al., 2009). However, neither mental fatigue and nor self-reports of physical capacity have been significantly linked with sickness-related absenteeism (Brborović et al., 2017).

In a review of international research on determinants of duration of sick leaves, key predictors were grouped into several categories: work, individual health, and demographic characteristics (Beemsterboer, Stewart, Groothoff, & Nijhuis, 2009). Job characteristics associated with shorter sick leaves include: better social integration, job satisfaction, support, and autonomy and lower demands in the work environment (Beemsterboer et al., 2009). Health-

related variables that were predictors of shorter durations of sick leaves include: better perceived physical and mental health and lower annual doctor visits, less frequent of use of medication, tobacco, alcohol and illicit drugs (Beemsterboer et al., 2009). Demographic characteristics linked with taking any sick leaves include younger and older age. Younger workers had more sick leaves but shorter ones than older workers. Additionally, being a man, being married, and having a higher level of education were also associated with a shorter duration of sick leave (Beemsterboer et al., 2009). Other reviews of the literature have reached different conclusions. One found little evidence of individual or work-related factors predicting duration of leave except for some weak associations between older age and previous sick leaves and longer sick leave (Dekkers-Sánchez, Hoving, Sluiter, & Frings-Dresen, 2008). A second systematic review that included only seven articles concluded that only older age (>50 years) was significantly associated with continuing disability and longer time to return to work (Cornelius, van der Klink, Groothoff, & Brouwer, 2011). The authors described limited and conflicting evidence for the association of other individual, health-related, and job-related factors with these outcomes (Cornelius et al., 2011). Overall, while literature findings are sparse, older age and the extremes of age appear to be associated with leaves versus no leaves.

Two other absenteeism-related measures of nurse occupational health of relatively recent vintage and not extensively researched are presenteeism and 'mental health days.' Presenteeism is said to occur when a worker comes to work when they should take time off to deal with illnesses and conversely 'mental health days' implies workers use a sick absence even though from a health standpoint they are able to work. By definition, a mental health day has been defined as "any self-reported sickness absence which participants attribute to their mental well-being" (Lamont et al., 2017, p. 1174).

Presenteeism is working while not well (Johns, 2008). Otherwise put, presenteeism is sickness attendance rather than sickness absence. Presenteeism is said to occur when a worker chooses to come to work even though he or she is of diminished capacity or is working with limitations that potentially impact productivity and quality of work (Rainbow & Steege, 2017). Deciding to work despite feeling significantly impaired is clearly a complicated choice and may be influenced by a range of personal and work-related factors such as the amount of sick time banked, and overconfidence in one's stamina. Mixed messages from workplace colleagues and managers are often conveyed. While nurses should protect patients and colleagues from contagious illnesses and should not work impaired; it is also implied that they should do their part to maintain safe staffing levels and not abandon their patients or colleagues. "Nurses continue to work, even on days when they feel very poorly, because of the impact their absence has on coworkers and loyalty to their patients" (Letvak, Ruhm, & Lane, 2011, p. 164). In nursing, presenteeism appears to be a potentially significant element in considering indicators of health-related work limitations (Rainbow & Steege, 2017).

Nurses who reported taking mental health days in one Australian study were significantly younger, worked in front-line clinical roles, worked varied shifts, sat less, and frequently reported heavy/demanding work (Lamont et al., 2017). In addition, nurses taking 'mental health days' were more likely to have experienced symptoms of a common mental disorder in the past 12 months, take psychotropic medications, report workplace abuse or injury, and intent to leave their jobs in the next 12 months (Lamont et al., 2017).

Health-related work limitations. Work limitations of nurses, also known as work disabilities or impairments in work functioning, are yet another indicator of nurse occupational health. Young et al. (2016) define health-related work limitations or disabilities as restrictions

imposed by nurses' health conditions that affect their ability to do their jobs. In workers, and nurses in particular, limitations can be the result of disease, illness, disability and other health problems in nurses in the workplace. In a review of literature, work limitations have been linked to a range of health problems including migraine, allergies, irritable bowel syndrome, gastroesophageal reflux disease, mental health problems, and increased body weight (d'Errico et al., 2013; Schultz & Edington, 2007). Work limitations in nurses can be acute, episodic, or chronic (Johns, 2008).

Work limitations can result in loss of productivity prior to an absence, experienced or imposed restrictions in the nature or pace of work when on the job, lost work days, and permanent disability (Young et al., 2016). In the literature, work limitations have been negatively associated with productivity. Physical limitations can affect physical strength, stamina, movement, coordination and flexibility (Munir, 2008). Psychological limitations tend to impair time management, reduce cognitive abilities to complete job tasks, and impair social interactions (Munir, 2008). In one systematic review, authors concluded work limitations entailed with common psychological health issues such as stress, mild depression, and anxiety disorders, are associated with decreased work function and adverse patient safety outcomes including medication errors, and near misses (Gärtner et al., 2010).

Summary. Overall work-related health and well-being is a multifaceted concept encompassing several key components that predict the ability of the nurse to participate in nursing work without limitations. There is a paucity of studies on the overall work-related health of nurses. Absenteeism may represent as a summary measure of work-related health of nurses. Absenteeism and work-related limitations have a multitude of complex antecedents and consequences that limit the ability to draw broad conclusions from the current literature.

However, age might predict absenteeism rates and work limitations such that when away, older workers experience longer absences while younger workers have a greater number of absences and report a greater use of 'mental health days.'

Correlates of Occupational Health Outcomes in Nurses

The following section briefly reviews literature of potential correlates of nurse occupational health indicators other than age. As the primary predictor variable for this study, a review of literature on the association between age and generationally defined age groups will be the focus of a later section of this chapter.

Demographic Characteristics

Sex/gender. Sex is the biological influence of the X and Y-chromosomes on reproductive function and concentrations of sexual hormones, whereas gender is a category based on the influence of specific behavior, lifestyle and life experiences on the individual (Regitz-Zagrosek, 2012). It is important to note there has been limited research to date on the occupational health of a small, but non-trivial number of nurses who may identify as other than the binary categories of male and female (Eliason, DeJoseph, Dibble, Deevey, & Chinn, 2011).

Gender is particularly relevant to nurse occupational health given that nursing is a profession composed predominantly of women. The significance of gender is not only related to biologically-based differences and social experiences that lead individuals of different genders to experience health differently, but also because understanding the determinants of occupational health of the male minority in nursing may have implications for promoting gender diversity in the profession.

While not focused specifically on nurses, one literature review identified sex differences in almost all bodily systems and disease processes (Regitz-Zagrosek, 2012). In general, women

experience higher incidence of Alzheimer's disease, strokes, autoimmune diseases, fibromyalgia, and rheumatoid arthritis whereas, cardiomyopathies and polycystic kidney disease are more frequent in men (Regitz-Zagrosek, 2012). Furthermore, although women experience higher incidence of myocardial infarctions, men are at a higher risk of sudden death after cardiac ischemia (Regitz-Zagrosek, 2012). The differences of incidence and severity of some diseases also seem to change based on gender and the aging process. For example, asthma is seen in higher frequency in young boys than girls, but after young adulthood, severe asthma is more common in women (Regitz-Zagrosek, 2012). Women are also at higher risk for coronary artery disease, and tend to experience a first cardiac event ten years later than males (Regitz-Zagrosek, 2012).

Studies identifying significant sex/gender differences in occupational health have been limited. In one systematic review of studies, authors found women workers reported higher levels of job insecurity, less sense of control, worse contractual working conditions, and poorer perceptions of physical and psychological health than men (Campos-Serna, Ronda-Pérez, Artazcoz, Moen, & Benavides, 2013). On the other hand, men were found to report more physically demanding job responsibilities, lower support, higher job status, higher exposure to noise, and longer work hours than women (Campos-Serna et al., 2013).

Empirically-based descriptions of gender differences in nurse occupational health outcomes have also been sparse. In a review of studies on depression in nurses, Brandford and Reed (2016) found women were at greater risk than men. Similarly, in a study of social well-being in Iranian nurses, men expressed significantly higher levels of social well-being than women (Mozaffari, Dadkhah, Shamshiri, Mohammadi, & Dehghan Nayeri, 2014). Researchers also found in a study of Spanish nurses, men experienced better health than the women

(Limiñana-Gras, Sánchez-López, Román, & Corbalán-Berná, 2013). In contrast, a large cohort study of Australian and New Zealand nurses, authors concluded men nurses were more likely to report higher levels of: respiratory, cardiovascular, and metabolic diseases, elevated BMIs, tobacco use, physical restrictions, and sedentary lifestyles, yet they reported better health and well-being, and fewer health-related worries than female nurses (Tuckett, Henwood, Oliffe, Kolbe-Alexander, & Kim, 2016). This finding was similar to two different international studies of nurses where women reported higher levels of stress and less vitality than men (Perry, et al., 2015; Yada et al., 2014). There are relatively few study results in the area, but existing literature suggests that in the nursing workforce, men seem to perceive less stress and better health than women regardless of actual disease or risk factor status.

Marital/cohabitation status. According to a review of rigorously designed studies, married and cohabitating individuals tend to have better health than unmarried individuals (Wood, Goesling, & Avellar, 2007). Perhaps this is because having a spouse is likely to provide support for healthy habits and behaviors, assistance in health emergencies, and increased likelihood of having health insurance. Furthermore, the literature suggests that married individuals experience lower overall mortality than their unmarried or widowed individual counterparts (Koball, Besculides, Goesling, Moiduddin, & Henderson, 2010). Some researchers hypothesize that this relationship could either be a reflection of marriage itself being linked to better health or the result of healthy individuals being more likely to get married (Koball et al., 2010). A variable similar to marital status, cohabitation (i.e. living together) has shown to be comparably associated with better health outcomes (Kohn & Averett, 2014), suggesting that it is valid to consider marriage and cohabitation as equivalent in health-related studies.

Research findings in the wider literature (i.e. not specific to nurses) have linked marital

status to differences in psychiatric illnesses such as depression as well as adherence to health-related behaviors and outcomes. In their review of literature of marriage and health, four studies found depression as measured with a variety of depressive measures (i.e. major depressive episode, depression symptomatology scales) to be significantly lower in married individuals than the single or divorced (Koball et al., 2010). In this same review, not specific to nurses, gender also seems to relate to depression in those experiencing a divorce, with women reporting depression more frequently than men (Koball et al., 2010). In terms of physical health, overall, unmarried adults reported less preventative care, exercise, and nutritious dietary intake and used more alcohol, tobacco, and illicit drugs compared with married individuals (Koball et al., 2010; Lee, 2005). Interestingly however, a number of studies show that both women and men gain weight after marriage (Koball et al., 2010).

Further, in the review of literature specific to nurses and marital status, a systematic review of studies of nurses, unmarried and divorced nurses were found to experience more depressive symptoms than married ones (Brandford & Reed, 2016). Additionally, in their review, the authors found married nurses were more likely to engage in health-promoting behaviors than unmarried nurses (Brandford & Reed, 2016). Similarly, divorced nurses who remarried had an increase in mean BMI compared with unmarried nurses (Lee, 2005).

Race, ethnicity, and birth origin. Given well-documented health disparities in the general population, it could be hypothesized that nurses of various racial, ethnic, and non-U.S. birth backgrounds might have different experiences of occupational health. A race is defined as a group of people who share similar ancestry and genetics (Live Science Staff, 2012). However, it is important to note that defining race as a biological construct related to the human genome is contested by those who argue race is a weak proxy for genetic diversity (Barkan, 2013). These

scholars instead argue that race is a social construct similar to ethnicity. Ethnicity is used to describe the culture of persons including their language, heritage, religion and customs, often a reflection of roots in a distinct geographic region (Live Science Staff, 2012). In addition to race and ethnicity, whether workers are foreign (i.e. migrant) or native born can also have important influences on their personal and professional lives. Minority and migrant nurses can experience language barriers, cultural misunderstandings and mistrust with those around them, and lack of understanding of their unique backgrounds, all of which potentially have physical and psychological health implications (Schilgen, Nienhaus, Handtke, Schulz, & Moèsko, 2017). However, complicating the study of occupational health differences related to differences in worker race, ethnicity and national birth origins is the underrepresentation of minority workers in many professions and occupations (Murray, 2003) as well as the optional recording of race, ethnicity, and place of birth information in workers' compensation datasets (Souza, Steege, & Baron, 2010). Furthermore, in general, as is the case with study of other demographic factors, different methods of measurement and design and methods limitations likely contribute to inconsistent and mixed findings regarding race, ethnicity, and birth origin as predictors of nurse occupational health. In a sample of patient care workers (which included some nurses), Black workers had higher odds of both self-reported and administratively-reported occupational injuries (Hurtado et al., 2012; Sabbath et al., 2017). Disparities in administrative reporting of occupational injuries have also been seen in certain racial and ethnic groups (Sabbath et al., 2017). Additionally, in a secondary analysis from the parent study, researchers found identical rates of injuries with days away for Black and White nurses (Boden et al., 2012). However, Black nurses claimed fewer injuries that did not involve days away from work than White nurses (Boden et al., 2012).

In a review of 30 international and U.S. studies on the topic, researchers found mixed evidence for differences in occupational injuries in immigrant workers (Salminen, 2011). In a systematic review of 14 studies mostly from the U.S., researchers found higher levels of reporting work-related injuries in minority and foreign-born nurses than native-born nurses, in addition to higher levels of occupational injuries in immigrant nurses (Schilgen et al., 2017). Further, in a review of literature exploring differences between native-born and foreign-born individuals of the same race and not nurses in particular, foreign-born individuals appeared to have better general health than their racial native-born counterparts (Cunningham, Ruben, & Venkat Narayan, 2008). Foreign-born Hispanics also had lower mortality, weight, prevalence of mental health problems, and birth weight babies than U.S.-born Hispanics (Cunningham et al., 2008). In this review, there was some indication that assimilation into American culture may explain decreases in health differences or disparities the longer individuals are in the U.S. (Cunningham et al., 2008). Overall, it appears from the limited literature available that there is some trend towards foreign-born and non-White individuals showing better health outcomes.

Correlates Related to Working Conditions

Work hours. Long hours, a well-known aspect of nurses' work, have shown associations with occupational health. Long work hours for nurses tend to be defined as more than 40 hours per week or eight hours per day (Banakhar, 2017). This approach automatically places nurses working 12-hour shifts, a common scenario in hospitals, in a high-risk category for adverse occupational health outcomes. For a variety of reasons, nurses have historically worked long hours with few breaks in between shifts (Rogers, Hwang, Scott, Aiken, & Dinges, 2004). In 2008, slightly more than half (54.2%) of nurses surveyed worked 40 or more hours in a week; 6.1% reported working 56 or more hours per week (Department of Health and Human Services,

2010). It is also important to point out that the nursing workforce has often been managed in ways that have created artificial staffing shortages on the assumption that nurses can either be persuaded to take on extra shifts with financial incentives or appeals to their sense of duty to their patients and colleagues.

In the literature, working long hours have been associated with adverse health outcomes in nurses. Bae and Fabry (2014) found mixed results regarding the association in the literature between nurse overtime, hours worked and adverse nursing outcomes. Nurses working longer shifts and overtime experienced more fatigue, poor quality of sleep, alertness, diminished reaction time, and decision-making abilities leading to adverse nurse health outcomes such as workplace injuries (Bae & Fabry, 2014). One review concluded that longer hours worked was associated with increased likelihood of sustaining injuries, specifically musculoskeletal injuries and needlesticks (Bae & Fabry, 2014). In two systematic reviews, one examining only studies of nurses, the authors concluded that long work hours were associated with significantly increased major depressive episodes, anxiety, sleep conditions, and coronary heart disease (Banakhar, 2017; Bannai & Tamakoshi, 2014). One of the studies reviewed found that nurses working shifts longer than 10 hours were nearly two and half times more likely to experience burnout and job dissatisfaction and to indicate intent to leave their jobs within the next year (Stimpfel, Sloane, & Aiken, 2012).

Shift work. Shift work, a reality of ensuring coverage for services that are normally delivered on a 24-hour basis, is also a correlate of nurse occupational health outcomes. A night shift is defined in the literature as a shift that includes working at least two hours between 10 p.m. and 5 a.m. Working at night is believed to affect nurses' health through the disruption of circadian rhythms, which leads to adverse effects on physiological and metabolic processes and

altered sleep-wake patterns.

Adverse health outcomes for nurses consistently working night shifts have been reported. Caruso's (2014) systematic review concluded that nurses working nights had worse health and safety outcomes than those working other shifts, including increased risks for obesity, occupational injuries, and commuting accidents driving to and from work. McCaughey et al.'s (2016) literature review found that working on days off (i.e. on days when a nurse was not originally scheduled to come in) in addition to working a night shift increased the likelihood of injury in nurses. Disease risks proposed to be associated with night shift work have included: breast cancer, fractures, obesity, type 2 diabetes, menstrual irregularities, stroke, cardiovascular disease, irritable bowel syndrome, and depression (Hughes, 2015). Conversely it has been conjectured based on some empirical data that night shifts may offer protection against Parkinson's disease and skin cancer (Hughes, 2015).

It is important to note that several reviews have found weak evidence of a correlation between night shifts and health outcomes. Two systematic reviews found no clear association between working night shifts and poorer psychological functioning or occupational health outcomes (Tahghighi, Rees, Brown, Breen, & Hegney, 2017; Zhao, Bogossian, & Turner, 2010). Nonetheless, evidence for a connection between night shift work and breast cancer risk has been somewhat stronger and has been hypothesized to relate to health risks associated exposure to light at night (Dickerman & Liu, 2012).

Holding multiple jobs. Holders of second or multiple jobs are defined as wage and salary workers who have two or more jobs at the same time (Bureau of Labor Statistics, 2017b). The additional job(s) may include positions within or outside their primary employing organization. It is estimated approximately 4.9% of U.S. workers hold a second job (Bureau of

Labor Statistics, 2017b). There are a variety of reasons identified in the literature for holding a second job including: the inability to work more hours at current job, financial need, desire to gain a competitive edge, additional skills or experience, and/or enjoyment of experiencing varied workplaces (Bouwhuis et al., 2019). In lay press, a CareerBuilder Survey found the health care industry was one of two fields with the highest proportion of workers reporting a "side hustle" (sales was the other). Consistent with the rising national student debt bill expecting to reach $2 trillion by 2021 (Byrne, 2018), the survey also found the Millennial demographic reported the largest proportion of "side hustles" with 44 percent of those ages 25-34 and 39 percent of those 18-24 reporting 'side gigs' compared to only 19 percent of those ages 55 and older (Grasz, 2015).

It could be hypothesized that reporting an additional job could compound risks to nurses' physical and psychological health. In a large nationally representative study of all types of U.S. workers 18 and older, workers with multiple jobs reported little break time between their jobs and getting less sleep (Marucci-Wellman, Lombardi, & Willetts, 2016). This potentially placed them at increased risk for fatigue and health problems (Marucci-Wellman et al., 2016). Additionally, a study of Dutch workers, aged 45 and older, found multiple job holders with high demands and low resources experienced worse physical and mental health (Bouwhuis et al., 2019); however, the authors acknowledged that they were unable to disentangle whether poor health predated the second job or poorer health created hardships that to poorer health.

Clinical specialty. The type of unit and/or clinical specialty where a nurse works has also been studied in relation to nurse occupational health. A nursing unit is defined as small, functional group of staff working together to provide care to a discrete population of patients within a hospital (Choi & Boyle, 2014). Nursing unit specialties vary in terms of the main patient

populations served, intensity of care provided, and the nature of specialized services offered. One schema for categorizing units used in the National Database of Nursing Quality Indicators (NDNQI) identifies clinical specialties first by patient population and then by acuity or type of care for that patient population (Choi & Boyle, 2014). These include: critical care, step-down, medical, surgical, combined medical–surgical, obstetric, neonatal, pediatric, psychiatric, perioperative, and emergency (Choi & Boyle, 2014).

Overall, working conditions in terms of the quality of the work environment and its impact on high-quality nursing practice have been linked to occupational health outcomes in the literature. Work environments have been rated highest by nurses working on pediatric units and the least favorably on units providing care to a blend of different adult medical and surgical patient populations (Choi & Boyle, 2014). This could be related to aspects of the nurse work environment of medical/surgical units including diminished levels of nursing autonomy with a lower perceived control of their environment, nature of their dynamic and unpredictable patient populations, and/or diminished prestige/pride in their specialty (Choi & Boyle, 2014).

In other clinical specialty work environment differences, higher reports of stress in nurses have been reported on critical care, trauma, and neonatal intensive care units (Nowrouzi et al., 2016). Further, in a review of studies on depression, nurses working in psychiatric, intensive care, and surgical units reported higher levels of depression compared to other units in acute care hospital (Brandford & Reed, 2016). Additionally, in a systematic review, nurses working on orthopedic and intensive care units were at heightened risks of injury (McCaughey et al., 2016). In a separate analysis of occupational health data, researchers found patient care workers in operating rooms, float pools, and stepdown units had higher rates of days away from work related to injuries compared with those assigned to pediatric/neonatal and outpatient units.

(Boden et al., 2012).

Summary

The major correlates of health outcomes in nurses in the literature were outlined in this section. As previously highlighted, demographic characteristics such as sex/gender, specifically self-identifying as a female significantly affects some nurse occupational health outcomes. Additional individual characteristics such as single status, non-White race, ethnicity, and being born outside the U.S. appear to experience significantly lower levels of health. Nurse work conditions including long working hours, second jobs, rotating and permanent night shift work, and working on adult psychiatric, intensive care and medical surgical units also appear to be associated with negative nurse occupational health outcomes.

Age/Generations of Nurses in the Workplace

The second section of this literature review will discuss age, generations, and the relationship between age and generationally-defined age groups and various outcomes, including health.

Definitions/Conceptual Issues

Age has been categorized in several ways: chronological age (birth year), subjective age (how old workers feel), relative age (how old a worker is comparison with another worker or other workers), and normative age (whether a person is older than others in the same job) (Ng & Feldman, 2013). Calculating years elapsed since an individual's birthdate is arguably the most common way of operationalizing age. Individuals can also be categorized using terms such as young, middle-aged, and old, even though there is only a general and non-empirically based understanding of what those distinctions mean. Commonly, 21 to 40-year-olds are often considered young adults while a person who is roughly 45 to 64 is considered middle aged.

Although everyone over the age of 65 has traditionally been considered to be in "old age," three additional categories have evolved as the average life and work expectancy have improved: the young-old (approximately 65–74), the middle-old (ages 75–84), and the old-old (over age 85). Of note, in occupational health research, an "older worker" is often operationalized as one 40-55 or more years old (Poscia et al., 2016). Researchers however are also beginning to critically examine subjective or perceived age in terms of how experiences of health align or are discordant with chronological age (Grierson, 2014).

The concept of generations combines age with the timing of a person's birth and progression through the phases of life. A generational birth cohort is defined as a group of "individuals who have grown up in the same historical and social context, whose shared formative experiences instill in them beliefs, values, and general dispositions that differ from those of others born and raised in different contexts and time periods" (Woodward, Vongswasdi, & More, 2015, p. 9). Individuals belonging to a generational cohort are theorized to share a collective peer personality with unique values and attitudes (Eyerman & Turner, 1998; Kowske, Rasch, & Wiley, 2010; Strauss & Howe, 1991). However, authors have defined and demarcated generations differently in terms of ranges of birth years, labels, and the specific key formative events or societal forces believed to shape their development (Costanza et al., 2012). In their review of generational research, Parry and Urwin (2011), described over 15 studies using different beginning and end dates to describe each generational cohort, revealing disparate boundaries between generations in various schemes.

One commonly used framework supported by a detailed rationale describes four generationally-defined age groups currently in the workforce as follows: the Silent Generation (b. 1925-1942), Baby Boomers (b. 1943-1960), Generation X (b. 1961-1981), and Millennials (b.

1982-2004) (Howe & Strauss, 2007; Strauss & Howe, 1991). This framework was used in this study. It is relevant to note that Howe and Strauss (2007) use 2004 as an outer limit for birth year of the Millennials; however in more recent literature the end date seems more likely to be closer to 1996 for a number of reasons, including key political, economic and social factors that emerged since then such as the influence of 9/11 terrorist attacks and the phenomenon of living with devices and attention "always on" due to technological advancements (Dimock, 2018).

Generational differences are discussed extensively in popular culture. Researchers have attempted to describe and explain differences in tastes and preferences, consumer behaviors, workplace values and behaviors, and political perspectives related to generations. However, recent reviews have noted mixed empirical support for the idea of generations and have identified weak theoretical underpinnings in this area of research (Costanza et al., 2012; Lyons & Kuron, 2014; Parry & Urwin, 2011). Interpreting findings in this area and disentangling effects of generational birth cohorts, historical periods, aging, and life course is very challenging (Costanza et al., 2012; Lyons & Kuron, 2014; Parry & Urwin, 2011; Pew Research Center, 2015; Twenge, 2010). Period effects are the impacts of events on an entire population occurring during the study (Pew Research Center, 2015). Age and life cycle/stage (i.e. life/developmental milestones, the aging process) effects also contribute to differences in individuals within generational cohorts (Pew Research Center, 2015). In the end, most generational research provides cross-sectional descriptions of the effects of period and age/life course on generational cohorts at one time point (Costanza et al., 2012; Lyons & Kuron, 2014; Parry & Urwin, 2011; Twenge, 2010).

Generational Cohorts

It is hypothesized that generational cohorts evolve distinct joint biographies (Strauss &

Howe, 1991) through a shared collective memory (Eyerman & Turner, 1998) of "significant life events at critical developmental stages" (Kupperschmidt, 2000, p. 66). Most generational experts believe a generational worldview is developed when a group of individuals are at their most malleable and prone to influences, which is generally thought to be from 17 to 25 years of age. These influences impact the development of a typical cohort profile and potentially outlook and outcomes related to health and wellness. The following sections provide a brief overview and a narrative describing of the typical profiles of older and younger generations, more from popular culture/lay impressions than from empirical data.

Older generations. Older generations (i.e. Silent, Generation X, and Baby Boomer Generations) are also posited to have distinct characteristics related to key events and circumstances that occurred when they came of age. The Silent Generation experienced World War II and the Great Depression. This generation is said by some to be hard working, loyal, financially conservative, and cautious, respectful of seniority and authority, supportive of hierarchy, and disciplined in their work habits (Duchscher & Cowin, 2004). Only three members of this generation were found in the study sample and therefore patterns in this generation could not be examined in this study.

The following generation, the Baby Boomers, grew up in a prosperous, optimistic post-war period (Stanley, 2010). The generation was coined in a "baby boom" period with high birth rates over the course of two decades after World War II (Badley et al., 2015). Baby Boomers experienced the Cold War, Vietnam War, civil rights movement, and the first landing of people on the moon. Baby Boomers have been described as valuing optimism, personal growth, health and wellness. Nurses of this generation were found in one study to have the lowest levels of burnout and highest levels of job satisfaction compared with nurses from other generations

(Widger et al., 2007). Baby Boomers are often described as the most self-focused generation and some have described them as prizing individuality over all else, rejecting social solidarity and being unwilling to sacrifice anything for the good of society at large (Gibney, 2017; Kahana & Kahana, 2014). This is a large generation, although the Millennials outnumbered them by 2015 (Fry, 2016), and therefore hold disproportionate political and economic power relative to the generations before and after (Badley et al., 2015). In one particularly harsh assessment of this generation and its impact on society, a book entitled, "A Generation of Sociopaths: How the Baby Boomers Betrayed America," Gibney (2017), describes them as individuals who are "pillaging the nation's economy, repeatedly cutting their own taxes, financing two wars with deficits, ignoring climate change, presiding over the death of America's manufacturing core, and leaving future generations to clean up the mess they created" (Illing, 2018, p. 1).

The generation immediately following the Baby Boomers, Generation X, grew up in a less optimistic time when economic downturns and shifts led to many families experiencing lower incomes and less rosy prospects compared to previous generations. It has been said that Gen Xers (as they are sometimes called) experienced changing family structures related to increased acceptance of divorce, single parenting and both parents working outside the home, leading many children to leave their homes for school alone and return afterwards to empty houses. 'Latchkey children' was coined in the popular media at the time as a term to capture this trend (Katz, 2017). Generation X individuals came of age as the AIDS epidemic emerged, the Cold War flared and then ended, and conflict in the Middle East culminated in Operation Desert Storm. Generation X individuals are said by some to value work-life balance and show less loyalty to employers than previous generations. They have been described as alienated, skeptical, cynical, anti-institutional, nonconformist, and even more radically individualistic than Baby

Boomers (Katz, 2017). Like its generation label, Generation X, the X indicated the unknown identify for this generation, a placeholder for describing the "disaffection and alienation" experienced by this generation compared to previous generations (Katz, 2017, p. 15). Given their harsher outlook on both work and home life, it has been proposed that Generation X individuals may confront compounded stressors both at home and at work, with adverse effects on their health compared with the previous two generations (Badley et al., 2015; Robinson, Utz, Keyes, Martin, & Yang, 2013).

Younger generations. The most recent generations are considered by some to experience social change and multidimensional stressors in slightly different ways. The youngest and largest generation in the workforce are the Millennials. (Generation Z, the group about to enter in the workforce, will not be discussed here because there were no members of this generation in the dataset used here). Millennials experienced fears of terrorism that began with the 9/11 attacks, rapid evolution of societal values regarding diversity and multiculturalism, globalization, and technological advancements. Millennials are reported to be comfortable with and accustomed to engaging in multiple tasks simultaneously, express strong preferences for situations where there is much structure and feedback, and "live for today" and value work as a means to an end, not as an activity. Emerging literature on younger generations of individuals are also describing a distinct generational "personality" influenced by: improved socioeconomic statuses, high expectations for academic achievements from society, rising number of non-traditional families with maternal employment (Sweeting, West, Young, & Der, 2010), and change from authoritative to permissive parenting where parents act as a resource for their child rather than modifier of their behavior (Odenweller, Booth-Butterfield, & Weber, 2014).

It is often stated that younger generations of workers currently in the workforce, by virtue

of the historical circumstances during which they have come of age, such as end of the century (year 2000) the burst of culture wars for cultural and social integration, have had interactions with parents, authority figures, and the wider world in ways that have rendered them more vulnerable to stress and associated adverse health perceptions and outcomes (Twenge, 2015; Twenge et al., 2018). Some have also argued that increasing societal and parental demands and the ubiquity of technology in daily home, school and work lives for all, but especially for younger generations, have had important impacts on psychological and social health (Twenge et al., 2018). The streamlined, almost clichéd narrative emerged: children, teenagers and adults in the second decade of the millennium are said to have been raised by "helicopter" parents (described as such because it is said they "hover over" their offspring) (Odenweller et al., 2014). One study of undergraduate college students with an average age of 19.8 (n=118), found higher student reported levels of "helicopter parenting" predicted lower levels of well-being in undergraduate college women (Kouros, Pruitt, Ekas, Kiriaki, & Sunderland, 2017).

Another thread in this narrative relates to the impact of technology on society at large and on younger people in particular. In less than two decades, Internet access and smartphone use, as well as social media use have become nearly universal and these trends are even more striking in younger people. Several studies have explored the psychological effects of new media (i.e. use digital technology) use. One study of a nationally representative sample of U.S. adolescents in Grades 8 through 12 (n=506,820) found that higher use of social media as opposed to non-screen activities (i.e. in-person interaction, sports, homework, print media, and attending religious services) was significantly correlated with depressive symptoms (Twenge et al., 2018). In several of these studies, depressive symptoms in girls appeared to be significantly more affected by new media influences (i.e. digital two-way communications) than in boys (Twenge, Sherman, &

Lyubomirsky, 2016; Twenge et al., 2018).

Findings Regarding Age/Generations and Physical Health

Due to the interconnections between these age and generations and because many comparisons of generational groups are actually analyses of age differences at a particular point in history and the life course of the individual, the literature on the relationship between age and generational cohorts on health will be discussed together.

Workers in general. Overall, across studies and outcomes, a variety of findings regarding the association of age/generational cohort and the physical health of workers in general have been reported. In one meta-analysis of chronological age and health, researchers identified a trend across studies where age was found unrelated to subjective perceptions of physical health, or with self-reported eating or exercise habits despite declines in certain medical indicators such as blood pressure and cholesterol levels (Ng & Feldman, 2013). Similarly, a longitudinal study found no differences in self-rated health among different generational cohorts (Badley et al., 2015).

Nonetheless, other researchers have identified variations in health-related behaviors across generationally defined groups. Younger workers were found more likely to use illicit drugs, whereas older workers were more likely to smoke cigarettes (Ng & Feldman, 2013). In a report from the gray literature exploring differences in consumer engagement across generations, Millennials engaged in more physical activity and were more likely to be of normal weight compared to other generational groups despite having the highest rates of smoking (Fronstin & Elmlinger, 2017). Not all studies have replicated these findings. In a sample of Australian residents (n=15,792), researchers found no differences in physical activity between Generation X and Baby Boomer individuals as measured by self-reported time walking or doing moderate or

vigorous exercise, in the two weeks prior to the survey (Pilkington, Taylor, Hugo, & Wittert, 2014).

In terms of generational difference in physical health, limited studies show better self-perceptions of physical health in older generations relative to their younger work colleagues (Carter & Kelly, 2013; Pilkington et al., 2014). However, researchers hypothesized in one study of self-rated health that beneficial effects of improving education, income, and reduced tobacco use were counteracted by the increasing BMI in the younger generations (Badley et al., 2015). Each successive generation of youth in the United States and similar societies appears to be increasingly overweight, report poorer lifestyle health behaviors, and ultimately experience worse health outcomes. One study using U.S. representative data of respondents from the National Health and Nutrition Examination Survey (NHANES) (n=27,159) found that Generation X individuals had higher rates of obesity measured by waist circumference than Baby Boomers (Robinson et al., 2013). These findings were echoed in a separate study conducted in Canada from the longitudinal National Population Health Survey (1994-2010) (n= 8,570 at baseline) using self-reported weight and height measurements calculated into a BMI (Badley et al., 2015). In this longitudinal study, younger cohorts of individuals had significantly higher BMI levels compared with older cohorts (Badley, Canizares, Perruccio, Hogg-Johnson, & Gignac, 2015). Researchers hypothesize that because Baby Boomers were brought up during the prosperous post-World War II era, members of this generation experienced lower levels of stress than other generations, making them less likely to be sensitive to an "obesogenic environment" including *in utero* and environmental influences to eat more and exercise less (Robinson et al., 2013, p. 2). Similarly, in Australian National Health Survey data on over 37,000 participants drawn from the general population during two different survey administrations, researchers

concluded Generation X residents were more likely to be overweight or obese and have diabetes than members of the Baby Boomer generations (Pilkington et al., 2014).

Nurses. Differences in physical health across age groups of nurses have been explored in the literature. Overall, Oyama and Fukahori (2015) reviewed ten international studies on the topic and concluded increased age was related to worse physical health. In a second scoping review of multinational studies exploring challenges of older/aging nurses, researchers found limited conclusions; older nurses were at greater risk of poorer health outcomes including musculoskeletal disorders (Ryan, Bergin, & Wells, 2017). In a cross-sectional survey study of Australian nurses and midwives (n=4,592) from 2014 to 2015 increasing age was associated with worse quality of life related to physical health (Perry et al., 2017). These findings included evidence of decreased physical function and greater bodily pain in older age groups broken down by decade (i.e. 25-34; 35-44, etc.) (Perry et al., 2017).

Other studies have explored age differences in physical health symptoms in nurses. In a study of North Carolina nurses (n=1,171), comparing older nurses (>50 years old) to younger nurses, older nurses reported significantly higher BMIs, average pain level, prevalence of health problems, and health-related productivity loss than younger nurses (<50 years old) (Letvak, Ruhm, & Gupta, 2013). Leiter et al., (2010), in a study of Canadian Baby Boomer and Generation X nurses (n=522) found Generation X nurses reported more frequent physical symptoms, such as back strain and repetitive strain injuries, than Baby Boomer nurses. Further, McCaughey et al., (2016) in a synthesis of literature found conflicting support for age in their review with three studies finding older employees more likely to be injured and two other studies finding older employees were less likely to be injured.

Finally, in a cross-sectional study of 1,254 Canadian nurses, researchers found when job

demands were high and resources were low, Generation X nurses reported more physical job demands than Generation Y nurses (Lavoie-Tremblay, Trépanier, Fernet, & Bonneville-Roussy, 2014). Similarly, in this same study, researchers found Generation Y (Millennial) nurses were more physically fit than Generation X nurses (Lavoie-Tremblay et al., 2014). Overall, studies exploring age and generational cohort as a predictor of health reveal limited, mixed or inconclusive findings. This may, as some researchers suggest, be due to varied cut-points used to define "older" age, with some studies considering older nurses to be 40 or more years old (Ryan et al., 2017).

Findings Regarding Age/Generations and Psychological Health

Nurses. Limited studies have explored age and generational differences exploring psychological health. Age or age group and psychological health were positively correlated in several reviews and studies, whereby as age increases so does psychological health of nurses (Brandford & Reed, 2016; Kelly, Runge, & Spencer, 2015; Lavoie-Tremblay et al., 2014; Leiter et al., 2009, 2010; Letvak et al., 2013; Oyama & Fukahori, 2015; Perry et al., 2017; Widger et al., 2007).

Several studies explored age differences in various components of psychological health including mental health and well-being and burnout. In the general population, a U-shaped (i.e. happiness curve) relationship between age and happiness held in a study of 44 of the 46 countries examined—with life satisfaction dipping in mid-years and bouncing back in later years (Graham & Ruiz Pozuelo, 2017). In their literature review, Oyama and Fukahori (2015) also found increased age in hospital nurses was associated with better mental health. Similarly, in a study of nurses from North Carolina (n=1,171), researchers found older nurses (>50 years old) showed better mental well-being than younger nurses (<50 years old) (Letvak et al., 2013). In Perry et

al. (2017), researchers found older Australian nurses and midwives had higher mental health scores compared to their younger counterparts, again divided by age groups on the decade (i.e. 25-34; 35-44) and separated by quality of life components. Finally, in a literature review of studies from 1983-2014 examining depression and depressive symptoms in nurses, authors concluded that as age increases nurses are less likely to suffer from depression and depressive symptomatology (Brandford & Reed, 2016).

Nurses in younger generationally-defined or -named cohorts also appear to experience worse psychological health symptomatology and outcomes than older generations of nurses. In one study of Canadian nurses, researchers reported findings by generationally-defined age group (Blythe et al., 2008). Every age group reported moderate levels of stress, but nurses aged 20-29 (mixed Generation X and Y), 30-39 (Generation X), and 40- 49 (Baby Boomers) years reported significantly more symptoms of stress than nurses aged 50 or older (labeled as 'Resilient Generation') (Blythe et al., 2008). Additionally, nurses aged 20-29 and 30-39 reported greater levels of emotional exhaustion and depersonalization than the 50+ age group (Blythe et al., 2008). Similarly, in a separate study of Canadian nurses (n=1,254), when faced with high cognitive demands, Generation Y nurses reported significantly more psychological distress than Generation X nurses (Lavoie-Tremblay, Trépanier, Fernet, & Bonneville-Roussy, 2014).

Younger generations of nurses also appear more likely to experience consequences of stress such as burnout, secondary traumatic stress (i.e. vicarious trauma), emotional exhaustion, and compassion fatigue than older generations. One study of nurses in the Southwest U.S. (n=491) reported Millennial nurses were significantly more likely to experience burnout and secondary traumatic stress than either Baby Boomer or Generation X nurses (Kelly et al., 2015). Similarly, researchers in a Canadian sample of nurses (n=8,207) found Generation Y (otherwise

known as Millennials) had the largest proportion of nurses with scores suggestive of burnout (Widger et al., 2007). Likewise, a descriptive study of only Generation X and Baby Boomer Canadian nurses (n=667), researchers found Generation X nurses had significantly higher levels of burnout than Baby Boomer nurses (Leiter et al., 2009). Higher levels of compassion fatigue were also found in the younger generations of nurses and seemed to increase with amount of work experience (Kelly et al., 2015). In a study of Generation X and Baby Boomer Canadian nurses (n=522), members of Generation X reported significantly more exhaustion and experienced a less civil workplace in relation to coworkers, teams, and supervisors. These factors are believed to explain higher burnout compared to Baby Boomers (Leiter et al., 2010). However, the authors did not consider the possibility that burnout might be less common in older nurses because those experiencing the worse burnout may have left the workplace.

In the literature, despite a complex and sometimes contradictory web of findings, age and potentially generationally-defined age groups appear to be a potential predictor of nurse occupational health. Baby Boomers reported higher perceptions of well-being than both Generation X and Generation Y nurses despite the increasing physical illnesses and disease associated with age. Younger generations appear to have some poorer health outcomes and perceived well-being compared to older generations in the nursing workforce.

Summary

Despite mixed and inconclusive findings regarding age differences general and occupational health, some trends are discernable in the literature on age, generations and health outcomes. Some evidence exists that the prevalence of obesity is increasing in recent generations. Additionally, there is evidence that over the past decade, adolescents and early adults, especially women, show poorer psychological health and worse psychological well-being

than older generations.

Conceptual Framework

The occupational health of nurses is the relative state in which the nurse is able to function physically, mentally, socially, and spiritually and express the full range of his or her unique potentialities within their work environment. Nurse occupational health is influenced by many factors. This study used a life course approach, sometimes also known as life course theory and a life course perspective, to guide an extension of this literature. Life course approaches posit that individuals show a cumulative effect of aging and shared contextual circumstances (i.e. historical, social, and economic) over the course of a life, with a particularly strong influence of events in an individual's formative years (Elder, Johnson, & Crosnoe, 2003). In this study, where the aim was to determine if certain generationally defined age groups of nurses show significantly different occupational health, life course perspectives was used to frame and interpret health outcomes observed in individuals of similar age and generational cohorts.

Generational birth cohorts are "group[s] of individuals, who are roughly the same age, and who experience and are influenced by the same set of significant historical events during key developmental periods in their lives, typically late childhood, adolescence, and early adulthood" (Costanza, Badger, Fraser, Severt, & Gade, 2012, p. 377). Generational theory hypothesizes that individuals belonging to a specific cohort experience life and societal events around the same chronological age (i.e. year of birth) and experience life's milestones (i.e. starting school, building relationships and families entering and retiring from the workforce) not only around the same age and time, but under the influence of the same cluster of societal contexts and world events (Mannheim, 1952; Strauss & Howe, 1991).

It is mostly unknown whether individuals within cohorts share characteristics and

occupational health outcomes. Occupational health specialists and nursing administrators report anecdotally that younger generations of workers are reporting more occupational injuries (Breslin & Smith, 2006), sick calls (Bates, 2011), need for training and coaching (Lavoie-Tremblay et al., 2010), intention to leave their positions (Brunetto et al., 2013a; Tourigny & Baba, 2016), feelings of agitation and burnout (Erickson & Grove, 2007), and utilization of more antidepressants (Iarovici, 2014) than older generations of nurses. Recent mainstream media publications ("Millennial employees are the most likely to call in sick," 2014), studies examining age related health differences in nurses (Oates, Drey, & Jones, 2017; Ryan et al., 2017; Smith-Miller, Shaw-Kokot, Curro, & Jones, 2014; Tucker, Weymiller, Cutshall, Rhudy, & Lohse, 2012), and the anecdotal experiences from nursing leaders and educators further suggest this is worth examining (Clipper, 2012).

Younger generations of women seem more strongly affected by stress and stress-related health sequelae possibly related to a prolonged period of peer stress, decreased body image, and potential gender genetic components compared to men (Beiter et al., 2015; Hankin et al., 2015; Twenge et al., 2018). Thus, conducting a study with a primarily female sample of acute care hospital nurses (most nurses being women) offers a special opportunity to examine relationships between generationally-defined age groups and nurse occupational health.

Ascertaining which (if any) age groups of nurses are at greatest risk for different adverse health outcomes is important. If different generationally-defined age groups have distinct occupational health and safety values, behaviors, and characteristics affecting subjective and objective levels of the health and safety, nursing leaders can target generational specific safety improvement strategies efforts in lieu of a one-size-fits-all approach to fostering a healthy, productive workplace.

Life Course Approach

A life course approach was selected as the conceptual basis for this study (Elder et al., 2003). In terms of health, the life course approach considers the influence of social, structural, and cultural experiences in shaping the individual's perception and actualization of health. In contrast to the life cycle framework, which describes the influence of events on individual behavior based on what is expected at certain ages from birth to death, a life course perspective takes into consideration the impact of how an individual experiences life within their unique social, economic and historical contexts. In the life course perspective, aging is a dynamic process across the individual's life cycle.

Life course theory incorporates several overarching concepts (Elder et al., 2003) detailed in Wethington (2005): trajectories, transitions, turning points, culture and contextual influences, timing in lives, linked lives, and adaptive strategies. Trajectories are sequences of roles and experiences over a long period of time (Elder et al., 2003) and would include the diagnosis of a chronic disease that spans a lifetime. Transitions, experienced in trajectories, are expected changes in roles and experiences such as getting married (Elder et al., 2003). Turning points are unexpected and extreme transitions within an individual's trajectory (Wethington, 2005). Cultural influences are external circumstances that impact an individual's life course based on their timing for the individual (Elder et al., 2003)—an example would be the events of September 9, 2001 ("9/11"). It has been hypothesized that 9/11 influenced individuals differently based on their age at the time of the events. Some children saw their parents visibly upset and crying for the first time and experienced the perils of the world in a pronounced way, whereas older adults, although also affected likely had other formative life experiences including previous terrorist attacks that had already shaped their worldviews. The final two concepts describing

influences on individuals over the life course are linked lives and adaptive strategies (Elder et al., 2003). Linked lives are the interdependence and influence of an individual's social and familial network on their life choices and behaviors (Wethington, 2005). Adaptive strategies are conscious decisions by individuals to respond in certain ways to external influences and changes.

Using a life course approach, distinct contextual effects of the environment, home, and work would be hypothesized to influence nurse occupational health outcomes differently for individuals in the same age groups. The life course elements simultaneously and cumulatively shape the nurse's experience and participation in prevention and promotion health and safety behaviors at work. Together, contextual factors shape the formation of generationally-defined age groups of nurses and along with other individual, work, and organization characteristics, influence nurse occupational health and organizational outcomes.

Figure 1, is a schematic depiction of the relationships tested in the study. In this study, generationally-defined age groups were the major independent variable. In the model, demographic characteristics, of which age is one, and individual-level work characteristics influence overall nurse health outcomes to the nurse and the organization. In this study, only physical and psychological health outcomes were examined, including: body mass index, pain frequency, severity, and limitations, occupational injuries, psychological distress, and work limitations.

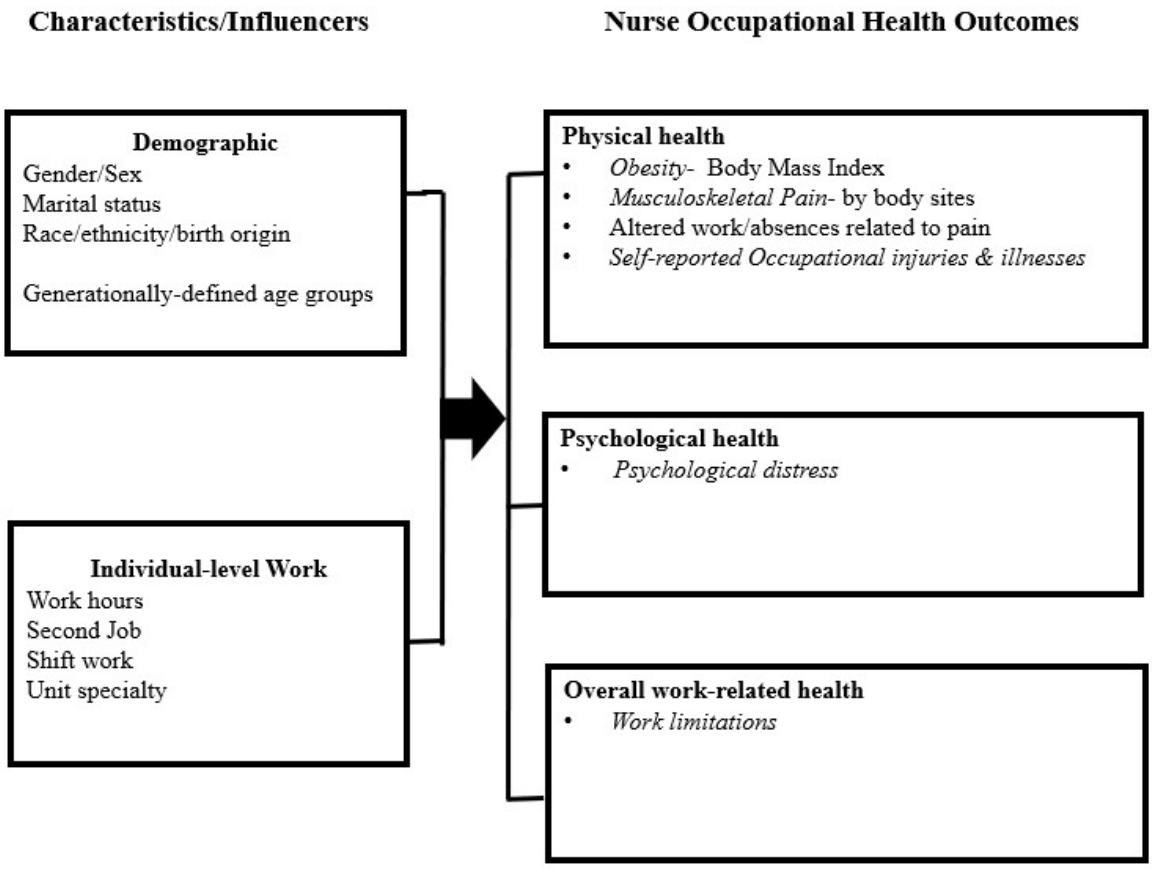

Figure 1. Study conceptual framework

Aim, Research Questions, and Hypotheses

The aim of this cross-sectional quantitative research study was to describe the relationship between age groups constructed based on generations and occupational health outcomes of registered nurses in two large academic and teaching hospitals in Massachusetts. It was a secondary analysis of previously collected administrative and self-reported survey data of nurses collected in 2014. Because of the lack of a clear pattern of findings in previous literature it was deemed inappropriate to propose a pattern or direction for the differences that might be seen in outcomes across age groups. A map of the variables tested in this study is presented in Figure 2.

Research question 1 (RQ1). Is there a relationship between generationally-defined age

groups and *physical health* as measured by BMI, presence and severity of musculoskeletal pain in various body regions, pain related absences from work, and reports of occupational injury and illness controlling for gender, marital status, race/ethnicity/birth origin, work hours, second job, shift-type worked, and primary clinical specialty?

Null hypothesis (RQ1). There will be no significant differences in levels of *physical health* across generationally-defined age groups in a cohort of acute care registered nurses in two large academic hospitals before or after control for key correlates.

Research question 2 (RQ2). Is there a relationship between generationally-defined age groups and *psychological health* measured by psychological distress controlling for gender, marital status, race/ethnicity/birth origin, work hours, second job, shift-type worked, and primary clinical specialty?

Null hypothesis (RQ2). There will be no significant differences in levels of *psychological health* across generationally-defined age groups in a cohort of acute care registered nurses in two large academic hospitals before or after control for key correlates.

Research Question 3 (RQ3). Is there a relationship between generationally-defined age groups and *overall work-related health* measured by work limitations controlling for gender, marital status, race/ethnicity/birth origin, work hours, second job, shift-type worked, and primary clinical specialty?

***Null hypothesis RQ3*.** There will be no significant differences in levels of *overall work-related health* across generationally-defined age groups in a cohort of acute care registered nurses in two large academic hospitals before or after control for key correlates.

The next chapter outlines the research methods used to address these questions, along with ethics considerations for the study.

Chapter 3: Design & Methods

This chapter describes the design and methods for the study. After a brief discussion of secondary data analysis as a research strategy, sampling and data collection procedures from the primary study are described. Next, the instruments and variables extracted from administrative data and surveys are outlined. Finally, ethics clearance and the data analysis used in this study are presented.

Research Study Design

The overall purpose of this secondary analysis was to describe the relationship between generationally-defined age groups and the occupational health status of direct care registered nurses working in two large academic medical centers in Boston, Massachusetts. It drew upon data from the Boston Hospital Workers Health Study (BHWHS) regarding a cohort of approximately 15,000 patient care workers at two large Boston-area hospitals that are part of Partners HealthCare, Inc. The BHWHS is an ongoing study funded by the National Institute for Occupational Safety and Health (NIOSH) and carried out by the Harvard Center for Work, Health, and Wellbeing, a NIOSH Total Worker Health Center of Excellence. The BHWHS is a partnership between Boston College, Partners HealthCare, Inc., Harvard T.H. Chan School of Public Health, and Boston University School of Public Health. Two distinct data sources from the primary study were used in this analysis: administrative data from Occupational Health and Human Resource databases and self-reported surveys conducted in 2014. These two sources were merged at the level of the individual study participant.

Procedures

Sample, Site and Data Collection Procedures

Sample. The parent study, the BHWHS, is fully described in Sabbath et al. (2018). The

parent study included nurses, patient care associates, and other miscellaneous patient care workers. For the survey portion (i.e. three waves of surveys: 2009, 2012, and 2014) of the BHWHS, one in three workers were randomly sampled and invited to participate in the 2009 and 2012 surveys. Participants were excluded from surveys on several grounds: 1) not being classified as an active patient care services worker (i.e. no administrative nurses were included), 2) working <20 hours/week (i.e. no per diem nurses), 3) being a traveling nurse, and 4) being on a leave of absence for at least 12 weeks in the previous year. The same workers who participated in the 2012 survey were invited to participate in the 2014 survey (as long as they were still actively employed). Additional staff were invited in efforts to refresh the sample to replace losses due to resignations and other sources of attrition (Sabbath et al., 2018). The sample design incorporated weighted sampling to ensure adequate coverage of smaller units. The response rates for the first two waves were: 79% in 2009 (sampled=2,000; completed=1,572) and 75% in 2012 (sampled=2,133; completed=1,595) (Sabbath et al., 2018). The response rate for the 2014 survey for all patient care services workers was slightly lower overall with 72% overall (sampled=1,968 completed=1,409); 71% longitudinally (returning=1,301) returning from 2012 survey; and 84% of new employees (new participants=128) participated in the 2014 survey (Sabbath et al., 2018).

While the parent study described in the previous section involved all patient care services workers, the sample for this secondary analysis was restricted to registered nurses with the job title “staff nurse” employed in inpatient care units under the Patient Care Services divisions of the two academic medical centers. Nurses in leadership, education, or advanced practice positions were excluded, because small numbers of nurses in these groups likely had very different work characteristics and experiences compared to staff nurses. The final analytic sample was comprised of 1,146 staff RNs. The sample was roughly equally divided into nurses

in their 20s, 30s, 40s, and 50s (and older) which allowed the construction of three generationally-defined age categories of comparable size in an age group scheme based on the generational birth year scheme proposed by Strauss and Howe (1991).

Site. The sites for the parent study were two large internationally-recognized academic medical centers in the Partners HealthCare System in Boston, Massachusetts. Together these facilities were licensed to operate approximately 1,798 inpatient beds in 2014, across 105 different departments in 12 types of specialized units (i.e., emergency department, operating room, adult medical/surgical, adult intensive care, step-down, pediatric medical/surgical, pediatric/neonatal intensive care, psychiatry, obstetrics/postpartum, float pool, ambulatory units, and orthopedics).

Original data collection procedures. Participants were provided with an informed consent form and were informed that completing the survey would serve as consent to link their questionnaires with human resource and health data [See Appendix A]. The surveys in each wave took approximately 30 minutes to complete and workers were allowed to use time on shift to fill it out. Nonresponders were sent two more email reminders during the four weeks following the first contact. Those who had not completed the survey online were mailed a paper copy. After two additional weeks, a third e-mail reminder and a second paper survey were sent to all nonresponders. As an incentive for participation, a $20 gift card was offered upon survey completion.

Procedure for secondary analysis. After collection of survey data, the research information systems specialist for the primary study assigned each individual a secure study ID number permitting linkages across survey and administrative data at the individual level. Following provisions for ethics review and approval for the parent study, after appropriate

approvals were received for this secondary analysis, data on selected variables were released in a deidentified dataset.

Measures/Instruments

This section outlines the tools and instruments measuring the predictor, outcome, and potential cofounding variables employed in this secondary analysis. A combination of data sources and instruments was used to explore the relationships between generationally-defined age groups and nurse occupational health displayed in Figure 1.

Generationally-Defined Age Groups

Based on its intuitive appeal and widespread use in the popular and research literatures, the generational birth year scheme proposed by Strauss and Howe (1991) was used in this study classified nurses based on their birth year provided in the administrative dataset. Based on their birth year, each nurse was assigned to one of three generationally-defined age categories: Baby Boomer, Generation X, and Millennial as presented in Table 1. For example, if a nurse was born in 1986, this nurse was placed in the Millennial age group. Only three nurses in the database were born before 1943 and were excluded from the final sample.

Table 1

Generationally-Defined Age Group Labels with Birth Year Range and Age at Time of Survey

Generational Labels	Birth Year Range	Age Range in 2014
Baby Boomers	1943-1960	54-71
Generation X	1961-1981	33-53
Millennials	1982+	<32

Measures of Nurse Occupational Health Outcomes

Five measures of physical health, one measure of psychological health, and one measure of overall nurse occupational health were analyzed.

Measure of physical health. ***Body mass index (BMI).*** Body mass indices were calculated from self-reported weight and height measurements in the survey by dividing weight by height squared (kg/m^2). BMI was explored as a linear and a categorical variable. The linear form was the calculated BMI in a continuous variable. For BMI categories, each nurse was categorized into: underweight/normal weight (<24.9 kg/m^2), overweight (25–29.9 kg/m^2), or obese (≥ 30 kg/m^2). It is important to note that in a systematic review of studies correlating measured versus self-reported weight, BMI, and height, researchers found some evidence obese individuals more often under-report weight and men are more likely to over-report their height (Gorber, Tremblay, Moher, & Gorber, 2007). However, results from a large study from the Behavioral Risk Factor Surveillance System validated the notion that even if not completely accurate, self-reported BMI can correctly predict health-related quality of life and is a valid and useful measure (Ford, Moriarty, Zack, Mokdad, & Chapman, 2001).

Occupational injuries/illnesses. Occupational illness and injuries are an indicator of physical health and were measured from survey self-reports. Each nurse was asked: "During the past 12 months, excluding sharps injuries, were you injured seriously enough while performing your job that you got medical advice or treatment or lost time from work?" As detailed in Sabbath et al. (2017), the response options on the survey were: "No, I did not have an injury" (coded "not injured") "Yes, I had one injury and did report it (coded "injured and reported"), "Yes, I had one injury and did not report it" (coded "injured and unreported"), "Yes, I had more than one injury and did report all of them" (coded "injured and reported"), and "Yes, I had more

than one injury and did report one but not all of them" (coded "injured and partially reported"). For analysis of this variable, categories were collapsed into either "Yes" or "No" to experiencing an occupational (non-sharps) injury in the past 12 months regardless of the reporting outcome of the injury.

Pain/pain-related limitations: Standardized Nordic Musculoskeletal Questionnaire. Several questions from the Standardized Nordic Musculoskeletal Questionnaire (NMQ) that measure musculoskeletal pain and aching along with how these symptoms potentially interfere with a nurse's ability to work (Crawford, 2007) were included in the parent study and examined here. The full NMQ, a research tool, was developed by support from the Nordic Council of Ministers in 1987 to standardize measurement of musculoskeletal symptoms (Kuorinka et al., 1987). Although, no overt theoretical or conceptual framework guided its construction, it was designed to mirror questionnaires used in studies of cardiovascular and pulmonary function (Kuorinka et al., 1987). The NMQ consists of two sections. The first is a general questionnaire (40 forced-choice items) to identify specific body sites affected by musculoskeletal symptoms interfering with functioning in the last 12 months and last seven days (Crawford, 2007). The second part consists of 25 additional forced-choice questions identifying musculoskeletal injuries affecting the individual's home and job-related duties (Crawford, 2007).

Overall, the full NMQ for musculoskeletal symptoms has demonstrated strong reliability and validity (Crawford, 2007). Test-retest reliability, as measured with the percentage of discordant answers between readministrations over a 15-day interval, was an average of 4.4% in samples of individuals from various occupational groups, including 25 nursing workers. (Kuorinka et al., 1987). In a review of validation studies comparing the tool against clinical histories, the authors found acceptable consistency, sensitivity to change, and specificity of the

NMQ at both 12 month and weekly recall periods (0-20% disagreement), and concluded that the instrument was useful as a screening and surveillance tool (Crawford, 2007).

An abridged version was used in the surveys analyzed here due to space constraints. In the parent study only the question asking the participant to identify pain or no pain in the past three months in six different areas of the body according to a labeled diagram, in addition to ratings of the severity of pain symptoms (five responses: not severe to extremely severe), and two additional questions measuring functional status at work related to musculoskeletal symptoms were analyzed. The results of several studies support construct validity of the specific items in this secondary analysis (Buxton et al., 2012; Dennerlein et al., 2012; S. Kim et al., 2013, 2014; Sembajwe et al., 2013; Sorensen et al., 2011).

In the current analyses, pain in particular body regions was recoded as being present or absent. For the ease of interpretation, the answers to the severity questions for pain in various body regions in the past week were collapsed into "not severe"/"mild" or "moderate"/ "severe"/ "extreme". The wording of the questions involving functional status at work were: "Have you ever needed to reduce or alter your work because of any injury or musculoskeletal pain?" and "Have pain or physical limitations ever caused you to be absent from work?" over a three-month time interval. The response options for both questions "Yes/No".

Measure of psychological health: K-6 Non-Specific Distress Scale. The K-6 Non-Specific Distress Scale was developed to screen for serious mental illness over a 30-day time frame (Kessler et al., 2010). It was constructed for both research and clinical purposes. In clinical practice, this tool was intended as a screen for patients meeting criteria for at least DSM disorder involving serious impairment in the preceding 12 months other than a substance use disorder (Kessler et al., 2010). In this study, the scale was used to assess psychological distress as a proxy

of diagnosable psychiatric illness in this sample. Psychological distress is defined as the presence of symptoms such as anxiety, irritability, sadness, and cognitive impairment. The K-6 consists of six questions that ask subjects to rate how often they felt (1) nervous, (2) hopeless, (3) restless or fidgety, (4) so depressed that nothing could cheer you up, (5) that everything was an effort, and (6) worthless in the previous 30 days. The item responses from 0 ("no distress") to 4 ("distress all of the time") are typically totaled to yield a range of scores between 0 and 24 (Kessler et al., 2010). Higher scores are suggestive of greater psychological distress.

The K-6 was developed as a brief scale for the U.S. National Health Interview Survey in 1997 (Kessler et al., 2010). During tool development, K-10 was tested alongside the K-6 as developers were unsure about space considerations in the final survey (Kessler et al., 2002). Because both the K-10 and K-6 have shown to be reliable and valid predicators of serious mental illness, the K-6 is often preferred (Kessler et al., 2002). The developers report that the K-6 is that it shows minimal bias across age, sex, and education levels and that extensive evidence of reliability and validity of the K-6 has accumulated over nearly two decades of use in a variety of countries (Kessler et al., 2010).

For instance, in their review of studies using the K-6 screening scale in varied populations to measure serious mental illness, researchers found that several studies of varied populations had strong concordance with validated diagnoses of many serious mental illness from the DSM-IV diagnoses such as depressive and anxiety disorders (Kessler et al., 2010). Concordance between the diagnostic interview schedule results (standardized research tools assessing diagnosable conditions at the time of the interview and in the past) and the K-6 in the screening of serious mental illness was examined using the receiver operating characteristic (ROC) curve. Concordance was generally substantial as evaluated with diagnostic interview

schedules (Median 0.83; Range 0.76-0.89; Inter-quartile range 0.81-0.85) (Kessler et al., 2010). In three studies of nurses the K-6 had sufficient internal consistency with a Cronbach's alpha of 0.80-0.89 (Hurtado et al., 2015; Hurtado, Nelson, Hashimoto, & Sorensen, 2015; Kunie, Kawakami, Shimazu, Yonekura, & Miyamoto, 2017). Finally, in a sample of Chinese undergraduates, Cronbach's alpha for the K-6 was 0.84 and test–retest reliability (32- to 53-day interval) was 0.79 (Kang et al., 2015). In the current study, a Cronbach's alpha of 0.80 was calculated for the K-6.

To address Research Question #2, the K-6 responses were analyzed both as a scale score and also as individual items, in linear and categorical form, respectively, because the distribution of responses was very uneven across symptom type. The linear form was the total calculated scale score of responses in a continuous variable. For modeling, the categorical variables for each individual item were collapsed into two dichotomous categories: reporting each symptom little/none of the time versus some/most/all of the time.

Measure of overall work-health: Work Limitations Questionnaire. The Work Limitations Questionnaire (WLQ) exists in an original 25-item version and a condensed 8-item version (Center for Health Solutions at Tufts Medical Center, n.d.). The latter was used in the BHWHS survey and was analyzed here. The original version was developed in 1994 to measure health-related losses of productivity at work and drew upon extensive focus groups and interviews (Center for Health Solutions at Tufts Medical Center, n.d.). Two field trials of the 25-item WLQ, showed stable test-retest reliability at two weeks (rather than four weeks). These trials revealed four dimensions: limitations in handling time, physical, mental-interpersonal, and output demands (Lerner et al., 2001). All four dimensions measuring self-reported health status and work productivity showed Cronbach alpha scores exceeding 0.90 (Lerner et al., 2001).

The 8-item WLQ examines the extent to which an individual's health issues interfere with and/or limit job performance and productivity (Munir, 2008) and was developed from the longer WLQ by trimming the tool down to the eight questions showing the highest correlations with lost productivity measured by the percentage of time an employee has meeting the respective work demand (Walker, Tullar, Diamond, Kohl, & Amick, 2017). The eight questions in the tool evaluate the proportion of time at work that emotional and physical problems interfered with the ability to work the required number of hours and start work on time, physical work activities, mental/interpersonal activities, and overall work capability over the previous two weeks (Burton, Pransky, Conti, Chen, & Edington, 2004). Each of the eight questions begins either with the root: "In the past 2 weeks did your physical health or emotional problems make it *difficult* to …" or with "In the past 2 weeks, how much of the time were you *able* to…" Response options included (with percentages noted on the survey): all of the time (100%), most of the time (75%), some of the time (50%), a slight bit (25%), none of the time (0%), and does not apply to my job.

In this analysis, the two questions looking at ability were reverse scored and then all were added together to calculate a total score. Higher scores were indicative of greater limitations with score of 0 suggestive of no limitations at work related to health (Amick et al., 2017). For additional analysis, because of high variation in the response patterns across items, after calculating a total limitation score, each of the 8-items was analyzed individually. Each question was collapsed into two categories: those reporting regular work limitations (50% of the time or more) due to emotional or physical problems and those with work limitations less than 50% of the time in the past two weeks. WLQ-8 total scores were continuous variables calculated as averaged scores from each of the eight questions with a score of 100 indicating limitations in all domains all (or 100%) of the time.

The factorial validity, scale reliability, test-retest reliability, and convergent/discriminant validity testing for additional construct validity of the 8-item WLQ were assessed in a large sample of employees working in a public university system (Walker, Tullar, Diamond, Kohl, & Amick, 2017). A confirmatory factor analysis based approach rather than Cronbach's alpha was used to test scale reliability (Walker et al., 2017). All factor loadings were statistically significant (Walker et al., 2017). A reliability score of 0.69 demonstrated adequate fit for scale reliability in the 8-item WLQ with a 0.65 or greater being considered acceptable (Walker et al., 2017). To determine the test-retest reliability of the 8-item WLQ, a small group of employees (n=42) completed the scale twice within a 45-day period. The scale demonstrated acceptable interclass correlation (ICC) agreement of 0.78 (Walker et al., 2017). Convergent and discriminant validity tests suggested overall that WLQ scores of those respondents with more than one chronic condition or in worse general health to have significantly higher WLQ scores than healthier respondents supporting sufficient construct validity (Walker et al., 2017). In the current sample, a Cronbach's alpha coefficient of 0.61 was computed, which is somewhat on the low side and reflects relatively low internal consistency, and suggests that it may be appropriate to analyze the items individually as well as together.

Descriptive Variables and Confounding Measures and Correlates

Nurse characteristics are potential confounders of the relationships of interest in this study and were used as control variables in multivariate modeling to address the research questions. These were also used to describe and characterize the sample as a whole and each of the generationally defined age groups. These self-report variables were drawn from both the hospital/system and survey databases. With respect to the questions about gender, marital status, and race/ethnicity and birth origin, limitations in how they were operationalized relative to some

current thinking about the underlying concepts are noted below.

Individual confounding measures and correlates. ***Gender***. Gender was self-reported by participants as a dichotomous indicator (male or female).

Marital status/cohabitation. Another self-reported variable was marital status/cohabitation. The question asked: "Are you married or do you have a permanent romantic partner that [sic] lives with you?" The answer analyzed as a dichotomous "yes/no" variable.

Race, ethnicity, birth origin. The two original questions regarding race and ethnicity in the BHWHS were: "How would you describe your race?" with six race choices (i.e. Native American, Asian, Native Hawaiian, Black, White, and Other) and "Do you consider yourself Latino or Hispanic? (yes/no). Although arguably less than ideal from a conceptual perspective, because Black Latinos were such a small group, four categories formed: non-Hispanic White, non-Hispanic Black, Hispanic/Latino, and mixed race/other were collapsed into a dichotomous variable of White and non-Latino versus non-White/Latino as in Sabbath et al. (2017). In addition, a question "Were you born in the U.S.?" with a dichotomous "yes/no" response option set was also asked of participants and used in the analysis.

Work condition confounding measures and correlates. ***Work hours.*** Participants were asked to report the number of hours they worked in a typical week as one of the following categories: <20, 20-29, 30-34, 35-39, 40-44, 45-50, and >50 hours. As noted earlier, only individuals working 20 or more hours per week on average were eligible to participate in the parent study. In addition to examining the seven-category version of the variable, a two-category version was explored: part-time worker (all categories less than 34 hours/week) and full-time/overtime worker (>35 hours/week).

Second job. Nurses were asked if they had a "second job outside the hospital." Responses

were either “yes” or “no.”

Primary work shift. The nurse’s primary work shift schedule was retrieved from self-reported job characteristics in the survey: Day (D), Evening (E), Night (N), Rotating D/E, Rotating D/N, or Other. Responses were recategorized into one of the following levels: Day, Evening, Night, Rotating, or No typical shift.

Primary clinical specialty/unit type. Nurses in the study worked in 128 different patient care units across the two hospitals. Following earlier analyses of this dataset, patient care units were grouped into seven categories reflecting the patient clienteles, patient loads and physical demands of work: medical surgical, intensive care, pediatrics, obstetrics, operating, emergency, or other.

Data Analysis Procedures

General Considerations

The protocol for this secondary analysis was reviewed according to processes developed by the BHWHS (see section below on Ethical Considerations), and after it was approved, project staff prepared an analytic dataset with respondents who met selection criteria (i.e. nurses). [The variables requested are listed in Appendix B]. The dataset provided by BHWHS was imported into IBM SPSS Statistics v.24 for analysis (IBM Corporation, 2016). While a statistical significance level of $p<.05$ was used, caution was used in interpreting isolated statistically-significant findings at or around this level to avoid Type I error given multiple outcome variables and extensive significance testing in this study. Patterns of results rather than the results of single hypothesis tests were used to determine whether the study hypotheses were supported or not. To account for the increased number of nurses employed in smaller units who were provided with questionnaires in the sampling design, the final analytic sample of 1,146 direct care registered

nurses in non-administrative roles was adjusted with sampling weights using a setting in SPSS to yield a working sample size of 1,876.

Data Preparation and Cleaning

The process of preparing and cleaning the data for analysis began with identification of out-of-range values or missing data points. In the original study, if a respondent's survey was missing more than 50% of variables, the entire individual record was dropped from the dataset. Given the low rates of missing data, listwise deletion was used to deal with missing data. Next, scores for multi-item scales were calculated and new analytic variables created.

Preparation for Statistical Modeling

In preparation for modeling, frequencies and descriptive statistics were used to characterize the sample as a whole as well as its subgroups. Next, normality of variables was assessed using kurtosis/skew. Additional steps in preparation for model building and hypothesis testing included construction of dummy variables for the categorical measures for the independent variable of age/generation and for categorical-level control variables. Lastly, a correlation matrix was constructed for the predictor/control variables to rule out multicollinearity using a conservative cutpoint of Pearson's r of 0.5 or greater between variables (Cohen, 1988) as an indication of the need to either select one of the variables or to combine them somehow before attempting use them in a model.

Addressing Research Questions/Hypothesis Testing

To address each of the research questions, the regression models of the following form were fitted:

$y=a + bx + cz + d$ [for continuous variables, modelled using linear regression modeling] and

$\ln(y)=a + bx + cz + d$ [for dichotomous dependent variables, using logistic regression modeling]

Here, x is a vector of dummy variables capturing generationally-defined age group classification and z is a vector of nurse characteristics (gender, marital status, race/ethnicity/birth origin, work hours, shift type, and primary specialty) and *b* and *c* are vectors of computed coefficients, *a* is an intercept or constant and *d* is an error or disturbance term. See Table 2 for the Model building and analysis included assessing whether generationally-defined age groups were significantly associated with each outcome variable, first before and then after adding nurse characteristics to the models by examining model fit. The final models constructed incorporated survey weights in the dataset and used generalized estimating equations modeling strategies to control for the clustering of nurses by unit of employment to reduce bias in the computed parameter estimates. The statistical significance of the parameter estimates for generationally-defined age groups were evaluated. Patterns across models for the same outcomes and across different outcomes were examined for each research question, and reviewed to determine the extent to which each hypothesis was supported.

Table 2

Measures and Statistical Models Used in the Data Analysis

Hypothesis	Dependent Measures	Reporting period/frequency	Level of Measurement	Statistical Model
1- Physical Health	Body Mass Index (BMI)	Self-report	Continuous (ratio of weight in kilograms divided by height in meters squared - kg/m^2)	Linear Regression
	Presence of Pain/Aching by Body Site	Past 3 months	Dichotomous Pain Present (Y/N)	Logistic Regression
	Pain Severity by Body Site	Past week	Dichotomous variable self-report (none/mild vs. moderate/severe/extreme)	Logistic Regression
	Absence due to pain	Ever	Dichotomous (Y/N)	Logistic Regression
	Reduced or altered work due to pain	Ever	Dichotomous (Y/N)	Logistic Regression
	Serious injury (non-sharps)	Past 12 months	Dichotomous (Y/N)	Logistic Regression
2 - Psychological health	Psychological distress as measured by K-6 (total index score)	Past 30 days	Continuous variable	Linear Regression
	K-6 Psychological Distress (6-psychological distress symptoms)	Past 30 days	Dichotomous (none/little vs. some/most/all of the time)	Logistic Regression
3 – Overall work-related health	Work Limitations due to Emotional or Physical Problems (WLQ-8) (total index score)	Past 2 weeks	Continuous variable	Linear Regression
	Work Limitations (8- individual work limitations)	Past 2 weeks	Dichotomous (none/slight bit vs. some/most/all of the time)	Logistic Regression

Ethical Considerations

Ethical concerns in secondary analysis normally relate to whether participants in an original study provided informed consent for their data to be used in subsequent projects and whether there any risks to subject privacy in the new study. Because deidentified data were provided by the original research team and all conditions of the BHWHS data use agreement were respected, this study posed minimal risks to human subjects. For the BHWHS, the primary Institutional Review Board monitoring this project was at Partners HealthCare, Inc and Boston College ceded review to Partners HealthCare, Inc. through a legal agreement signed by the primary investigator of the BHWHS, Dr. Erika Sabbath, that covers Boston College investigators carrying out projects under her supervision, including this study.

Summary

This chapter described the methods for the secondary analysis performed in this study of age and occupational health in hospital nurses. The next chapter presents the results of the study.

Chapter 4: Results

This chapter presents the results of this cross-sectional study comparing occupational health indicators across age groups in nurses at two academic medical centers in Massachusetts. After a description of the sample and some preliminary analyses of the predictor and outcome variables, this chapter presents the results of hypothesis testing to address each of the study's research questions.

Description of the Sample

The analytic sample for this study consisted of 1,146 direct care registered nurses in non-administrative roles. After adjusting results for sampling weights to account for the increased number of nurses sampled from smaller units, the working sample size was 1,876.

Demographic Characteristics

The ages of nurses in the sample ranged from 23 to 69. The average age (mean ± SD) of the nurses in the sample was 39.9 ± 11.6 years, and the median age was 37. As displayed in Table 3, the majority of the sample was female (95.5%) and reported being either married or having a permanent romantic partner that lived with them (73.0%). In the sample, 86.7% of the nurses identified as White and/or non-Latino and 91.7% reported having been born in the United States.

Individual-level Work Characteristics

Table 3 displays further characteristics of the positions held by nurses in the sample. In terms of hours and shift worked, the majority of the sample (68.6%) worked full time (more than 35 hours/week). The greatest share of the sample worked rotating shifts (41.0%), with approximately one quarter working regular night and day shifts, respectively. The three most

common clinical specialties in the sample were medical-surgical (43.1%), intensive care (17.2%), and obstetrics (13.8%). Finally, 15.0% reported having a second job.

Table 3

Demographic and Individual-level Work Characteristics of the Overall Sample of Registered Nurses (N=1,876)

Characteristics of Nurses	Number of Nurses	% of Sample
Demographic		
Female	1792	95.5
Married or cohabiting with a "permanent romantic partner"	1369	73.0
White/non-Latino race-ethnicity	1627	86.7
U.S.- born	1721	91.7
Work		
Full-time (>35 hours/week)	1286	68.6
Held a second job	282	15.0
Typical shift worked		
Rotating	769	41.0
Night	500	26.7
Day	424	22.6
No typical shift	135	7.2
Evening	48	2.6
Unit specialty		
Medical surgical	809	43.1
Intensive care	323	17.2
Pediatrics	279	14.9
Obstetrics	258	13.8
Operating	61	3.3
Emergency	58	3.1
Other	88	4.7

Health Indicators for the Overall Sample

Physical health. ***Body mass index (BMI).*** The calculated BMIs of the overall sample based on self-reported heights and weights ranged from a minimum of 15.7 to a maximum of 52.4 (mean ± SD: 25.5 ± 5.1). As detailed in Table 4, 57.0% of the sample had BMIs in the underweight/normal weight range (< 24.9 kg/m^2), 26.3% had a BMI in the overweight range (25 – 29 kg/m^2), and 16.6% had a BMI in the obese range (≥ 30 kg/m^2).

Pain and pain-related work limitations. Reports of pain, aching, and pain severity are also displayed in Table 4. Overall, 78.4% of nurses in the sample reported pain or aching in at least one body site in the last three months. Over half of all nurses reported pain or aching in the lower back (56.2%) and nearly a third of all nurses in the sample reported shoulder pain (28.7%). Less than a quarter of the overall sample of nurses reported pain or aching in the neck (24.1%), knee (19.4%), ankle/feet (19.2%), or wrist/forearm (10.4%) in the past three months. The most common sites for moderate, severe, or extreme pain in the past week were the lower back (19.5%) followed by feet (13.0%).

Two additional questions addressed work limitations related to pain and injuries. Less than half of the sample (42.6%) reported needing to reduce or alter their work. Roughly a third of the nurses (35.2%) reported that pain or physical limitations had caused them to be absent from work at some point in the past.

Occupational injury/illness. Data regarding self-reported occupational injuries in the past 12 months are displayed in Table 4. Only 6.1% of subjects reported an injury (excluding sharps injuries) serious enough to require medical advice/treatment and/or lost time from work in the past 12 months.

Psychological health. ***Psychological distress.*** The calculated scores on the K-6 psychological distress symptom scale ranged from a 0 to 16 in this sample (out of a theoretical maximum of 24 points) with higher scores corresponding to higher psychological distress. The mean calculated overall K-6 score was (mean ± SD) 2.2 ± 2.8 which suggests a low symptom level in this sample. There are varied scoring interpretations in the literature (Kang et al., 2015; Kessler et al., 2010). One scheme rates individuals scoring 0-12 as unlikely to exhibit serious mental illness and those scoring 13-24 indicating probable serious mental illness (Kessler et al.,

2010). A second approach categorizes three ranges: those scoring 0 to 7 indicated low psychological distress, 8 to 12 indicating moderate psychological distress, and a calculated score of 13 or higher indicating high psychological distress (Kang et al., 2015). A third interpretation uses a cutoff of 18 as an indicator of significant mental distress (Averett, Argys, & Sorkin, 2013). Regardless of interpretation, the overall psychological distress of this sample was quite low with 94.1% of the overall sample scoring in the 0-7 range and 5.8% of sample having score greater than 7 which by least restrictive criteria indicate moderate to high likelihood of serious mental illness.

Table 4 provides a summary of the six individual psychological distress symptoms from the K-6 within the overall sample of nurses. For purposes of the analyses, specifically the modeling of the individual symptom questions, responses were recoded into two categories: infrequent (none of the time/little of the time) versus regular (some/most/all of the time) experiences of the symptoms. Categorizing the K-6 items into dichotomous responses has been addressed and validated in a previous study comparing the summative scoring with categorization (Krynen, Osborne, Duck, Houkamau, & Sibley, 2013). In ascending order, a minority of nurses reported experiencing the following symptoms of psychological distress on a regular basis in the past 30 days: "worthless" (2.6%), "hopeless" (3.1%), "so sad nothing could cheer you up" (5.7%), "that everything was an effort" (10.1%), "restless or fidgety" (12.8%), and "nervous" (20.6%) in the past 30 days.

Overall work-related health. To calculate the total WLQ-8 score (generally interpreted as a percentage) a mean was calculated from the eight responses and expressed as an average percentage reflecting the extent of impairment. The higher the score the greater the extent of work limitations due to physical and emotional problems in the past two weeks. For the overall

sample, the mean modified Work Limitations Questionnaire (WLQ-8) score was (mean ± SD) 11.6 ± 12.3. The scores from this sample ranged from 0 indicating no work limitations to a high of 71.9 (i.e. implying limited capacity 71.9% of the time), and only 1% of the sample scoring showing higher (worse) than 50% impairment. The majority of nurses (89.6%) in the sample experienced overall work limitations related to ongoing or permanent physical and/or emotional health conditions in the past two weeks as either none of the time or a "slight bit" (i.e. under 25%). Similar to the approach used in analyses of the K-6, the eight items on the WLQ-8 measuring overall occupational health were also analyzed individually (Walker, Tullar, Diamond, Kohl, & Amick, 2017; Walker, Tullar, Diamond, Kohl, & Amick, 2017b). The responses were recoded into two categories for further analysis and modeling: none/slight bit or some/most/all of the time. While no other studies were identified that used this approach, it was chosen because of the strongly skewed total scale scores and very different response patterns across questions. As displayed in Table 4, work limitations were infrequent, with fewer than 10% of the nurses reporting regular work limitations some, most, or all of the time in the past two weeks in these domains all but one case.

Table 4

Nurse Occupational Health Indicators for the Overall Sample (Categorical Level) (N=1,876)

Nurse Occupational Health	Number of Nurses	% of Sample
Physical health		
Body mass index category (self-reported)		
Underweight/normal weight (</24.9)	1018	57.0
Overweight (25-29.9)	470	26.3
Obese (>/30)	297	16.6
Pain/aching in any body site during past three months	1470	78.4
Any pain/aching in past three months (by body site)		
Lower back	1054	56.2
Shoulder	538	28.7
Wrist/forearm	196	10.4
Knee	364	19.4
Neck	453	24.1
Ankle/feet	361	19.2
Moderate, severe, or extreme pain in past week		
Lower back	365	19.5
Arm/shoulder/hand	218	11.6
Tingling arm/hand/shoulder	127	6.8
Legs/knees	211	11.2
Feet	243	13.0
Absence from work due to pain or physical limitations	659	35.2
Reduced/altered work due to injury/musculoskeletal pain	793	42.6
Serious injury (non-sharps) in past 12 months	114	6.1
Psychological nurse health		
Psychological distress symptoms some/most/all of the time in past 30 days		
"So sad nothing could cheer you up"	107	5.7
Nervous	386	20.6
"Restless or fidgety"	239	12.8
Hopeless	58	3.1
"That everything was an effort"	190	10.1
Worthless	49	2.6
Overall nurse occupational health		
Work limitations some/most/all of the time in past two weeks in terms of *difficulty*:		
Getting going easily at beginning of workday	181	9.7
Starting job as soon as you arrive to work	103	5.5
Concentrating on work	170	9.1
Speaking with people in phone or in-person meetings	46	2.6
Finishing work on time	68	3.6
Handling the workload	88	4.7
Work limitations some/most/all of the time in past two weeks in terms of *ability*:		
Staying in one position >15 minutes while working	1534	82.5
Repeating same motions over and over again	1698	91.5

Summary

The nurses in this sample ranged from 23 to 69 years old. The sample was relatively culturally homogenous. A typical respondent was a White/non-Latino, U.S.-born female nurse approximately 40 years old who was married, working full-time, worked at least some night shifts and was assigned to a medical-surgical unit. The summary measures of physical, psychological, and overall work-related health of the nurses are suggestive of a healthy sample with generally minor impairments; serious work-related injuries and major limitations were seen in only a small proportion of the sample.

Characteristics across Generationally-Defined Age Groups

As explained in Chapter 3, the sample was divided into three groups based on respondent birth year. As displayed in Table 5, the three generationally-defined age groups were: Baby Boomers (aged 54-69 years old), Generation X (aged 33-35 years old), and Millennials (aged 23-32 years old). As stated previously, three nurses aged 70 or older were excluded because only three nurses fell in that age group. The Generation X age group was the largest of the sample (45.1%), followed by Millennials (37.3%), and Baby Boomer nurses (17.5%).

Demographic characteristics. Table 5 displays the demographic characteristics of the three generationally-defined age groups. The Millennial age group had the highest percentage of female nurses (97.1%), and the highest proportions of White non-Latino nurses (90.0%), as well as those born in the United States (95.9%). The Generation X age group showed the highest proportion of nurses who were married or had a permanent romantic live-in partner.

Individual-level work characteristics. Table 5 also displays work characteristics across generationally-defined age groups. Nurses in the Millennial age group (88.0%) and Baby Boomers (62.9%) were more likely than the Generation X group to work full time hours with

only a little over half reporting working more than 35 hours/week (54.7%). Millennial nurses were most likely to report a second job (17.3%), followed by the Generation X (15.9%) and Baby Boomer nurses (7.9%). In terms of typical shift and unit type worked, the following were reported by the three generationally-defined age groups and are displayed in Table 5. The Baby Boomer age group was more likely to work regular day shifts (45.3%) than Generation X and Millennial age groups. Baby Boomers were also more likely to work on obstetric (23.7%) and pediatric (20.1%) units. Generation X registered nurses in this sample were more likely than the other two generations to work the night shift (59.0%) and in intensive care units (18.5%). Greater proportions of Millennial-aged nurses worked rotating shifts (65.1%) and on medical-surgical units (60.9%) compared to the older two generational age groups.

Table 5

Demographic and Individual-level Work Characteristics of Nurses within each Generationally-Defined Age Group (N=1,876)

Characteristics of Nurses	Baby Boomer (54-69 years old) (n= 329)	Generation X (33-53 years old) (n= 847)	Millennial (23-32 years old) (n= 700)	*p*
Demographic				
Female	312 (94.8)	800 (94.5)	680 (97.1)	.03
Married or partnered	255 (77.5)	696 (82.2)	418 (59.7)	<.001
White/non-Latino race/ethnicity	290 (88.1)	707 (83.5)	630 (90.0)	.001
U.S.- born	301 (91.5)	748 (88.3)	672 (96.0)	<.001
Work				
Full-time (>35 hours per week)	207 (62.9)	463 (54.7)	616 (88.0)	<.001
Held a second job	26 (7.9)	135 (15.9)	121 (17.3)	<.001
Typical shift worked				<.001
Day	149 (45.3)	204 (24.1)	71 (10.1)	
Evening	13 (4.0)	27 (3.2)	8 (1.1)	
Night	82 (16.4)	295 (59.0)	123 (24.6)	
Rotating	53 (16.1)	260 (30.7)	456 (65.1)	
No typical shift	32 (9.7)	61 (7.2)	42 (6.0)	
Unit specialty				<.001
Medical surgical	87 (26.4)	296 (34.9)	426 (60.9)	
Intensive care	38 (11.6)	157 (18.5)	128 (18.3)	
Pediatrics	66 (20.1)	135 (15.9)	78 (11.1)	
Obstetrics	78 (23.7)	144 (17.0)	36 (5.1)	
Operating	30 (9.1)	26 (3.1)	5 (0.7)	
Emergency	15 (4.6)	30 (3.5)	13 (1.9)	
Other	15 (4.6)	59 (7.0)	14 (2.0)	

Notes: Statistics calculated using sample weights. The corresponding birth years to the generational age groups were as follows: Baby Boomers (1945-1960), Generation X (1961-1981), and Millennials (1982-1991). Chi-square significance set at a level of $p \leq .05$.

In all, each of the demographic and individual-level work characteristics varied across generationally-defined age groups suggesting the need to control for them in modeling to test the hypotheses under study.

Hypothesis Testing

After preparing for model building and testing, hypotheses testing was conducted to

address each of the three research aims related to differences across generationally-based age groups in terms of physical, psychological, and overall nurse occupational health outcomes.

Preparing for Hypothesis Testing/Modeling

The correlations between predictor variables were screened to rule out multicollinearity that might cause difficulties in modeling associations. As displayed in Appendix C - Table A1, none of the bivariate correlations among the predictors/correlates exceeded 0.50 (Cohen, 1988). As a result, it was decided to retain all of the potential correlates in the models used to test the hypotheses.

Following the process outlined in Chapter 3, each of the study hypotheses within each aim was systematically evaluated examining bivariate associations between each variable and then through regression modeling, controlling for confounding demographic and individual-level work characteristics. In line with our research questions, multiple indicators of nurse occupational health were examined: physical, psychological and overall nurse occupational health. As described in Chapter 3, the regression modeling undertaken used generalized estimating equations to take the clustering of nurses within units into account in calculating parameter standard errors. The survey design was taken into account with incorporation of clustered weights in the analysis using functionality in SPSS that permits this. Because of the conflicting findings in the previous literature, no patterns or directions were anticipated in terms of the differences or absence of differences that might be seen in outcomes across age groups. The main comparisons of interest were between the Millennials (youngest) and both Generation X (middle) and the Baby Boomer (oldest) subjects and are presented in detail in this chapter. However, differences between Generation X and Baby Boomer nurses in their health outcomes were also explored; significant differences are presented in Appendix D (Table D1 and Table

D2) and will be referred to in this chapter as relevant.

Research Question 1: Physical Health

The first hypothesis related to potential differences between generationally-defined age groups and physical health as measured by Body Mass Index, pain, and occupational injury and illness.

Body Mass Index (BMI). Significant differences on BMI were identified across the three generationally-defined age groups as displayed in Table 6 and Appendix D – Table D1. Baby Boomers and Generation X age groups both reported higher BMIs than Millennial nurses (p <.001). Millennial nurses had BMIs that were on average 2.53 points lower than Generation X nurses and 3.72 points lower than those of Baby Boomers.

Table 6

Associations between Generationally-Defined Age Groups and Body Mass Index (BMI): Unadjusted and Adjusted

	Unadjusted Parameters			Adjusted Parameters[a]		
	B [95% CI]	*SE*	*p*	β [95% CI]	*SE*	*p*
Boomer vs. Millennial	3.28 [2.68, 3.88]	.31	<.001	3.72 [2.98, 4.46]	.38	<.001
Gen X vs. Millennial	2.32 [1.91, 2.72]	.21	<.001	2.53 [2.06, 3.00]	.24	<.001

Note. All parameters derived from regression models with weighting to correct for differential sampling of staff across nursing units and correction for clustering of nurses within hospital units using generalized estimating equations.
[a] Adjusted for individual and individual-level work characteristics: sex, marital status, race/ethnicity/birth origin, hours, shift-type worked, and primary clinical specialty.
Gen X= Generation X (age) (33-53); Boomer= Baby Boomers (54-69); Millennial= (23-32).
β = Beta coefficient; SE = standard error; CI= confidence interval

Pain. Pain or aching as an outcome of physical health was examined in terms of pain presence, severity, and impact on work limitations and absences. Results of modeling of pain

using age group as a predictor are displayed in Table 7.

Reports of pain or aching. The Baby Boomer (OR = 1.67; 95% CI = 1.16, 2.40; p = .01) and Generation X (OR = 1.52; 95% CI = 1.13, 2.05; p = .01) nurses were approximately one and half times more likely to report pain in at least one body site than Millennials as displayed in Table 7.

Differences were also found in nurses reporting any pain and aching in specific body sites within the past three months. These results are also displayed in Table 7 and Appendix D – Table D2. In the adjusted models, the following body sites showed significant differences: shoulder, wrist/forearm, knee, and lower back. The only differences in shoulder and wrist/forearm pain were only present in Generation X versus Baby Boomers. Shoulder pain was more likely reported by Generation X compared to Baby Boomers (OR = 1.33; 95% CI = 1.00, 1.77; $p < .001$) and wrist/forearm pain was less likely to be reported by Generation X compared to Baby Boomers (OR = .60; 95% CI = .41, .89; p = .01). In terms of knee pain, Baby Boomers were nearly twice as likely as Millennials to report knee pain (OR = 1.64; 95% CI = 1.16, 2.30; p = .01). Generation X nurses were also less likely to report knee pain than Baby Boomers (OR = .60; 95% CI = .45, .79; $p < .001$). No differences were identified between Generation X and Millennials in knee pain/aching. In contrast, Millennial nurses were two and half times more likely to report lower back pain compared to Baby Boomer nurses (OR for Boomers relative to Millennials: OR = .37; 95% CI = .27, .52; $p < .001$) and nearly twice as likely to report lower back pain as Generation X nurses (OR for Generation X relative to Millennials= .59; 95% CI = .47, .74; $p < .001$). Generation X nurses were also more likely to report lower back pain or aching compared to Baby Boomers (OR = 1.58; 95% CI = 1.19, 2.09; p = .001).

Moderate to extreme pain. There were also notable differences in moderate to severe

pain in body sites. The results of the models are displayed in Table 7 and Appendix D – Table D2. Similar to the findings involving reporting any pain in the lower back by Millennials compared to older age groups, Millennial nurses were also nearly twice as likely to report moderate, severe, or extreme lower back pain compared to Baby Boomers (Baby Boomer vs. Millennials: OR = .57; 95% CI = .36, .89; p = .01). Generation X were also more likely to report significant severity of lower back pain compared to Baby Boomers (OR = 1.66; 95% CI = 1.17, 2.35; p = .004).

The remainder of the significant findings suggested worse pain severity in the older age groups in specific body regions. Both Baby Boomers (OR = 2.42; 95% CI = 1.48, 3.97; p < .001) and Generation X nurses (OR = 1.61; 95% CI = 1.03, 2.52; p = .04) had a greater likelihood compared to Millennials of reporting moderate, severe or extreme arm, shoulder, or hand pain. Both Baby Boomers (OR = 2.20; 95% CI = 1.21, 4.03; p = .01) and Generation X nurses (OR = 2.32; 95% CI = 1.33, 4.04; p = .003) were more than twice as likely as Millennials to report moderate, severe or extreme tingling/pins and needles in the upper extremities. Knee or leg pain was moderate to extreme but only for Baby Boomers compared to Millennials (OR = 2.01; 95% CI = 1.37, 2.94; p < .001). Generation X nurses were also less likely than Baby Boomer nurses to report pain severity in the arm/shoulder (OR = .67; 95% CI = .45, .99; p = .05) and leg/knee (OR = .64; 95% CI = .42, .97; p = .04). There were no differences were found across generational groupings for reporting moderate, severe, or extreme pain in the feet in the past week.

Pain-related absences and work modifications. Differences were found across generationally-defined age groups in terms of self-reported absences from work due to pain or physical limitations after adjusting for demographic and individual-level work characteristics. As

displayed in Table 7, Baby Boomer nurses were approximately two to three times more likely than Millennial nurses to report absences due to pain or physical limitations (OR = 2.72; 95% CI = 1.98, 3.72; $p < .001$). In models predicting the other measure of physical health at work, altering or reducing work due to an injury or musculoskeletal pain, Baby Boomer aged nurses were nearly one and half times as likely to reduce or alter their work for physical health reasons compared to Millennial aged nurses (OR = 1.38; 95% CI = 1.01, 1.87; $p = .04$). As identified in Appendix D – Table D2, Generation X nurses were also less likely than Baby Boomer nurses to report absences due to pain or physical limitations (OR = .73; 95% CI = .58, .93; $p = .01$).

Table 7

Odds Ratios (OR) of Pain Variables between Generationally-Defined Age Groups: Unadjusted and Adjusted (Categorical)

	Unadjusted OR		Adjusted[a] OR	
	Expβ [95% CI)	*P*	Expβ [95% CI)	*p*
Any aching or pain in past three months (by body site)				
Pain vs. No Pain				
Boomer vs. Millennial	2.08 [1.48, 2.93]	<.001	1.67 [1.16, 2.40]	.01
Gen X vs. Millennial	1.70 [1.29, 2.25]	<.001	1.52 [1.13, 2.05]	.01
Lower Back				
Boomer vs. Millennial	.27 [.19, .39]	<.001	.37 [.27, .52]	<.001
Gen X vs. Millennial	.48 [.37, .62]	<.001	.59 [.47, .74]	<.001
Shoulder				
Boomer vs. Millennial	.84 [.63, 1.13]	.25	.87 [.60, 1.26]	.45
Gen X vs. Millennial	1.11 [.95, 1.30]	.20	1.15 [.95, 1.40]	.16
Wrist/Forearm				
Boomer vs. Millennial	1.44 [.97, 2.14]	.07	1.47 [.92, 2.33]	.11
Gen X vs. Millennial	.91 [.64, 1.29]	.60	.88 [.59, 1.33]	.56
Knee				
Boomer vs. Millennial	1.38 [.95, 2.00]	.10	1.64 [1.16, 2.30]	.01
Gen X vs. Millennial	.86 [.65, 1.14]	.30	.98 [.71, 1.35]	.91
Neck				
Boomer vs. Millennial	.69 [.51, .93]	.01	.77 [.54, 1.10]	.15
Gen X vs. Millennial	.81 [.70, .93]	.003	.96 [.78, 1.18]	.69
Ankle or Foot				
Boomer vs. Millennial	1.13 [.75, 1.72]	.56	1.04 [.67, 1.63]	.85
Gen X vs. Millennial	.94 [.76, 1.18]	.62	.95 [.69, 1.31]	.75
Moderate, severe, or extreme pain in the past week (by body site)				
Lower back				
Boomer vs. Millennial	.44 [.28, .70]	<.001	.57 [.36, .89]	.01
Gen X vs. Millennial	.85 [.65, 1.11]	.24	.94 [.68, 1.27]	.68
Arm, shoulder, or hand				
Boomer vs. Millennial	2.05 [1.32, 3.19]	.001	2.42 [1.48, 3.97]	<.001
Gen X vs. Millennial	1.43 [.95, 2.16]	.09	1.61 [1.03, 2.52]	.04
Tingling (pins and needles) in my arm, shoulder, or hand				
Boomer vs. Millennial	2.41 [1.47, 3.96]	.001	2.20 [1.21, 4.03]	.01
Gen X vs. Millennial	2.14 [1.34, 3.43]	.002	2.32 [1.33, 4.04]	.003
Legs or knees				
Boomer vs. Millennial	1.53 [1.09, 2.14]	.01	2.01 [1.37, 2.94]	<.001
Gen X vs. Millennial	.98 [.67, 1.42]	.91	1.29 [.87, 1.90]	.21
Feet				
Boomer vs. Millennial	1.24 [.86, 1.78]	.24	1.40 [.83, 2.35]	.21
Gen X vs. Millennial	1.10 [.84, 1.43]	.49	1.25 [.84, 1.86]	.26
Absence due to pain or physical limitations				
Boomer vs. Millennial	3.21 [2.35, 4.39]	<.001	2.72 [1.98, 3.72]	<.001
Gen X vs. Millennial	2.15 [1.70, 2.73]	<.001	1.98 [1.50, 2.62]	<.001
Need to reduce or alter your work due to injury or musculoskeletal pain				
Boomer vs. Millennial	1.17 [.88, 1.63]	.27	1.38 [1.01, 1.87]	.04
Gen X vs. Millennial	1.01 [.80, 1.27]	.92	1.16 [.91, 1.49]	.22

Note. All parameters derived from regression models with weighting to correct for differential sampling of staff across nursing units and correction for clustering of nurses within hospital units using generalized estimating equations.

[a] Adjusted for demographic and individual-level work characteristics: sex, marital status, race/ethnicity/birth origin, hours, shift-type worked, and primary clinical specialty.

Gen X= Generation X (age) (33-53); Boomer= Baby Boomers (54-69); Millennial= (23-32).

expβ = *exponentiated Beta coefficient*; CI= [confidence interval]

Occupational injury and illness. Both Baby Boomers (OR= 2.35; 95% CI = 1.32, 4.18; p = .004) and Generation X (OR = 1.89; 95% CI = 1.23, 2.90; p = .004) were approximately twice as likely to report an occupational injury or illness (non-sharps) in the past year compared to Millennials after adjustment for nurse and individual-level work characteristics [Table 8].

Table 8

Odds Ratios (ORs) for Reporting an Occupational (Non-Sharps) Injury and Illness in the Past 12 Months Serious Enough to Seek Medical Attention or Lose Time from Work between Generationally-Defined Age Groups

	Adjusted OR		Adjusted[a] OR	
	Expβ [95% CI]	*p*	Expβ [95% CI]	*P*
Boomer vs. Millennial	1.52 [.95, 2.44]	.08	2.35 [1.32, 4.18]	.004
Gen X vs. Millennial	1.33 [.96, 1.83]	.09	1.89 [1.23, 2.90]	.004

Note. All parameters derived from regression models with weighting to correct for differential sampling of staff across nursing units and correction for clustering of nurses within hospital units using generalized estimating equations.
[a] Adjusted for demographic and individual-level work characteristics: sex, marital status, race/ethnicity/birth origin, hours, shift-type worked, and primary clinical specialty.
Gen X= Generation X (age) (33-53); Boomer= Baby Boomers (54-69); Millennial= (23-32).
Expβ = exponentiated Beta coefficient; CI= [confidence interval]

Summary of results: Physical health. The first aim of this study was to explore the differences between generationally-defined age groups and various physical health indicators: Body Mass Index, pain presence, pain severity, pain limitations/absences, and reports of occupational injury and illnesses in the past year. Both Baby Boomer and Generation X nurses had larger than Millennial BMIs and were more likely to report pain in any body site compared to Millennial nurses. On closer examination, Baby Boomer nurses were more likely to complain of pain/aching and regular severity of knee or leg pain compared to Millennials. However, Millennials were more likely to report any lower back pain compared to both Baby Boomer and Generation X nurses and more likely to report moderate to extreme lower back pain—the latter comparison was only significant for Millennials compared to Baby Boomers though. Both Baby

Boomer and Generation X nurses were more likely to report serious upper extremity pain and tingling/pins and needles than Millennial aged nurses. The consequences of pain on work limitations and absences were also more likely in the Baby Boomer and Generation X age group as were the odds of reporting occupational injury or illnesses compared to Millennial aged nurses. Overall, older generations were more likely to report musculoskeletal pain and pain-related limitations compared to the Millennial age group in all respects except lower back pain.

Research Question 2: Psychological Health

The second aim and associated hypotheses related to identifying differences in psychological health measured as psychological distress. Several differences in psychological distress symptoms were found. Findings regarding overall K-6 scale score measuring psychological distress across generationally-defined age groups are displayed in Table 9 and Appendix D – Table D1. Although possible scores range from 0 to 24, the observed range in this sample was 0 to 16. K-6 total scores were markedly positively skewed (most scores at lower end) but some higher scores were noted, with a mean score in this sample of 2.2 ± 2.8 (mean ± SD). Older nurses showed significantly lower psychological distress symptoms as measured by the overall K-6 index. Millennials had scores 0.89 points higher on average than Baby Boomers ($p < .001$) and Millennials had scores 0.44 points higher on average than Generation X nurses ($p = .003$). Baby Boomer nurses showed psychological distress symptoms that were 0.45 points lower on average than Generation X nurses ($p = .01$).

Table 9

Association between Generationally-Defined Age Groups and Total Index Score from the K-6 Psychological Distress Tool

	Unadjusted Parameters			Adjusted Parameters [a]		
	β [CI 95%]	*SE*	*p*	β [CI 95%]	*SE*	*p*
Millennial vs. Boomer	1.23 [.84, 1.62]	.20	<.001	.89 [.52, 1.26]	.19	<.001
Millennial vs. Gen X	.83 [.54, 1.11]	.15	<.001	.44 [.15, .74]	.15	.003

Note. All parameters derived from regression models with weighting to correct for differential sampling of staff across nursing units and correction for clustering of nurses within hospital units using generalized estimating equations.
[a] Adjusted for demographic and individual-level work characteristics: sex, marital status, race/ethnicity/birth origin, hours, shift-type worked, and primary clinical specialty.
Gen X= Generation X (age) (33-53); Boomer= Baby Boomers (54-69); Millennial= (23-32).
β = Beta coefficient; SE = standard error; CI= confidence interval

Specific psychological distress symptoms. Significant age differences were observed on several of the psychological distress symptoms as displayed in Table 10 and Appendix D - Table D2. Not only were regular experiences of nervousness (21%) and restlessness/fidgetiness (13%) in the past 30 days more common in the sample as a whole compared to other psychological distress symptoms, there were notable differences in the reporting of these two symptoms across age groups. Comparing the older two generations to Millennial nurses, regular experiences of both nervousness and restless/fidgetiness were more common in Millennials. Millennials were nearly two and half times more likely to report regularly experiencing nervousness in the past 30 days compared to Baby Boomers (OR for Boomers relative to Millennials = .42; 95% CI = .28, .63; $p < .001$). Similarly, Generation X nurses were approximately half as likely to report regular experiences of nervousness compared with Millennials (OR = .50; 95% CI = .36, .76; $p < .001$). No difference was found between Generation X and Baby Boomer nurses in nervousness. A similar trend was also noted in reporting symptoms of restlessness/fidgetiness. Baby Boomer (OR = .42; 95% CI = .27, .66; $p <$

.001) and Generation X nurses (OR = .69; 95% CI = .48, .99 ; p = .05) were also less likely than Millennial nurses to report being restless/fidgety some, most, or all of the time in the past 30 days. As displayed in Appendix D – Table D2, Generation X, as a younger age group, was approximately one and half times more likely to report regularly feeling restless or fidgety compared to Baby Boomers (OR = 1.64; 95% CI = 1.08, 2.50; p = .02). As displayed in Appendix D, Table D2, additional differences were found when comparing Generation X to Baby Boomer nurses. Generation X nurses were half as likely as Baby Boomers to report feeling "so sad nothing could cheer them up" some, most, or all of the time in the past 30 days (OR = .52; 95% CI = .29, .93; p = .03). Furthermore, Generation X were one and half times more likely to report feeling like 'everything was an effort' compared to Baby Boomers nurses although it bordered on significance (OR = 1.57; 95% CI = 1.00, 2.48; p = .05). Taken in tandem, these findings are conflicting in terms of depressive symptoms. Finally, as displayed in Table 10, likely because relatively few nurses reported high levels of worthlessness and hopelessness, the models to predict these outcomes did not converge and no conclusion could be drawn regarding an association between age/generation and either.

Table 10

Odds Ratios (OR) of Reporting Regular Symptoms of Psychological Distress (some/most/all of the time) in the Past 30 Days between Generationally-Defined Age Groups

	Unadjusted OR		Adjusted[a] OR	
In the past 30 days felt symptom (some/most/all of the time):	Expβ [95% CI]	*p*	Expβ [95% CI]	*P*
"So sad nothing could cheer you up"				
Boomer vs. Millennial	.96 [.62, 1.47]	.83	1.25 [.74, 2.13]	.40
Gen X vs. Millennial	.52 [.31, .86]	.01	.65 [.39, 1.09]	.10
Nervous				
Boomer vs. Millennial	.34 [.23, .50]	<.001	.42 [.28, .63]	<.001
Gen X vs. Millennial	.39 [.29, .50]	<.001	.50 [.36, .76]	<.001
"Restless or fidgety"				
Boomer vs. Millennial	.38 [.25, .59]	<.001	.42 [.27, .66]	<.001
Gen X vs. Millennial	.50 [.36, .68]	<.001	.69 [.48, .99]	.05
Hopeless				
Boomer vs. Millennial	.75 [.38, 1.49]	.41	*	*
Gen X vs. Millennial	.58 [.31, 1.08]	.09	*	*
"Everything was an effort"				
Boomer vs. Millennial	.51 [.29, .88]	.02	.68 [.39, 1.18]	.17
Gen X vs. Millennial	.84 [.60, 1.18]	.31	1.07 [.74, 1.53]	.73
Worthless				
Boomer vs. Millennial	.76 [.31, 1.84]	.54	*	*
Gen X vs. Millennial	.49 [.26, .91]	.02	*	*

Note. All parameters derived from regression models with weighting to correct for differential sampling of staff across nursing units and correction for clustering of nurses within hospital units using generalized estimating equations.

[a] Adjusted for demographic and individual-level work characteristics: sex, marital status, race/ethnicity/birth origin, hours, shift-type worked, and primary clinical specialty.

Gen X= Generation X (age) (33-53); Boomer= Baby Boomers (54-69); Millennial= (23-32).

expβ = *exponentiated Beta coefficient*; CI= [confidence interval]

*models did not converge due to low frequencies of the event being predicted relative to the number of covariates; no estimates possible

Summary of results: Psychological health. After adjusting for demographic and individual-level work characteristics, the Millennials in the sample showed higher overall psychological distress scores and greater likelihood of regular experiences of nervousness and restlessness/fidgetiness compared to their older nursing colleagues in both the Baby Boomer and

Generation X age groups. Additionally, Baby Boomer nurses, although with less significance demonstrated more depressive symptoms than Generation X nurses.

Research Question 3: Overall Nurse Occupational Health

The third research aim related to potential differences between generationally-defined age groupings and overall work-related health adjusting for key individual and work correlates. Regression parameters examining overall WLQ-8 scale score measuring work limitations due to both emotional and physical problems across generationally-defined age groups are displayed in Table 11. The observed range in this sample was positively skewed with a range of 0% to 71.9% with the majority of nurses reporting few severe work limitations (reflected in a mean WLQ-8 total score of 11.6 as well as a wide standard deviation of 12.3).

The Millennial nurses demonstrated a significantly higher percentage of work limitations due to ongoing physical and emotional problems in the past two weeks as measured by the WLQ-8 total score. As displayed in Table 11, Millennials had scores 1.92 points higher on average than Baby Boomers (β=1.92; SE=.92; p = .04). These results were robust to removing the small number of very high scores (the top 1% of the sample—with over 50% impairment) from the analysis.

Table 11

Association between Generationally-Defined Age Groups and Total Index Score on the Work Limitations Questionnaire (WLQ-8)

	Unadjusted Parameters			Adjusted Parameters[a]		
	β [CI 95%]	*SE*	*p*	β [CI 95%]	*SE*	*p*
Millennial vs. Boomer	4.43 [2.61, 6.25]	.93	<.001	1.92 [.12, 3.72]	.92	.04
Millennial vs. Gen X	2.73 [1.07,4.40]	.85	.001	.80 [-.82, 2.41]	.82	.33

Note. All parameters derived from regression models with weighting to correct for differential sampling of staff across nursing units and correction for clustering of nurses within hospital units using generalized estimating equations.
[a] Adjusted for demographic and individual-level work characteristics: sex, marital status, race/ethnicity/birth origin, hours, shift-type worked, and primary clinical specialty.
Gen X= Generation X (age) (33-53); Boomer= Baby Boomers (54-69); Millennial= (23-32).
β = Beta coefficient; SE = standard error; CI= [confidence interval]

Specific work limitations. Each of the eight questions inquiring about work limitations due to emotional and physical problems in the past two weeks was also examined. Several of the adjusted models to estimate associations of age groups with work limitation questions did not converge. No estimates of generational differences were therefore possible for the following WLQ-8 questions: the ability to sit, stand, or stay in one position longer than 15 minutes and repeat the same motions over and over again, speaking with people in meetings or on the phone, handling the workload, and difficulty finishing on time. This is likely related to an infrequent number of nurses reporting these types of work limitations (less than 1 in 10 of the sample reported these limitations regularly).

As displayed in Table 12 and Appendix D- Table D2, in the adjusted model, analyses of three of the eight specific work limitation questions did identify significant differences across the generationally-defined age groups: getting going easily at the start of the work day, starting their job on arrival to work, and concentrating at work. Results indicated Millennials were nearly

twice as likely to report difficulty starting their job on arrival to work compared to Generation X nurses. Additionally, the Millennial age group was six times as likely to report difficulty starting their job on arrival in the past two weeks due to ongoing physical or emotional problems compared to Baby Boomers and nearly three times as likely compared to Generation X nurses. Measuring a similar phenomenon, Generation X nurses were half as likely as Millennial nurses to report difficulties getting going easily at the beginning of their work shift.

Finally, the proportion of work limitations related to difficulties concentrating at work appeared to be inversely related to age. The Millennial age group of nurses were approximately three times as likely to report difficulty concentrating on their work compared to Baby Boomers (OR for Boomers relative to Millennials= .35; 95% CI = .19, .65; p = .001). The significant differences between Generation X and Millennial age groups in terms of concentrating at work fell out of significance in the model after adjusting for demographic and individual-level work characteristics. As displayed in Appendix D- Table D2, Generation X nurses were two times more likely to report difficulty concentrating compared to Baby Boomers (OR = 2.15; 95% CI = 1.16, 3.96; p = .02).

Table 12

Odds Ratio (OR) of Reporting Regular Work Limitations (50% of the time or more) Due to Emotional or Physical Problems in the Past Two Weeks between Generationally-Defined Age Groups

	Unadjusted OR Expβ [95% CI]	*P*	Adjusted [a] OR Expβ [95% CI]	*P*
Difficult to do the following some, most, or all of the time:				
Get going easily for start of work day				
Boomer vs. Millennial	.54 [.38, .77]	.001	.75 [.47, 1.19]	.22
Gen X vs. Millennial	.46 [.32, .65]	<.001	.55 [.39, .79]	.001
Start on your job as soon as you arrive				
Boomer vs. Millennial	.14 [.06, .37]	<.001	.17 [.06, .46]	.001
Gen X vs. Millennial	.34 [.21, .54]	<.001	.38 [.23, .62]	<.001
Concentrate				
Boomer vs. Millennial	.26 [.16, .43]	<.001	.35 [.19, .65]	.001
Gen X vs. Millennial	.58 [.40, .83]	.003	.75 [.52, 1.08]	.12
Speak with people in meetings/phone				
Boomer vs. Millennial	1.03 [.52, 2.01]	.94	*	*
Gen X vs. Millennial	.78 [.40, 1.53]	.47	*	*
Handle the workload				
Boomer vs. Millennial	.43 [.20, .91]	.03	*	*
Gen X vs. Millennial	.87 [.54, 1.38]	.55	*	*
Finish on time				
Boomer vs. Millennial	.51 [.22, 1.17]	.11	*	*
Gen X vs. Millennial	1.24 [.78, 1.95]	.36	*	*
Able to do the following some, most, or all of the time:				
Stay in one position >15 minutes				
Boomer vs. Millennial	1.15 [.84, 1.55]	.38	*	*
Gen X vs. Millennial	1.33 [.98, 1.81]	.06	*	*
Repeat motions				
Boomer vs. Millennial	1.24 [.78, 1.97]	.37	*	*
Gen X vs. Millennial	1.08 [.80, 1.46]	.62	*	*

Note. All parameters derived from regression models with weighting to correct for differential sampling of staff across nursing units and correction for clustering of nurses within hospital units using generalized estimating equations.

[a] Adjusted for demographic and individual-level work characteristics: sex, marital status, race/ethnicity/birth origin, hours, shift-type worked, and primary clinical specialty.

Gen X= Generation X (age) (33-53); Boomer= Baby Boomers (54-69); Millennial= (23-32).

expβ = *exponentiated Beta coefficient*; CI= [confidence interval]

*models did not converge due to low frequencies of the event being predicted relative to the number of covariates; no estimates possible

Summary of results: Overall health. Work limitations related to overall health, including both emotional and physical problems were slightly but significantly higher in Millennial nurses in relation with the two older groups. Several areas of work limitation were significantly more common among Millennials than among Gen Xers, Baby Boomers or both: getting going easily at the beginning of the work day, difficulty starting one's job upon arrival and difficulty in concentrating at work; however less than 10% of the overall sample reported regular problems in these respects.

Summary

Overall, the sample of nurses from two Boston-area teaching hospitals was primarily White, Caucasian, U.S. born, and married or partnered. These nurses were generally in good health and experienced minimal health-related work limitations; only a small fraction of the sample included those reporting poor health or marked limitations. The pattern of generation/age differences in physical health (including pain and BMI), psychological health, and health-related work limitations varied across and within domains. BMIs were progressively higher (and significantly so) in each older age group. Furthermore, older nurses were also more likely to report upper extremity and leg/knee pain and work limitations such as increased absences and occupational injury and illness reports. However, Millennials were more likely to report lower back pain in the past three months compared to older age groups. No differences across age groups in terms of most of the other physical health measures were noted. Despite low reports of regular psychological distress symptoms across all three age cohorts, Millennial nurses appeared more likely to report regular nervousness and restlessness/fidgetiness compared to Baby Boomers. Similarly, self-reported work limitations related to physical and psychological were slightly but significantly higher for Millennials than nurses in either of the other two age groups;

Millennials were more likely to report regular difficulties concentrating and starting work upon arrival for their shift, but relatively few nurses in the sample reported problems in these respects. The next chapter discusses these results in the context of theory and previous empirical findings, discusses strengths and limitations of the data, and concludes with a discussion of implications for nursing administrators and directions for future research.

Chapter 5: Discussion and Conclusion

The purpose of this study was to describe occupational health differences across generationally-defined age groups of direct care registered nurses working in two large academic medical centers in Boston, Massachusetts. Differences in a number of health indicators across generationally-defined age groups were observed before and after controlling for demographic and job characteristics—some suggestive of increasing impairment or worsening health with greater age and some suggestive of worse health indicators in the younger age groups.

Chapter Five places these results in the context of the current literature and the conceptual framework that guided the study. After discussing the patterns of age-related differences in physical, psychological, and overall work-related health, this chapter presents the study's strengths and weaknesses, and implications for nursing administrators and the profession. The chapter concludes with directions for future research and contributions of this study to the literature.

Age-Related Differences in Nurse Occupational Health Outcomes

Overall, none of the three age groups studied here showed consistently better or worse health in relation to the others across all outcomes. The differences that were observed will be reviewed in two groups: health outcomes that were worse in older nurses, and those that were worse in the younger age groups. Each of the significant differences will be discussed within the context of the existing literature.

Health Outcomes Found to be Worse in Older Nurses

On average, older nurses (especially Baby Boomers) had higher BMIs and were more likely to report certain upper and lower extremity pain symptoms than younger nurses, as well as more work-related injuries and limitations/absences related to pain. An accumulation of risk

factors and stressors for becoming overweight and experiencing injuries over time (or with age) may play a role in explaining these findings.

Body mass index. Older nurses had higher BMIs than younger ones in this study. This pattern has been seen in other U.S. studies of direct care nurses, licensed practical nurses, and nurses' aides working in a variety of practice settings (Kramer & Son, 2016) and international studies of nurses from Australia (Perry, Gallagher, et al., 2015), Australia, New Zealand, United Kingdom (Bogossian et al., 2012), Scotland (Kyle, Neall, & Atherton, 2016), and Malaysia (Coomarasamy, Wint, Neri, & Sukumaran, 2014). In searching the literature, a single study was found that identified no significant age group differences in self-reported BMIs of nurses working in Mexico; however, it was likely underpowered (N=265) to find such differences (Sánchez-Jiménez, Sámano, Chinchilla-Ochoa, Morales-Hernández, & Rodríguez-Ventura, 2018).

In the literature exploring BMI trends in the general population, older age has not been identified as an independent predictor of obesity (Schulte, Pandalai, Wulsin, & Chun, 2012). Instead, obesity in later life is generally understood to be the result of the interplay of a multifactorial set of biological process of aging from midlife onwards with environmental and workplace factors playing contributory roles. The aging process appears to lower metabolic rates, decrease muscle mass available to burn calories, and result in hormone shifts that increase fat storage. Environmental factors such as availability of unhealthy food choices and fast food and also appear to influence obesity supported by a review of studies, where researchers found inconsistent eating patterns and higher consumption of higher sugar and fat options in nurses was possibly due to the increased availability in the work setting (Priano et al., 2018). Finally, as nurses age they may move into clinical specialties and roles requiring less physical activity

potentially placing them at a higher risk for weight gain. Researchers in one study found overweight and obese nurses reported their jobs had less physical exertion and more limited movement than the underweight/normal weight nurses in one study (Han et al., 2011). Additionally, younger overweight and obese nurses may have already self-selected out of staff nurse roles (and from this sample) opting for nursing positions with less physical demands and requiring less exertion (Han et al., 2011). In the aggregate, while not all nurses in this sample showed high BMIs (even the older ones), a combination of biological, environmental, and workplace factors are likely responsible for the link between age and elevated BMI.

Musculoskeletal pain. With the exception of reports of lower back pain which was higher in younger age groups (and will be discussed in an upcoming section), more frequent reports of musculoskeletal pain/aching in the lower and upper extremities in the past three months were seen more in older nurses. Baby Boomer nurses also had nearly double the likelihood of reporting severe pain symptoms in the arm, shoulder, and hand in the past week compared to Millennial and Generation X nurses. The trends towards elevated BMIs in older nurses just discussed provides one potential explanation: Elevated BMIs and associated adiposopathy (having a larger than average waist line) may lead to a chronic systemic inflammatory state that results in elevated reports of musculoskeletal pain (Seaman, 2013). It also appears the increasing BMIs may be associated with cumulative stress on the leg and knee joints (Messier, Gutekunst, Davis, & DeVita, 2005).

Lower extremity pain. Baby Boomer nurses were more likely to report the presence of pain or aching in the knee in the past three months in addition to increased regularity of severe pain in the legs and knees in the past week compared to Generation X and Millennial nurses. This is consistent with some but not all earlier results in this area. A study of Greek nurses also

identified an association between age and higher prevalence of knee pain as measured with the Nordic questionnaire (Alexopoulos et al., 2011). However, a cross-sectional study of German nurses using both objective (i.e. physical assessment variables) and subjective self-report measures of knee-related musculoskeletal disorders (MSD), no age-related differences across age groups were identified including at the extremes (<35 years vs. ≥45 years) (Heiden, Weigl, Angerer, & Müller, 2013). Potential explanations for this finding include cumulative effect of age-related muscle changes in the lower body, including wear and tear over time. Clinical nurses appear to spend more than two-thirds of their workdays on their feet, standing or walking (Li, Sommerich, Lavender, Chipps, & Stasny, 2017). Potentially excessive exertion (overexertion theory), in terms of the application, posture, motion, and duration of functional tasks, beyond the ability of an individual's musculoskeletal system, may increase the perception of pain and pain-related limitations (Kumar, 2001) in older age groups.

Upper extremity pain. Baby Boomer and Generation X nurses were also more likely than Millennials to complain of regular moderate to severe pain in the arm, shoulder, or hand in the past week, although older nurses were not at higher likelihood of reporting any aching or pain in their shoulder, wrist/forearm, or neck in the past three months. Baby Boomers were also more likely than Generation X age group nurses to complain of moderate, severe, or extreme pain in the arm, shoulder, or hand, further suggesting a relationship between age and upper extremity pain.

Similar findings were seen in an earlier study from a sample of patient care workers from the BHWHS where age was positively associated with wrist pain (Sembajwe et al., 2013). Further, in a survey of Australian hospital-based nurses, those 50 and older were nearly four times as likely to complain of wrist or hand pain in the past month compared to those less than

30 years old (Surawera, Hoe, Kelsall, Urquhart, & Sim, 2012) and two times as likely to complain of shoulder and neck pain in a separate but related study (Hoe, Kelsall, Urquhart, & Sim, 2012). The majority of studies in a systematic review examining work-related right upper quadrant musculoskeletal disorders specifically in health care workers failed to identify age-related differences in neck and shoulder musculoskeletal disorders (Long, Johnston, & Bogossian, 2012).

Little in the literature appears to directly explain these results. Cumulative stresses in nursing work may be implicated. While a systematic review of reviews concluded that computer work did not independently increase upper extremity musculoskeletal disease or carpel tunnel syndrome (Andersen, Fallentin, Thomsen, & Mikkelsen, 2011), a number of other repetitive tasks involving the upper extremities are characteristic of nursing work, including hanging intravenous solutions and manipulating other types of equipment as well as patient handling motions such as pushing and pulling. Pain and pain-related work limitations could result from repeated overexertion resulting in the need to alter or reduce work to avoid further symptoms when the structures in the arm and shoulder reach their maximal capacity.

Absenteeism and work limitations related to physical health. Baby Boomer nurses were more likely than Millennial nurses to report absences due to pain or physical limitations and more likely to reduce or alter their work for physical health reasons compared to Millennials. Baby Boomer nurses were also more likely than Generation X nurses to report absences or alteration in work due to pain or physical limitations. Very few studies were identified that explored functional limitations and absences of nurses related to pain by age or age groups. One study of Greek nursing personnel showed similar results to those reported here, finding that older nurses had higher rates of absences from work related to musculoskeletal health problems

(Alexopoulos et al., 2011). Considered alongside literature describing rising absences among younger workers in recent years (Krane et al., 2014; Ticharwa, Cope, & Murray, 2018), it will be interesting to see how sickness absenteeism evolves among Millennials and subsequent generations later in their careers and whether future generations demonstrate similar (or perhaps higher) absences for musculoskeletal health reasons when they reach older ages.

Occupational injury and illness. Reporting an occupational health injury or illness in the past 12 months serious enough to require medical attention or lost time from work was also higher in Baby Boomers and Generation X nurses compared to Millennial nurses. These findings parallel analyses of an earlier wave of surveys from the parent study conducted 2 years prior to the surveys that yielded the data analyzed here (Sabbath et al., 2017). In that study, nurses age 51 or older were nearly twice as likely as those 30 years or younger to report a serious injury in past year (Sabbath et al., 2017). Another study of hospital workers also found those older than 40 years old did have a greater likelihood of occupational injury than those younger than age 40 (Schuh & Canham-Chervak, 2016).

The analyses here could not distinguish between injuries due to falls and those associated with other mechanisms of injury. It has been proposed that older nurses may be more vulnerable to occupational injury than their younger colleagues due to physiological changes in balance, reaction time, and gait (Scott & Newman, 2013), such that older nurses may be more vulnerable to falls and younger ones more susceptible to overexertion injuries (Scott & Newman, 2013). A separate review of studies of examining falls in nurses identified several studies noting a significant increase in injury rates with older nurses and an even stronger association between age and fall rates (Jordan, Nowrouzi-Kia, Gohar, & Nowrouzi, 2015). Taken together, these findings might suggest that although injury prevention should be addressed for nurses of all ages,

perhaps additional exploration of possible age differences in physical injury risk could be potentially valuable.

Summary. Older nurses appear to experience more upper and lower extremity pain. Cumulative effects of nursing tasks may be felt by older nurses disproportionately, who in addition to increased BMIs over the life course might also experience aging of their joints and cumulative impacts of repetitive stress from their activities outside of work as well.

Health Outcomes Found to be Worse in Younger Nurses

Although the sample of nurses in this study as a whole generally reported good health and there were indications that older nurses were more likely to report worse health outcomes in some respects as just discussed, the youngest nurses reported greater likelihood and severity of lower back pain, higher levels of psychological distress and more frequent work-related limitations compared with their older colleagues. These differences may in part reflect changing societal norms and increased awareness and acceptance of reporting certain symptoms in the most recent generations but certainly actual differences in health cannot be ruled out.

Back pain. Lower back pain was more common in both younger generationally-defined age groups (Generation X and Millennials). The Millennial nurses also reported a higher likelihood of moderate to extreme lower back pain than Baby Boomer nurses. Reports of back pain were progressively less common in each older age group.

This is consistent with results of some but not all earlier research that examined age differences in lower back pain in the general population and a limited number of papers specifically examining nurses (however, many studies adjust for age as a potential confounder) (Bernal et al., 2014). A systematic review of studies describing neck and back pain in the general population found a decline in back pain after 60 years of age (Fejer & Leboeuf-Yde, 2012).

Further, Tissot, Messing, & Stock (2009), found in a sample drawn from the general population of Canadians, women aged 18-24 reported more lower back pain in the past 12 months compared with those aged 25-39; no age differences were found in the men studied. Further, researchers in three longitudinal studies described an increasing trend in reporting back pain in the general population although they didn't clearly specify which age groups experienced the most significant increases (Calvo-Muñoz, Gómez-Conesa, & Sánchez-Meca, 2013; Freburger et al., 2009; Leijon & Mulder, 2009). In contrast to the results of the present study, a systematic review of studies (n=25) of Italian nursing personnel published from 1990 to 2007, concluded increased age was associated with increasing prevalence of lower back pain (Lorusso, Bruno, & L'Abbate, 2007).

There are a number of potential explanations for the increased prevalence and severity of lower back pain in younger nurses seen in the present study. Researchers have found support for the widely-held impression that younger individuals today are more sedentary, and spend more time using various digital technologies (including handheld devices) and in total 'sitting time' (Knapton, 2015; Owen, Healy, Matthews, & Dunstan, 2010; Yang et al., 2019). All of these trends (sedentary lifestyle, technology use and sitting) are believed to increase the pressure in the neck and back vertebrae (Knapton, 2015) and provide a possible physiological explanation for greater and more severe lower back pain. It is also possible that these results reflect a tendency in younger people towards considering lower levels of symptoms as potentially meaningful and worthy of investigation and treatment, which along with access to medical care and advice, may have led to a greater likelihood that they would consider themselves to be suffering from low back pain. (Buchbinder et al., 2018) Additionally, the Millennials were the first generation to fully experience the protections extended by the Americans with Disabilities Act (U.S. Congress,

1990), which may have raised awareness about disability-related rights and destigmatized reporting pain-related disability (Sherbin, Kennedy, Jain-link, & Ihezie, 2017).

However, older nurses may also report less lower back pain related to a separate set of factors. There is the possibility of healthy worker/survivor bias—a form of selection bias whereby those in greatest distress or at greater risk of health problems self-select or are selected out of the workforce. This phenomenon and how it might have operated in the current dataset will be discussed at greater length in the Limitations section. The literature provides other explanations as well. In their review of studies from 2000 to 2011, Fejer & Leboeuf-Yde (2012) hypothesized that older nurses may report less back pain due to a higher tolerance for pain, a "survival of the fittest" attitude, and/or perhaps because they avoid pain aggravating activities into their later years.

Yet one more additional possible explanation worth considering, especially given the findings to be discussed in the next section, is that greater prevalence of lower back pain in younger individuals is related to the well-known association between psychological distress and both lower back pain symptoms and outcomes of lower back pain episodes. It is understood that the unpleasantness of back pain symptoms and their impacts can certainly trigger psychological distress. However, it is also well understood that concurrent psychosocial issues can heighten the sensitivity to symptoms, propensity to report them, and difficulty relieving them. Current literature, including several reviews, have supported the association between psychological symptoms and new-onset back pain, manifestations of pain, and reports of pain with disability both in the general population and in nurses (del Campo, Romo, de la Hoz, Villamor, & Mahíllo-Fernández, 2017; Linton, 2005; Pinheiro et al., 2015; Vargas-Prada & Coggon, 2015). Specifically, in a study of healthcare workers, including nurses, those with preexisting anxiety

and depression had five times the likelihood of an incidence of MSDs including back pain compared to those without preexisting anxiety and depression (del Campo et al., 2017).

A number of researchers have noted higher reporting of depression and anxiety symptoms in younger individuals in recent years (including in the current study) (Twenge et al., 2018; Twenge, 2011). Indeed, in supplementary analyses of the current dataset, not presented in Chapter 4, regular back pain was associated with higher likelihood of regular anxiety symptoms ($p < .001$) and back pain was significantly associated with overall psychological distress measured with the K6 ($F_{(1, 1829)} = 30.84$, $p < .001$), with the 160 Millennials who experienced regular lower back pain reporting the greatest psychological distress of any of the groups in the analysis (M=3.64 vs grand mean M=2.23). Wakim (2014) found that Millennial medical-surgical nurses (who were referred to as Generation Y) reported greater use of escape-avoidance behaviors to deal with stressful events than Generation X and Baby Boomer nurses. Back pain could reflect a coping style providing temporary, but not necessarily adaptive, relief for work-related and other stress for at least some younger nurses (Beales, Smith, O'Sullivan, Hunter, & Straker, 2015).

Psychological distress. As just noted, in this study, nurses in the Millennial age group were more likely to report higher levels of psychological distress than their colleagues in the Baby Boomer and Generation X age groups. This finding is consistent with other studies of nurses using a variety of psychological health measures. For instance, in one study of North Carolina hospital nurses, mental well-being was significantly better in older nurses (>50 years old) compared to younger nurses (< 50 years old) although researchers did not specify which tool they used to measure the concept of mental well-being (Letvak et al., 2013). Lavoie-Tremblay, Trépanier, Fernet, & Bonneville-Roussy (2014) found when faced with high cognitive demands,

nurses in Generation X nurses (born between 1965 and 1980) reported less psychological distress than Generation Y nurses (born between 1980 and 2000) as measured by the longer version (K-10 Psychological Distress Scale) (Kessler et al., 2002) of the K-6 tool used in the present study. Lastly, in another sample of Canadian nurses, those older than 50 reported lower levels of reported lower levels of emotional exhaustion than those younger than 39 years old (Blythe et al., 2008).

Interestingly, no differences were identified across age groups in terms of several of the individual psychological distress symptoms including: feeling hopeless, depressed, weary, and worthless, there were significant differences identified in terms of nervousness and fidgetiness with younger (especially Millennial) nurses more likely to report high and frequent nervousness and restless/fidgetiness in the past 30 days. Similar trends have been described in the popular press as well as a number of scholarly works, especially in North America. An increase in mental health complaints related to depression and anxiety have been noted in high school and higher education students, as well as in recent entrants to the workplace (Beiter et al., 2015; Denizet-Lewis, 2017; Novotney, 2014; Thielking, 2017). The American College Health Association's National College Health Assessment (NCHA) dataset provides some of the clearest and most authoritative data in this area, and studies using these data estimate that the overall rate of clinically-significant anxiety in college students aged 18 to 26 rose by approximately 48% between 2008 and 2014 (Scheffler et al., 2018). Of particular relevance to the present study involving members of a heavily-female profession, is the NCHA finding that currently, women students self-reported a doubled odds of having a diagnosis of anxiety in the past year compared to males. (Scheffler et al., 2018) It has been suggested that younger individuals in today's society are more likely to have experienced a "helicopter" parenting style, so described because parents

are thought to "hover over" their offspring, ready to intervene quickly at the earliest sign of problems (Odenweller et al., 2014). Despite the good intentions behind this parenting style, some have linked it with being ill-prepared to independently cope with the rigor and unpredictability in the workplace, elevated levels of psychological distress and heightened risks for more "emotional crises" (Lukianoff & Haidt, 2015). Still other scholars and commentators make reference to cultural shifts. Young adults surveyed in the 1990s and 2000s have tended to report higher levels of self-esteem and a greater propensity to focusing on oneself (Twenge, 2011). Twenge (2010) hypothesizes that although self-esteem and self-focus may serve as a defense against anxiety and depression in the short term, inaccurate self-perceptions and unrealistic expectations could have negative effects on life choices and behaviors (Twenge, 2010) and create considerable distress when transitions to adulthood lead to confrontations with life realities (Twenge, 2011). The results can include feeling overwhelmed and heightened levels of anxiety and depression.

Two social/cultural trends that might also explain higher psychological distress in younger individuals include financial stress and the ubiquity of social media. In a recent Internet-based study, Millennial workers reported the highest levels of anxiety and depression related to financial stressors of any age group (ComPsych, 2016). In this sample, younger nurses were most likely to report holding a second job and this may relate to the financial strain of working in a region where nurses are well-paid but where costs of living are very high (especially given that they are possibly also carrying significant student debt). Additionally, the greater use of technology and screen time by the Millennials provides another possible explanation for heightened psychological distress in the younger nurses. For instance, two recent studies suggested that psychological distress is lower in social media participants with more

"status updates" and "likes and links" (Shakya & Christakis, 2017) and in those who stopped using Facebook use for an entire week (Tromholt, 2016). The influences of deep involvement in social media, obviously more common in younger individuals, on psychological well-being and attention spans is largely a matter of conjecture rather than empirically-supported fact, but also provides yet another explanation for the findings here.

While all of these explanations have a ring of plausibility, it must be kept in mind that the overall differences in psychological distress observed across generations were relatively small. The most striking age differences were seen in the proportions of individuals reporting very frequent distress, consistent with the rise in distress leading individuals to seek professional assistance but could also at least in part reflect a healthy worker bias (see Limitations).

Health-related work limitations. Millennial nurses reported more overall work limitations using the tool in the parent study compared to nurses in the Baby Boomer age group, but not significantly more than Generation X nurses. Relatively small numbers of nurses reported regular work limitations and when individual items from the tool were examined, some of the frequencies were so low that the models did not converge (and therefore no conclusions about associations between age and risk could be drawn). Three types of work limitations linked to psychological wellbeing (rather than physical problems) showed the strongest age trends. Millennial aged nurses reported more regular difficulty starting their workdays compared with Generation X nurses and Millennials reported more difficulty starting their job as soon as they arrived compared to both Baby Boomer and Generation X nurses. Further, Millennial nurses reported more regular reports of difficulty concentrating at work compared with Baby Boomer nurses, but not Generation X nurses. Studies in the literature examining age differences in work limitations using measures such as work ability, presenteeism, and productivity have shown

conflicting and often statistically non-significant results (Lui, Andres, & Johnston, 2018). One study of nurses found higher health-related productivity loss (on a 0- to 10-point rating based on effect of health problems on preventing work over the past 14 days) in the older (over 50) age group (Letvak, Ruhm, & Gupta, 2013). However, the measure used by Letvak and colleagues (2013) was quite different than the health related work limitations questionnaire used in the present study (Letvak, Ruhm, & Gupta, 2013). In a recent systematic review of 'work ability,' researchers found 'work ability' declined with increasing age in most studies, but did report that it appeared entangled with other factors and required further focus in future research (Cadiz, Brady, Rineer, & Truxillo, 2019).

In a field where safe practice is particularly demanding in terms of cognitive skills, the results related to concentration difficulties in younger nurses (even if the absolute rates were low) are of potential concern. There has been limited research describing cognitive functioning in any age groups of nurses. One study (albeit one involving a sample size that might not have offered sufficient statistical power to identify significant differences) failed to identify associations between age and any of the subjective cognitive complaints examined in a group of nurses including attention, concentration, memory, prioritization of tasks, and working accurately and efficiently (Barbe, Kimble, & Rubenstein, 2018).

As discussed above, in relation to other health outcomes which were worse in younger nurses, increasing technology use by younger people may provide an additional mechanism potentially explaining cognitively-related work limitations. The phenomenon of habitual 'media multitasking' (MMT) (Hadlington & Murphy, 2018) in the digital age is believed by some to have also affected cognitive processing abilities including the ability to hold focus and stay attentive among younger people (Consumer Insights, 2015; Hadlington & Murphy, 2018).

According to a widely-cited finding from a non-peer reviewed study by Consumer Insights, a marketing group associated with Microsoft Canada, the average human attention span has dropped from 12 seconds in 2000 to 8 seconds in 2013, reportedly less than a goldfish's average attention span of 9 seconds (Consumer Insights, 2015). Some consider this as confirmation of the negative effects of "screen time" on attention. Hadlington and Murphy (2018), in a study of participants primarily in their 20's, found that individuals who engaged in more frequent MMT reported more everyday cognitive failures. Yet evidence for the impact of continuous use of technologies and frequent "channel switching" on real-world function is inconclusive. For instance, a study of undergraduate students completing a Media Use Questionnaire and completing several online response tasks, media multitasking was found to be not significantly related to general sustained-attention ability (Ralph, Thomson, Seli, Carriere, & Smilek, 2015). In the field of nursing, MMT seems destined to increase in coming years with the ever-growing use of electronic medical records and automated technologies, and it may become increasingly consider its potential impacts on performance and psychological well-being and consider interventions to mitigate potential negative effects.

Further, as was proposed as a possible explanation for pain and mental health reporting differences, increasing awareness and social acceptability of reporting attention and concentration deficits may be a reflection of wider acknowledgement of the existence of attention-related problems and broader acceptance of the integration of those with neurocognitive differences in the workplace (Timimi & Timimi, 2015).

Finally, there is also literature emerging that suggesting that the increasing presence of low back pain (D'Errico et al., 2013; Denis et al., 2007; Yokota et al., 2019) and psychological health problems (Leijten et al., 2014; Umann, Silva, & Guido, 2014) seen in this study are also

significant predictors and correlates of reporting work limitations. Further exploring the entangled relationships of these various types of limitations across different age groups may turn out to be useful in explaining worse overall work-related health in younger nurses, should this finding be replicated in other studies.

Summary. Younger (Millennial) nurses were seen in this study to be at higher risk of severe, regular lower back pain. They were also found to report higher levels of nervousness and restlessness. In the case of the psychological well-being findings, potential explanations for these results include parenting style, heavy technology/device use, and changing societal norms around reporting and treatment of various conditions are largely speculative. Furthermore, it might be expected that rising disability accommodations in K-12 and university studies for anxiety disorders, attention issues, and other mental health concerns might now be leading to a greater likelihood of diagnosis and self-definition of in the nurse workforce as well as in the general population, with consequences that not yet fully evident.

Summary

While some patterns were identified whereby higher body mass indices, along with greater levels of certain types of musculoskeletal pain, injuries and absences were more common in older nurses, and lower back pain, certain types of psychological distress, and work limitations apparently related to non-physical aspects of health were more common in younger nurses, it bears repeating that the overall health of the nurses studied here was quite good. None of the three age groups of nurses was obviously more or less healthy than the others, many of the differences in age differences were relatively small and/or related to relatively narrow aspects of health, and for several of the health outcomes analyzed, no age differences were found.

There were several differences in nurse health outcomes across age groups. Each

successive age group had significantly higher BMIs with older nurses, also reporting more upper and lower extremity pain severity in the arms, shoulders, hands, legs, and knees. Additionally, older nurses in the Baby Boomer and Generation X age groups also appear more likely to have work absences and need to reduce or alter their work due to injury or musculoskeletal pain symptoms compared to younger age groups. These findings are congruent with other findings that physical health declines as aging workers likely experience reduced muscular mass and strength of their musculoskeletal system (Shojaei, Vazirian, Croft, Nussbaum, & Bazrgari, 2016; Voorbij & Steenbekkers, 2001) resulting in a higher prevalence of musculoskeletal conditions (Heiden et al., 2013; Palmer & Goodson, 2015) across the life course.

Despite showing lower BMIs than older nurses, Millennials were more likely to report presence of lower back pain than older age groups. Additionally, the psychological health, principally due to regular reports of nervousness and restlessness, reported by each successive generationally-defined age groups is worse than its older colleagues in the other generationally-defined age groups. Further, although fewer than 1 in 10 of nurses in this sample reporting difficulty in work activities/limitations 50% or greater of time, specifically starting one's job upon arrival at work and difficulty concentrating were significantly more likely to be reported by younger generationally-defined age groups. An extensive set of potential explanations for these findings were reviewed.

These findings reflect the self-reported physical and psychological health status of nurses from a special set of hospitals at one point in time in 2014. Several strengths and limitations of the study design suggest the need for caution before extrapolating the findings here. These will be discussed further in the next section.

Study Strengths and Limitations

Many of the strengths of this secondary analysis relate to careful design of the parent BHWHS study, including the large sample and high response rates suggesting that confidence in the patterns of results as representative of nurses in the two hospitals is warranted. Additionally, the use of validated measures (or portions of measures) in the survey allowed for comparisons with earlier work and further add to the credibility to the findings.

A number of limitations of this study as a study of age/generational differences should be borne in mind as well. One such limitation lies with the cross-sectional design of the analyses, which examined responses from surveys conducted at a single point in time. Cross-sectional designs are limited in their ability to inform conclusions about causality and true generational effects. They are also associated with heightened likelihood of identifying spurious associations. In the specific case of this study, a cross-sectional design makes it impossible it to identify true generational differences given that it doesn't permit disentangling of age from membership in a birth cohort as a correlate of health outcomes (which is impossible without data following nurses across their careers/life courses). This was a study of generationally-defined age groups—an analysis of associations of various health indicators with being young, in the middle of the pack on age, or among the oldest nurses in 2014. Because cohorts of nurses were not followed forward over time and their membership in age categories was not examined over time and period, this was not a true generational study of nurse health so any conclusions about Millennials, Generation Xers or Baby Boomers as members of a generation must be tempered (Lyons & Kuron, 2014; Stevanin et al., 2018).

Furthermore, the main measures here were nearly all gathered from a one-time survey. In addition to the biases created by relying on a common data collection method, there are possible problems in terms of self-reporting errors and biases in the measures.

Additionally, several limitations in terms of the study's sample and the sites are important to consider. The sample of nurses was drawn from two hospitals that were quite similar (both top-ranked urban research- and teaching-intensive facilities affiliated with the same prestigious university medical school) and that are located in the same city known as an international hub for health care, which many would consider to provide a very distinctive social and economic context for the nurses and their careers. Further, Massachusetts holds a very high ranking among states in terms of population health indicators of various types ("Best States for Healthcare," 2018; United Health Foundation, 2018). The nurses themselves showed relatively little diversity in their backgrounds—they were primarily Caucasian women. For these reasons, the findings may not be generalizable or representative of all nurses practicing in the United States. Further, the patterns observed in this study might either have been attenuated or accentuated by the uniqueness of the sample and might be quite different in nurses of more diverse backgrounds working in different types of institutions.

Additionally, the two hospitals are known to be particularly desirable places to work as well as highly selective in their hiring of nurses. The sample might therefore have included high numbers of "healthy survivor" older nurses and a select group of early career nurses, which may have minimized the levels of health problems seen in either or both age extremes.

Several exclusion criteria in the parent study may have led to biases. Invitations to participate in this study excluded nurses on a leave of absence (>12 weeks) in the past year and those who worked less than 20 hours/week including traveling or per diem nurses (Sabbath et al., 2017). Both these exclusion criteria may have distorted the sample in various ways. A sample restricted to nurses not on sick leave and that leaving out part-timers working fewer than 20 hours/week may have excluded the sickest nurses in the hospitals' workforces, who may have

had different health outcomes in terms of leave of absences, reduced hours, or working in non-participating units (where physical and psychological demands may have been lower), leading to underestimates of health problems in the sample at large and perhaps disproportionately lower estimates in older nurses who are more likely to experience work modifications.

Lastly, considering the results related to poorer health outcomes in any group of nurses (young or old) to be reflective of effects of age or time in the profession as a risk factor (or as a risk mitigator) for health impairments must consider the likelihood of survivor bias influencing the distribution of health indicators in the sample (Li & Sung, 1999). Although the findings here are likely an accurate reflection of the health patterns of nurses in the full-time nursing workforce at these two hospitals, drawing conclusions about impact of age or experiences on health status from these data is risky because at least some unhealthy nurses likely dropped out of the full-time nursing workforce or moved to less physically-demanding work settings. This left a subset of workers in the study cohort for whom any health impairments they experienced were not severe enough to impact their work. For instance, the nurses in the Millennial group may have reported higher levels of back pain because they hadn't yet had a chance to develop pain severe enough or of long enough duration to cause them to move to a different setting or leave nursing altogether. Back pain may have driven others out of hospital staff nursing, leaving only those Generation X and Baby Boomer nurses with no pain or pain not severe enough to limit their work in the hospital setting in the sample. Such healthy worker bias may be operating to different extents in relation to different health conditions—for instance, perhaps no differences were seen in terms of depressed mood across age groups because depressive symptoms were more likely to lead to individuals being selected out of the pool of subjects than, for instance, symptoms of anxiety. Experience in the hospital or in the profession was excluded from analysis

here because the correlations between measures of nursing experience (i.e. years since nursing licensure) and age were so strong. This is a further reason to emphasize that this is a cross-sectional study of "healthy workers" rather than a study of experience or tenure in the profession as a correlate of health outcomes and is particularly salient, given that there is perhaps greater diversity in age at entry to practice in the profession than ever before and because age and experience have different implications from an occupational health perspective.

Despite the limitations described above, the findings from this study appear to clearly describe the relationship between three generationally-defined age groups and self-reported health of a cross-sectional sample of acute care nurses in two similar hospitals in one region of the United States. While the results here should be replicated in other populations, preferably across nurses drawn from a broader cross-section of personal backgrounds and working for a broader cross-section of employers before using them as a basis for dramatic changes in policy, they nonetheless have implications for leaders in nursing, which will be presented next.

Implications for Nurse Administrators (and the Profession)

The findings of this study related to favorable health for most nurses, significant impairments in small, albeit non-trivial, numbers of nurses in all three age groups, and relatively small age differences in many cases, suggest that on balance most strategies to improve nurse health should target risk factors rather than age groups (Poscia et al., 2016).

Nurse administrators managing and leading teams in health care organizations play a key role in creating a culture of health (Goetzel et al., 2014) through support of healthy behaviors at work and broad-based health promotion and wellness programs (Phillips & Miltner, 2015). However, there is a paucity of studies of workplace wellness and health promotion strategies that specifically targeting nurse health. A critical mass of evidence to make recommendations

regarding effective interventions targeting the nurse health outcomes addressed in this study exist for the following areas, as reflected in the systematic reviews cited: health promotion behaviors (Chan & Perry, 2012; Letvak, 2013; Romppanen & Häggman-Laitila, 2017; Williams et al., 2018), obesity (Kelly & Wills, 2018; Torquati, Pavey, Kolbe-Alexander, & Leveritt, 2017), musculoskeletal pain (Budhrani-Shani, Berry, Arcari, Langevin, & Wayne, 2016; Richardson, McNoe, Derrett, & Harcombe, 2018; Van Hoof et al., 2018), and psychological distress (Ghawadra, Abdullah, Choo, & Phang, 2019). In general, these reviews draw conclusions from a handful of high-quality studies showing statistically significant improvements with long term sustainable improvements; unfortunately the benefits reported are of unclear generalizability.

Collectively, formal on-site structured wellness and exercise programs, Mindfulness Based Reduction Strategies (MBRS) including Tai Chi and yoga, promoting increase intake of fruits and vegetables have been shown to somewhat improve physical and psychological health, reduce obesity, improve work ability, and prevent injuries to nurses (Kelly & Wills, 2018; Letvak, 2013; Romppanen & Häggman-Laitila, 2017; Schliemann & Woodside, 2019; Torquati et al., 2017; Williams et al., 2018). Although for the most part, these reviews cite more limited evidence drawn from lower-quality studies, MBRS appears to reduce low back pain (Budhrani-Shani et al., 2016), implementation of patient lift systems and patient handling training appears to reduce musculoskeletal pain and injuries, cognitive behavioral therapy to reduce psychological distress, and wearing supportive shoes is linked to reduced injuries (Richardson et al., 2018; Van Hoof et al., 2018). Lastly, it also bears mention the increasing role technology both in ameliorating related cognitive work limitations and as a mode for supporting health promotion and wellness interventions and initiatives in the future such as health applications and tablets (ComPsych, 2016). In summary, the findings from this study provide an initial platform for

nursing administrators to identify which nursing health outcomes need to be targeted in a multidimensional approach to workplace health and wellness. It also appears at a minimum, administrators should focus efforts on communicating the inherent health risks for nurses across the life course. Nursing leaders need to create a culture of health which establishes programs and policies that align with the organization's productivity goals, aging workforce, provide adequate resources, and encourage and incentivize participation by all age groups (Passey, Kavanagh, Hammerback, Harris, & Hannon, 2016). Nursing administrator support for health promotion and wellness activities aimed at nurses appears critical to the success of interventions and initiatives (Passey et al., 2016).

Despite limited evidence of widespread poor psychological health in the sample, given that younger nurses being significantly more likely to report high anxiety and in light of other data accumulating related to mental health issues, nurse leaders need to remain vigilant about psychological distress (including, but not limited to severe manifestations of distress) in the profession. For instance, higher rates of suicide were identified in nurses relative to matched counterparts in the general population in a 2014 dataset (Davidson, Proudfoot, Lee, & Zisook, 2019).

A disproportionate number of highly distressed young nurses in this sample may or may not be a sign of an "age of anxiety" at work in society more broadly. This finding and widely-discussed rising mental health challenges on American college campuses (Beiter et al., 2015; Denizet-Lewis, 2017; Novotney, 2014; Thielking, 2017), provide ample support for continuing to study psychological distress in nurses and developing cost-effective and scalable methods for preventing and treating its more severe manifestations.

On a final note in terms of recommendations, this study points out that although

generational theory/ideas have been very popular in the profession and in society more broadly and stereotypical depictions of the perceived shortcomings of younger generations are common, examining actual data suggests that differences may be small and that patterns may be considerably more subtle than popular thinking might suggest. Leaders should likely shift from unsupported stereotyped attitudes, beliefs, expectations, and behaviors in the workplace to using evidence-based management strategies for improving the health of nurses until clear and compelling evidence for treating generations differently emerges.

Directions for Future Research

While there has been a decades-long tradition of occupational health research on nurses and generational differences have been of active interest in the profession for at least a decade, the study of age (and generational trends) in health and well-being of the members of the profession has been limited. Further research may either suggest that greater emphasis on age/generational explanations and a focus on age/generational factors in health promotion interventions for nurses may be appropriate or may suggest that broad-based strategies across age groups (and/or emphasizing other risk factors).

Rigorous exploration of the possibility of generational differences of health outcomes in the nursing workplace will require carefully assembled samples of nurses and longitudinal follow-up in addition to more clearly articulated conceptual foundations for exploring possible associations (and including means of testing potential explanatory factors and mechanisms). For instance, longitudinal studies in particular will help determine whether any of the trends in this study are maintained as nurses age and whether the post-Millennial generation of nurses, now graduating from nursing school will experience a similar pattern of health outcomes as Millennials. As stated earlier, different populations from a more diverse range of nurses and work settings will be

important. In addition, inclusion of purposefully chosen comparison groups (perhaps non-nurses, perhaps nurses working in other settings) should be considered in replications (Li & Sung, 1999) to strengthen confidence in differences. Careful attention to selecting indicators of various domains of health of most relevance and that will allow comparison with earlier studies will be important in future studies. In some instance more detailed or specific questions about a smaller range of health outcomes may be worthwhile. If sample sizes in future studies will permit it, separating nurses into smaller age groups (i.e. 5 years) could facilitate an examination of the form of any relationships between age or generation identified in future research.

Contribution of the Study to the Literature

Review of the literature suggests that this study is one of the very first to examine a range of health indicators (physical and psychological health) in relation to age formed along generational lines in a recent sample of hospital nurses. It provided a detailed snapshot of a 2014 cohort of full-time hospital nurses and stands in contrast to the heavy emphasis on anecdote and impressions in the literature on generational differences. Findings regarding physical health risk factors such as body mass indices, and injuries and pain-related limitations as well as psychological distress in the youngest generationally-defined age groups point to important areas for future research. Describing the health status of nurses across age groups contributes to the ongoing development of evidence-based organizational interventions; results here, while intriguing, suggest a need to await further information before changing policy.

Conclusion

The findings from this study offers a profile of different domains of nurse occupational health across generationally-defined age groups in a hospital setting. The overall occupational health in this sample of nurses was quite positive with relatively few nurses in this sample

reporting serious physical or psychological health problems or limitations. However, this study did identify several specific differences in physical and psychological health across domains. Given the mixed findings, many of which were relatively subtle and/or relate to relatively small groups of nurses, it appears that reliance on stereotypes regarding ages and generations may distract the larger challenges of promoting well-being in the nurse workforce.

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Appendices

Appendix A: Informed Consent for Parent Study

Patient Care Worker Research Survey

BRIGHAM AND WOMEN'S HOSPITAL

MASSACHUSETTS GENERAL HOSPITAL

NIOSH (the National Institute for Occupational Safety and Health) has given the Harvard School of Public Health (HSPH) and Partners Occupational Health Services a grant to study health, safety and wellness among patient care workers. Inpatient care units at Brigham and Women's Hospital and Massachusetts General Hospital have been chosen to participate in the research study. You have been randomly selected to participate in this survey. The ***Be Well Work Well*** survey gathers information about your work experiences, programs and policies at work, and how these may be related to your health on and off the job. The survey will take no more than 30 minutes to complete.

This information will be used for research purposes only. No one at your hospital will see your answers. **We have created a unique survey ID number; all identifying information will be removed and will not be linked to you personally.** We will also use this same ID number in linking your survey information to other coded information obtained from your employee record, including demographic information, work shift data and benefit information. Only the project director will have the code that identifies you, which will be locked in a file cabinet. Thus, your information will be kept completely confidential and no one will be able to link any of the information back to you or your unit. Your identifying information will be destroyed after the end of the study.

Participation is voluntary. If you choose to take part, you may change your mind and leave the study at any time without penalty. Refusal to participate or withdrawal will not involve a penalty or loss of benefits to which you are otherwise entitled.

There are no known risks or benefits from participation in this study. Completing the survey indicates your consent to participate in the study. You do not need to finish the survey at one time and can stop and restart at any time. While we encourage you to complete all questions to give us valuable information, you are free to skip any of the questions you do not feel comfortable answering. After you complete the survey, **we will send you a $20 gift card to Amazon.com***. For more information, or if you wish to remove your name from our contact list, please call Evan McEwing, RN, Project Director at (617) 582-7912 or email him at emcewing@partners.org. Glorian Sorensen, PhD, MPH is in charge of this research study. You can call her at 617-632-2183 weekdays between 9:00am – 5:00pm with any concerns or questions. If you wish to speak with someone not directly involved in this research study about your rights as a research subject, please contact the HSPH Office of Regulatory Affairs & Research Compliance. They can be reached at 617-432-2149 or 90 Smith Street, Boston, Massachusetts 02120 for any of the following:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You have questions about your rights as a research participant.
- You want to get information or provide input about this research.

Once you have completed the survey, please either

- Drop it off at the Occupational Health Department at your institution

OR

- Return your survey in the self-addressed stamped envelope

Thank you for your participation!

Disclaimer:

*Amazon.com is not a sponsor of this promotion. Except as required by law, Amazon.com Gift Cards ("GCs") cannot be transferred for value or redeemed for cash. GCs may be used only for purchases of eligible goods on Amazon.com or certain of its affiliated websites. For complete terms and conditions, see www.amazon.com/gc-legal. GCs are issued by ACI Gift Cards, Inc., a Washington corporation. ©,®,™ Amazon.com Inc. and/or its affiliates, 2012.

Appendix B: Variables in the Secondary Analysis

Table B1

Independent Measures

Independent Measure	Data Source	Type of Data
Age	Survey	Demographic worker characteristics
Birth Year	Human Resources	Demographic characteristics

Table B2

Measures of Potential Confounding Variables

Potential Confounder	Data Source	Type of Data
Gender	Survey & Human Resources	Demographic worker characteristics Sociodemographic characteristics
Marital/Cohabitation Status	Survey	Sociodemographic characteristics
Race Ethnicity Immigration status	Survey & Human Resources	Demographic worker characteristics Sociodemographic characteristics
Work hours	Survey &	Occupational worker demographics
	Human Resources	Paid hours of work; Overtime
Second job	Survey	Occupational worker demographics
Shift-type worked	Survey	Occupational worker demographics
Primary clinical specialty	Survey	Occupational worker demographics

Table B3

Dependent Measures

RQ	Concept	Dependent Measures	Data Source	Type of Data
1	Physical health	BMI	Survey: Worker health and well-being	Self-reported-height & weight
		Pain	Survey: Worker health and well-being	• Pain severity • Pain interference with work • Musculoskeletal symptoms and functional limitations
		Occupational injury and illness	Occupational Health Services Survey: Worker health and well-being Survey: Physical occupational exposure	• Self- reported injuries
2	Psychological health	Psychological distress	Survey: Worker health and well-being	K-6
3	Work-related health	Work Limitations	Survey: Worker health and well-being	Work Limitations Questionnaire

Appendix C: Correlation Matrix for Predictor Variables

Predictor	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Baby Boomer	—																	
2. Generation X	-.42**	—																
3. Race/Ethnicity	-.02	.09**	—															
4. Sex	.01	.05*	.08**	—														
5. Married	.05*	.20**	-.02	.04	—													
6. Foreign Born	.00	.11**	.48**	.06*	.02	—												
7. Second Job	-.09**	.02	.02	.01	-.01	-.06*	—											
8. Full Time	-.06*	-.27**	.12**	.11**	-.31**	.07**	-.02	—										
9. Intensive Care Unit	-.07**	.03	-.02	.16**	-.05*	.01	-.02	.03	—									
10. Medical Surgical	-.17**	-.12**	.08**	-.03	-.09**	.02	-.03	.16**	-.42**	—								
11. Emergency	.04	.02	-.02	.04	-.02	-.02	-.02	.05*	-.08**	-.16**	—							
12. Obstetrics	.13**	.09**	-.01	-.07**	.10**	.01	.07**	-.16**	-.18**	-.37**	-.07**	—						
13. Pediatrics	.07**	.03	-.08**	-.08**	.10**	-.10**	.02	-.10**	-.20**	-.38**	-.08**	-.17**	—					
14. Operating	.15**	-.01	.03	.02	-.03	.07**	-.02	-.03	-.08**	-.17**	-.03	-.07**	-.08**	—				
15. Evenings	.04	.04	-.04	.05*	.06*	-.01	-.04	-.17**	-.07**	.06**	.01	-.04	-.02	.07**	—			
16. Nights	-.02	.17**	.03	-.07**	.09**	.01	-.07**	-.08**	-.04	-.06**	.02	.10**	.06*	-.10**	-.10**	—		
17. Rotating	-.23**	-.19**	.01	.04	-.16**	-.02	.08**	.19**	.08**	.11**	.02	-.13**	-.06**	-.10**	-.14**	**-.50****	—	
18. No Regular Shift	.05	.00	.03	.00	-.03	.01	.01	-.07**	-.02	-.02	-.00	-.01	.03	.04	-.05	-.17**	-.23**	—

Note. **Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed). **Boldface** is highest correlation values among predictors.

Appendix D: Health Indicators in Generation X versus Baby Boomer Nurses

Table D1

Parameters Suggestive of Statistically Significant Differences between Generation X and Baby Boomer Nurses on Nurse Occupational Health Indicators (Continuous)

Health Indicator	Unadjusted Parameters			Adjusted Parameters[a]		
	β [CI 95%]	*SE*	*p*	β [CI 95%]	*SE*	*p*
Physical nurse health						
Body Mass Index	-.96 [-1.59, -.34]	.32	.003	-1.19 [-1.84, -.54]	.33	<.001
Psychological nurse health						
K-6 Psychological Distress Scale	.41 [.07, .74]	.17	.02	.45 [.13, .78]	.17	.01
Overall nurse occupational health						
Work Limitations Scale	1.70 [.09, 3.31]	.82	.04	1.12 [.30, 2.54]	.72	ns

Note. All parameters derived from regression models with Baby Boomer as the reference category for the generation variable, with weighting to correct for differential sample sizes of staff across nursing units and correction for clustering of nurses within hospital units using generalized estimating equations.

[a] Adjusted for demographic and individual-level work characteristics: sex, marital status, race/ethnicity/birth origin, hours, shift-type worked, and primary clinical specialty.

β = Beta coefficient; SE = standard error; CI= confidence interval at 95%.

Significance at .05 level; ns=nonsignificant.

Table D2

Odds Ratio (OR) of Statistically Significant Associations between Generation X and Baby Boomer Nurses and Nurse Occupational Health Indicators (Categorical)

Health Indicator	Unadjusted OR		Adjusted OR[a]	
	Expβ [95% CI]	*p*	Expβ [95% CI]	*p*
Physical nurse health				
Presence of pain				
Lower back	1.75 [1.33, 2.30]	<.001	1.58 [1.19, 2.09]	.001
Shoulder	1.32 [.00, 1.74]	.05	1.33 [1.00, 1.77]	.05
Wrist	.63 [.44, .91]	.01	.60 [.41, .89]	.01
Knee	.63 [.47, .84]	.002	.60 [.45, .79]	<.001
Severity of pain				
Lower back	1.91 [1.34, 2.73]	<.001	1.66 [1.17 2.35]	.004
Arm/shoulder	.70 [.49, .99]	.04	.67 [.45, .99]	.05
Leg/knee	.64 [.44, .92]	.02	.64 [.42, .97]	.04
Absent from work d/t pain	.67 [.53, .85]	.001	.73 [.58, .93]	.01
Psychological nurse health				
"So sad"	.54 [.31, .94]	.03	.52 [.29, .93]	.03
Restless/fidgety	1.30 [.84, 2.03]	ns	1.64 [1.08, 2.50]	.02
"Everything was an effort"	1.66 [1.05, 2.63]	.03	1.57 [1.00, 2.48]	.05
Overall nurse occupational health				
Concentrate	2.24 [1.25, 4.00]	.01	2.15 [1.16, 3.96]	.02

Note. All parameters derived from regression models with Baby Boomer as the reference category for the generation variable, with weighting to correct for differential sample sizes of staff across nursing units and correction for clustering of nurses within hospital units using generalized estimating equations.

[a] Adjusted for demographic and individual-level work characteristics: sex, marital status, race/ethnicity/birth origin, hours, shift-type worked, and primary clinical specialty.

expβ = exponentiated Beta coefficient; CI= confidence interval at 95%*;*
Significance at .05 level; ns=nonsignificant.