

Who Cares about the Health of Healthcare Professionals? An 18-Year Longitudinal Study of  
Work Demands, Health, Job Satisfaction and Turnover among Nurses

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## **Abstract**

Healthcare professionals are employed in a complex, stressful, and sometimes hazardous work environment. Studies on the health of healthcare professionals tend to focus on estimating the effects of short-term health outcomes on employee attitudes and performance which are easier to observe than long-term health outcomes. Only scant attention has been given to work characteristics that are controlled by the employer and its employees and their relationship to long-term employees' physical health and organizational outcomes. To address this gap we use data from the National Longitudinal Survey of Youth (NLSY) to estimate the relationship between work characteristics, long-term physical health, job satisfaction and turnover of 245 registered nurses (RNs) from 1992 to 2010. Using a between- and within-person design we estimate how within-person change in work characteristics affects the within-person growth trajectory of Body Mass Index (BMI) over time. We then study the relationship between RNs' work characteristics, job satisfaction, changes in physical health, and job turnover. We find that RNs who work day shifts suffer from a steeper increase in their BMI trajectory over time. In addition, RNs with higher BMI are more likely to leave the nursing occupation. The importance of managing the long-term health of healthcare employees is discussed.

## INTRODUCTION

Healthcare systems and their outcomes have been studied extensively by focusing on performance and other organizational outcomes (e.g., Coffey, Skipper, and Jung 1988; Edwards and Robinson 2004; Laschinger, Finegan, and Shamian 2001; Preuss 2003; Scott, Rogers, Hwang, and Zhang 2006; Weinberg, Avgar, Sugrue, and Cooney-Miner 2013) as well as on work-related individual outcomes (e.g., Avgar, Pandey, and Kwon 2012; Avgar, Givan, and Liu 2011a, b; Clark, Clark, Day, and Shea 2001; Edwards and Robinson 2004; Zeytinoglu et al. 2007). Paradoxically, the physical health of healthcare employees, its antecedents, and its outcomes have received less attention (Egger, Smith, and Altman 2007). This is despite the fact that employees' physical health is important for individuals, families, and organizations. For individuals, physical health is related to longevity (Corroni-Huntley et al. 1991; Luo, Hawkey, Waite, and Cacioppo 2012), quality of life (Helgeson, and Lepore 2004), social mobility (Power, Matthews, and Manor 1996; Van de Mheen, Stronks, Schrijvers, and Mackenbach 1999), and career outcomes (Saporta and Halpern 2002). Research has also shown that health among family members is often interrelated (e.g., Martire, Lustig, Schulz, Miller, and Helgeson 2004). Similarly, employees' physical health is also critical to organizations; health insurance costs incurred by employers are directly related to employees' health (Alere 2011; Flegal, Carroll, Ogden, and Curtin 2010) and employees' health has been shown to have an effect on organizational outcomes, such as turnover (Carlson et al. 2011), satisfaction (Faragher, Cass, and Cooper 2005) and performance (Ford, Cerasoli, Higgins, and Decesare 2011; Fronteira and Ferrinho 2011; Jacobs, Tytherleigh, Webb, and Cooper 2007). We therefore focus our attention in the current study on registered nurses (RNs) and the relationship between their work demands, physical health, and two individual and organizational outcomes: job satisfaction and turnover.

RNs are especially prone to work-related threats on their physical health. The work environment for RNs is often stressful (Fronteira and Ferrinho 2011) and filled with potential risks of exposure to biohazards, diseases and tasks that can lead to musculoskeletal injuries (Fronteira and Ferrinho 2011). In addition, studies have shown that many RNs work irregular schedules (Rogers, Hwang, Scott, Aiken, and Dinges 2004), develop unhealthy eating habits as a result of the unpredictability of their work demands (Callaghan, Tak-Ying, and Wyatt 2000; Wong, Wong, Wong, and Lee 2010), and are not physically active at work (Hughes, and Rogers 2004; Rogers et al. 2004). Finally, RNs' turnover is a significant and costly problem that almost all healthcare organizations must confront (Jones 2008; Poghosyan, Aiken, and Sloane 2009). Because the turnover of experienced RNs out of the nursing profession is costly and represents a great loss of human capital, the long term determinants of RN turnover are important to study.

However, most studies are limited in their ability to observe a causal relationship between the work environment in healthcare organizations and health outcomes of RNs for several important reasons. First, these studies are almost exclusively cross-sectional, which limits their ability to draw causal relationships. Second, health outcomes, and especially physical health outcomes (e.g., obesity), may take a long time to develop. As a result, most studies focus on short-term indicators of health that are stress related (e.g., blood pressure and blood glucose) and not on health conditions that may be slower to develop. Third, most studies employ a between-person design that cannot rule out reverse causation between the variables and self-selection of employees into work demands based on a prior health condition. For example, RNs with health problems may choose lighter work load than RNs with no health problem. We attempt to overcome these limitations by utilizing a unique dataset to explore how between-person difference and within-person change in work demands affects RNs' physical health, job

satisfaction, and turnover. Specifically, we follow the same RNs over 18 years (11 waves of data) to examine how within-person change in work demands (i.e., work hours and work schedule) affects within-person change in Body Mass Index (BMI); we then examine how between-person differences in job demands, BMI, and job satisfaction relate to high turnovers of RNs to careers outside of the nursing profession.

The contributions of this study are threefold. First, this study extends our understanding of the relationship between work demands and individual physical health while using a rigorous longitudinal design. By concentrating on RNs, we are able to isolate many of the confounding occupational variables (e.g., complexity, responsibility, and physical demands) that exist among different professions and which may affect the relationships between work demands, health, and individual and organizational outcomes. Second, the 18-year longitudinal design allows us to explore physical health outcomes that are unobservable in studies that are cross-sectional and of limited duration. Specifically, we take into account that potential changes in physical health are slow to develop; and, that changes in health emanating from the within-person trajectory are more important than those related to between-person differences in health. Third, we contribute to a better understanding of the antecedents and outcomes of the health and well-being of healthcare employees. This will allow healthcare organizations to improve the quality of care they provide to all stakeholders: not only to their patients, but also to their employees. Finally, we conduct a system-wide view on the turnover of healthcare professionals by focusing on experienced RNs who leave their profession, and not simply on organizational turnover. Turnover costs per RN are estimated to be between \$82,000 and \$88,000 (Jones 2008) and the Bureau of Labor Statistics (BLS 2013) predicts a total of 1.05 job openings for nurses by 2022 due to growth and replacements. This high demand for RNs is not likely to be met by nursing

schools across the U.S. (American Association of Colleges of Nursing 2014). As such, the turnover of RNs' outside their profession is an acute problem for healthcare systems that deserves more attention.

## **THEORY AND HYPOTHESES**

The current study focuses on the physical health of employees as both an outcome of the demands that nursing work imposes on RNs and as a predictor of turnover among healthcare professionals. We begin by developing our hypotheses about the relationship between work demands and physical health, with a special focus on the work demands faced by healthcare professionals. We then continue developing our hypothesis by examining the role of physical health and job satisfaction in relation to employee turnover. We use BMI as our physical health indicator. BMI is an objective health measure, which is a widely used indicator of health in the medical field and is highly correlated with other physical health indicators, such as cholesterol levels, body fat, diabetes, coronary heart disease, lung function, and death (Kopelman 2000; Pistelli et al. 2008; World Health Organization Expert Committee 1995). Because BMI for most individuals is expected to increase with age (Kuhnlein, Receveur, Soueida, and Egeland 2004; Torrance, Hooper, and Reeder 2002) our analyses is based on changes in the growth trajectory of BMI over time. Specifically, we estimate how the trajectory (or slope) of BMI growth will be affected by work demands (i.e., work hours and work schedule); and, we expect greater work demands to be related to a steeper BMI growth trajectory. In addition, we explore the relationship of work demands and job satisfaction. Finally, we explore how physical health and job satisfaction affect turnover, with the expectation that higher job satisfaction and better health (lower BMI) will reduce the likelihood of turnover for RNs. Note that we do not test the slope in the latter relationships; instead, we expect that the main effect of work demands on job

satisfaction, and the main effect of job satisfaction and health on turnover, will be negative. We provide a detailed description of our analyses in the Analytic Strategy and Results sections.

Figure 1 depicts the research model of the paper.

[Figure 1 about here]

### **Work Demands and Individual Health**

Work demands include different work characteristics that consume time and energy, and create strain for individuals (Byron 2005; Greenhaus and Beutell 1985; Ilies, Wilson, and Wagner 2009; Voydanoff 2004). Research has emphasized the number of work hours as one of the central demands that work imposes on individuals (Voydanoff 2004). Another frequently cited work demand that is especially relevant to RNs is working schedule (Eby, Casper, Lockwood, Bordeaux, and Brinley 2005; Edwards and Rothbard 2000). RNs may work regular day shifts as well as irregular (evening and night) shifts. Note that work demands represent what could be called objective work demands, and not necessarily the perception of conflict between work and family demands. We thus diverge from the literature of work-family conflict and its emphasis on the effect of work-family conflict on stress and general mental health (Eby et al. 2005).

The conservation of resources theory (COR) proposes that individuals seek to maintain the resources they possess, utilize resources economically, and replenish the resources they use most efficiently. When facing a loss of resources, individuals are likely to experience health problems (Grandey and Cropanzano 1999; Hobfoll 1989). Resources include time, physical and mental energy, personal characteristics (e.g., individual differences), and work conditions (e.g., the work environment). We focus on time and energy as the two most relevant resources for

working individuals (Hobfoll 1989) and keep the work conditions constant by focusing on a single occupation.

Time is among one of the most important resources that employees have: this is because it cannot be replenished once lost. Similarly, energy, both physical and mental, is also a finite resource that cannot be replenished easily. An increase in work hours or a change to an irregular work schedule depletes both resources of time and energy that individuals possess and may result in negative health outcomes; this is because such a depletion is likely to result in lower engagement of individuals in health promoting behaviors such as preparing and eating healthy food, exercising, and sleeping (Barnes, Wagner, and Ghumman 2012; Edwards and Rothbard 2000).

Different studies provide support for this argument and show that individuals who experience increased time and energy demands at work are more likely to abandon health-promoting behaviors, such as exercising, in order to leave enough time and energy resources for meeting work and non-work demands (Backett and Davison 1995; Brown, Brown, Miller, and Hansen 2001; Brown and Trost 2003; Nomaguchi and Bianchi 2004). For example, studies in the healthcare setting have found that excessive work hours are positively linked to reduced personal health and sleep deprivation (Hughes and Rogers 2004; Rogers 2008; Weinger and Ancoli-Israel 2002). Unruh and Nooney (2011) have shown that RNs who worked longer hours reported significantly higher levels of “working very fast,” “working very hard,” “no time to get things done,” and “more work than can be done well,” all of which are likely to be connected to a depletion of energy resources. Similarly, changing a work schedule from a regular shift to an irregular shift potentially increases the demands that individuals may face and will deplete energy resources. Individuals who work irregular shifts in particular must confront the challenge

of scheduling their available time not only because their work hours are erratic but because they are no longer in sync with family members and social institutions, which makes healthy lifestyle maintenance even more difficult to achieve (Staines and Pleck 1984). Working irregular shifts increases individual transaction and coordination costs and consumes both resources of time and energy. In addition, research has shown that working irregular shifts has direct effects on physical health. Specifically, working evening and night shifts is associated with sleep deprivation, daytime sleepiness, insomnia, difficulty getting to sleep, and lower quality of sleep (Åkerstedt 2003; Härmä, Tenkanen, Sjöblom, Alikoski, and Heinsalmi 1998; Ohayon, Lemoine, Arnaud-Briant, and Dreyfus 2002) as well as with breast cancer (Grundy et al. 2013). In sum, working irregular shifts requires individuals to invest more energy resources in meeting demands both in the workplace and outside of it, therefore depleting the energy resources individuals possess for engaging in health-promoting behaviors such as exercising, sleeping, and eating well. We therefore expect to find both a between- and within-person effect of work demands on physical health. The between-person effect will result in differences between individuals with greater work demands and individuals with lower work demands; the within-person effect will result in steeper deterioration of health among individuals who increase their work demands over time relative to individuals who do not increase their work demands over time. Specifically, we propose that:

*Hypothesis 1a: RNs work hours will be positively related to BMI.*

*Hypothesis 1b: A within-person increase in an RN's work hours will be related to a within-person increase in the RN's BMI growth trajectory over time.*

*Hypothesis 2a: RNs who work irregular shifts will have higher BMI than RNs who work regular shifts.*

*Hypothesis 2b: A within-person change in an RN's work schedule from regular shifts to irregular shifts will be related to a within-person increase in the RN's BMI growth trajectory over time.*

## **Work Demands and Job Satisfaction**

The time and energy resources that are consumed by work demands are likely to be related not only to health outcomes but also to an employee's general attitude toward work. Job satisfaction in particular is highly susceptible to increases in work demands. Work hours are likely to have a curvilinear relationship with job satisfaction: individuals who are underemployed (work less hours than they desire) are likely to have lower job satisfaction than individuals who work the amount of hours they desire. Research supports this notion, which has found that employees who work part-time but desire to work full-time are less satisfied than employees who do have full-time work, whereas employees who work part-time and do not desire working a full-time schedule have similar job satisfaction to full-time employees (e.g., Maynard, Joseph, and Maynard 2006). We focus our attention on the right-hand side of the curve: the relationship between increased work hours and job satisfaction, because the vast majority of RNs (including those in our sample) have full-time employment.

Research has shown that employees who are working more hours than they desire are likely to have lower job satisfaction than individuals who work the amount of hours they desire (e.g., Millán, Hessels, Thurik, and Aguado 2013). Because working longer hours is correlated with increased reports by RNs of working at a rapid pace, harder work, lack of time and inability

to perform one's work well (Unruh and Nooney 2011), we expect job satisfaction among RNs to be negatively related to their hours of work (Boyle, Popkess-Vawter, and Tauton 1996).

Working irregular shifts is associated with less control over work schedule and is generally associated with lower job satisfaction, partly because the demands of irregular work shifts (defined in this study as rotating shifts, evening shifts, or night shifts) are greater than those of a day shift. Irregular shifts are incompatible with schedules of social institutions (e.g., schools and government services) and require an investment of more time and energy resources by the individual (Staines and Pleck 1984), which are all likely to be related to lower levels of job satisfaction. Yet, the relationship between working irregular shifts and job satisfaction may be more complex for healthcare professionals. While in most occupations (e.g., manufacturing) working irregular shifts is associated with lower status and lower control over one's resources (Frost, Kolstad, and Bonde 2009), the "normal" day shift for healthcare professionals is associated with an increased workload compared to other shifts (Unruh and Nooney 2011). Accordingly, previous studies have found mixed results about the relationship between irregular shifts and job satisfaction among healthcare professionals. Some have shown that working day shifts in comparison to other shifts increases satisfaction (e.g., Blegen and Mueller 1987); other studies show that working day shifts increases work difficulty (e.g., Unruh and Nooney 2011). To add further complexity to this issue, some studies find no relationship between the type of shift and job satisfaction (e.g., Sveinsdóttir 2006). While the mixed findings on the effects of irregular shift work on job satisfaction among nurses make it difficult to predict the direction of this relationship, the literature from outside the healthcare context overwhelmingly supports a negative relationship between irregular work shifts and satisfaction. We therefore contend that

individuals who work regular shifts will have higher job satisfaction than individuals who work an irregular shift. Specifically, we hypothesize the following:

*Hypothesis 3: Work hours will be negatively related to RNs' job satisfaction.*

*Hypothesis 4: RNs who work irregular shifts will have lower job satisfaction than RNs who work regular shifts.*

### **Satisfaction, Health, and Turnover**

Healthcare employees and RNs in particular experience high levels of burnout, job dissatisfaction, and turnover (Irvine and Evans 1995; Pfeffer and O'Reilly 1987; Poghosyan et al. 2009). Forty percent of hospital nurses in the U.S. have burnout levels that exceed the norms for healthcare workers; job satisfaction among RNs is much lower than the satisfaction level of an average U.S. worker; and one in five nurses report that they intend to leave their job within a year (Jones 2008). Turnover costs per RN are estimated to be between \$82,000 and \$88,000 and, for every one percent increase in turnover for RNs, hospitals spend an average of \$300,000 (Jones 2008). Job satisfaction is consistently shown to be a strong predictor of turnover across different occupations and in particular for nurses (e.g., Coomber, and Louise-Barriball 2007; Irvine and Evans 1995; Price and Mueller 1981).

Less attention has been devoted to the relationship between nurses' health and this dominant pattern of turnover. Most research on the relationship between nurses' health and turnover has shown that stress is a strong antecedent in fomenting disillusionment with work (e.g., Avgar et al. 2012; Coomber, and Louise-Barriball 2007) and that health-related occupational hazards (e.g., back injuries) are also related to turnover (e.g., Brewer, Kovner,

Greene, Tukov-Shuser, and Djukic 2012). However, there is yet to be a more detailed analysis of the long-term relationship between healthcare employees' physical health and turnover.

The relationship between long-term physical health and turnover is crucial for healthcare organizations. It is also important to distinguish this relationship from the short-term effects of stress on the turnover rates of healthcare workers. While stress can, of course, have cumulative effects on the health and well-being of professionals in all fields, the relationship between long-term physical health and turnover is likely to be different than the short-term relationship between stress and turnover. First, long term changes in health are more difficult to observe and assess in a cross-sectional or even short-lag longitudinal design because they are slow to develop. As such, their effect on turnover may especially pertain to RNs with greater tenure, whose experience and time on the job have given them the necessary coping mechanisms to manage work-related stressors, but who nevertheless leave nursing because their physical health is deteriorating. To put it differently, while stress may affect turnover among new RNs more than those with longer tenure, other physical health issues are more likely to have a greater effect on RNs with greater tenure. This may result in the turnover of experienced RNs, who can manage higher stress levels as well as the occupational hazards that are associated with their profession and are more costly to replace because of the human capital they have gained (Jones 2008).

Physical health may affect turnover in several different ways. We focus on BMI as a general measure of health noting that even small changes in BMI have been shown to negatively affect critical health outcomes (e.g., insulin sensitivity in non-obese individuals [Pagano et al. 2002]; coronary heart disease [Canoy et al. 2013]; and lung function [Pistelli et al. 2008]). As such, differences in the growth trajectory of BMI between individuals may lead RNs to perceive the burden of deteriorating health as outweighing the benefits of continued employment as a

healthcare professional. In turn, this health deterioration over time could lead to an increased likelihood of turnover out of the nursing profession. We therefore hypothesize that both job satisfaction and physical health will be related to turnover.

*Hypothesis 5: Job satisfaction will be negatively related to the turnover of RNs out of the nursing profession.*

*Hypothesis 6: BMI will be positively related to the turnover of RNs out of the nursing profession.*

## **METHOD**

### **Sample, Participants, and Measures**

The National Longitudinal Survey of Youth (NLSY) is a nationally representative panel study administered by the U.S. Department of Labor and the Bureau of Labor Statistics. 12,686 individuals were first surveyed in 1979 when they were 14–22 years old; participants were interviewed annually through 1994 and on a biennial basis since then. Funding constraints led to the omission of 1,079 individuals in 1984 and 1,643 individuals in 1990; 573 participants were deceased by the 2010 survey. In addition, by 2010, 164 participants were classified as “extremely difficult to interview,” and 1,661 participants refused participation, could not be located, or were not interviewed for other reasons. Discounting the participants who were dropped due to financial constraints and death, the 7,565 participants who were interviewed in 2010 represent a retention rate of 75.9%.

The NLSY provides detailed longitudinal data on occupations and labor market experiences of its participants. We use data from 1992 onward because some of the study’s variables are missing in earlier years. Furthermore, by 1992 participants were already 27–35

years of age, which would be an age sample that corresponds with the participants' potential to have completed postsecondary studies, such as a nursing degree. The final sample includes 245 nurses (identified based on the Census 3-digit occupational code) who met the following criteria: (a) worked as a registered nurse between 1992 and 2010 (for the entire period or just part of it); and, (b) completed the survey at least three out of the 11 time-points during the 18-year period between 1992 and 2010. Of the 245 participants who meet the inclusion criterion, 13.9% are Hispanic, 29.5% are Black and 93.5% are women. Participants were between 45 and 53 years of age in 2010, and their average age was 48.9 years old.

### *Measures*

*BMI.* We used height as reported in 1985 (when participants were 20-28 years old) and weight as reported in each of the years between 1992 and 2010. BMI is calculated using the following formula:

$$BMI = (Mass (lb) \times 703) / (Height (in))^2$$

BMI below 18.5 is considered underweight (only 1 participant had a BMI lower than 18.5 and only for part of the period). BMI between 18.5 and 24.9 is considered normal, while individuals with a BMI above 25 and up to 29.9 are considered overweight; individuals with a BMI of 30 or greater are considered obese.

*Job Satisfaction.* Participants were asked to state how satisfied they were with their job on a 1 – 4 scale. Specifically, participants were asked, “How do you feel about the job you have now? Do you like it very much, like it fairly well, dislike it somewhat, or dislike it very much?” Job satisfaction was recoded in such a way so that a higher value reflects greater satisfaction with the job.

*Turnover.* RNs were coded as 1 if they left the job market or switched occupation from an RN to another occupation. RNs who were continuously employed were coded as 0. Therefore, this variable represents occupational turnover and not job turnover.

*Time.* Time was coded linearly with 1992 coded as zero, 1993 as 1, 1994 as 2, 1996 as 4, and up to 2010 which was coded as 18.

*Weekly work hours.* Participants were asked, “How many hours per week do you usually work at this job?” The number of weekly work hours (for pay) that participants reported to be working was measured in each of the 11 time-points from 1992 to 2010.

*Shift work.* A binary variable was created to reflect whether participants work only a regular day shift (= 1) or any type of irregular shift (= 0) in each of the 11 time-points from 1992 to 2010. Irregular shifts included evening shifts, night shifts, rotating shifts, split shifts, or any other irregular type of shift.

*Sex, race/ethnicity, and age.* Sex, age, and race/ethnicity have been linked to BMI by previous studies (e.g., Bae, Wickrama, and O’Neal 2014; Flegal, Carroll, Kuczmarski, and Johnson 1998; Paeratakul et al. 2002). In our sample, age is not likely to have a strong between- or within-person effect because all participants are of similar age (all were 14 – 22 in 1979) and the time variable models the within-person increase in age. For sex, females were coded as 1 and males as 0. For race/ethnicity we used Black, Hispanic, and White, with White being the omitted category.

### ***Analytic Strategy***

We estimate a series of multilevel models using Stata 12 that account for the hierarchical structure of the data. Specifically, RNs are nested in time (with each RN having at least three

observations) and we have a combination of variables that are fixed over time (e.g., sex, race/ethnicity) and change over time (e.g., BMI and work hours). Hypotheses 1a, b and 2a, b postulate a difference between individuals who have different work demands (Hypotheses 1a and 2a) and within the same individuals who change their own work demands over time (Hypotheses 1b and 2b). This necessitates us to estimate a model that takes into account both within- and between-person differences. Over time, BMI is expected to increase (have a positive within-person growth trajectory). Considering differences exclusively in the BMI growth trajectory *between* individuals provides only a partial estimate of the effect of work demands on the BMI growth trajectory; this is because it does not account for the within-person effect work demands have on BMI (Singer and Willett 2003). For example, two RNs who work different amounts of hours may have a different BMI (a between-person effect) but an RN who increases the number of hours worked from  $t$  to  $t + 1$  may experience a change in the BMI growth trajectory (a within-person effect). To address this potential for both between- and within-person changes in the effect of work demands on BMI growth trajectory, we pursue an analysis that allows us to estimate both between-person differences and within-person change. Hypotheses 3 to 6 do not involve a dependent variable that is expected to have a growth trajectory and therefore are analyzed using a standard multilevel model.

## **RESULTS**

Descriptive statistics and intercorrelations among the study variables are provided in Table 1. As can be seen, nurses worked an average of 36.43 weekly hours, with 33% working only regular day shifts. RNs' mean BMI over the entire period between 1992 and 2010 was 28.07, and had a significant and positive correlation with time ( $r = .18, p < .01$ ) indicating that, as expected, there is a growth trajectory in BMI over time. RNs also had relatively high job

satisfaction levels over time (3.42 on a 1 - 4 scale). Turnover mean is .08 but this should not be interpreted as an 8% turnover rate over the entire period, but rather as an annual rate of turnover (.08 is the mean turnover rate among observations [N = 2,225] and not participants [N = 245]).

[Table 1 about here]

Hypothesis 1a, b and 2a, b postulated a positive relationship between work demands (work hours and work schedule) and BMI, with both between-person effects (Hypotheses 1a and 2a) and within-person effects (Hypotheses 1b and 2b). We begin with fitting the model to the data where time indicates the first year a subject was included in the data. As can be seen in the unconditional growth model (Table 2, Model 1) at the first year (time = 0), we estimate that the average RN has a BMI of 26.680 ( $p < .001$ ); over time BMI levels increase linearly at a rate of .169 per year ( $p < .001$ ). The variance components for both initial status and rates of change are statistically significant, suggesting there is an inherent wisdom in exploring the effects of person-specific predictors. This unconditional growth model tells an incomplete story, however, because work demands may have an effect on differences in BMI between RNs *as well as* on within-person changes in BMI over time. We therefore continue with a main-effects model (Table 2, Model 2) that allows estimating the between-person differences in the effect of work demands on BMI. We also account for between-person differences in sex, race/ethnicity, and age. The main effects represent the population average difference, over time, in BMI levels between nurses in work hours (in increments of 1 hour) and work schedule (regular day shift versus irregular shift). The coefficients for the demographics represent the population average difference between males and females, Blacks and Whites, and Hispanics and Whites, and based on age. The coefficient for Time ( $b = .178, p < .001$ ) represents the population average yearly rate of change in BMI, controlling for work hours, work schedule, sex, race/ethnicity, and age. Contrary to our

expectations, we find that working an irregular shift is associated with a lower BMI ( $b = -.265, p < .10$ ). We also find that Black nurses have a significantly higher BMI than White nurses ( $b = 3.195, p < .001$ ). All other variables show no significant effect on differences in BMI between individuals. Note that there is a significant improvement in Model 2 fit over Model 1 fit in both the deviance statistics and the Akaike Information Criterion (AIC) statistics, but not in the Bayesian Information Criterion (BIC) statistics.

The main effects model (Table 2, Model 2) also provides an incomplete picture because it does not account for the possibility that work demands affect the trajectory of the slope and not just its intercept. The analysis presented in the main effects model assumes that a change in work demand (e.g., a move from an irregular shift to a regular day shift) will “bump” the individual *immediately* to a higher (yet parallel) BMI growth trajectory. This assumption is unrealistic and does not take into account the fact that changes in work demands have a cumulative effect on BMI that would lead to a difference in its growth trajectory (the slopes in Table 2, Model 2 are constrained to be parallel). Because Hypotheses 1b and 2b postulate that an increase in work demands will make the trajectory of growth in BMI steeper, we continue with the analysis presented in Table 2, Model 3, which allows work demands to vary over time and does not constrain the growth trajectory of BMI between individuals to be parallel. We find no support for Hypothesis 1b: a within-person change in work hours over time is not related to within-person increases in the growth trajectory of BMI over time ( $b = .000, n.s.$ ). Contrary to our Hypothesis 2b (but consistent with the effect found in Hypothesis 2a), we find that within-person change from regular day shift to irregular shift schedule significantly decreases BMI among nurses ( $b = -.105, p < .01$ ). As such, a nurse who switches from working a regular day shift to an irregular shift schedule will experience a *decrease* in the slope of its BMI growth trajectory.

[Table 2 about here]

To test Hypotheses 3 and 4 we estimate a similar model to that presented in Table 2, (Models 1 and 2). We do not expect to have a within-person difference in slopes (Table 2, Model 3) because, unlike BMI, there is no theoretical reason to expect job satisfaction to have an unconditional trajectory of change over time. Supporting this assumption we find that in 1992 the average job satisfaction was 3.404 ( $p < .001$ ) and that the time variable had no significant effect on the change in job satisfaction over time (Table 3, Model 1). In Hypotheses 3 and 4 we argued for a negative relationship between work demands and job satisfaction. In contrast, as can be seen in Table 3, Model 2, we find that work hours are positively related to job satisfaction ( $b = .002, p < .10$ ). However, the effect size of work hours on satisfaction is quite small; for example, a difference of 10 working hours between two nurses will result in a difference of .02 units of job satisfaction. We find no effect for shift schedule on job satisfaction, thus Hypothesis 4 is not supported.

[Table 3 about here]

In Table 4 we estimate the association of work demands, BMI, and job satisfaction with turnover. The unconditional model (Table 4, Model 1) estimates the annual turnover probability to be .084 ( $p < .001$ ). Again, time is not expected to change the probability of turnover; and, indeed, we find no time effect in the unconditional model. In the next step of the analysis (Table 4, Model 2) we estimate the effect of demographics and work demands on turnover probability. We find that time has a small positive effect on turnover probability ( $b = .002, p < .10$ ). In addition, Black RNs have significantly higher turnover probability than White RNs ( $b = .057, p < .001$ ), age is positively associated with turnover probability ( $b = .008, p < .05$ ), and work hours

are negatively associated with turnover probability ( $b = -.007, p < .001$ ). We test Hypotheses 5 and 6 in Model 3 (Table 4) and find support for both hypotheses. Supporting Hypothesis 5, job satisfaction is negatively associated with turnover probability ( $b = -.038, p < .001$ ). This result can be interpreted in two ways: an RN who has one unit higher in job satisfaction than another RN has 3.8 percentile points lower in turnover probability rate; alternatively, an RN who experiences an increase of one unit of job satisfaction between  $t$  and  $t + 1$  has a 3.8 percentile points decrease in his or her turnover probability. This effect of job satisfaction is quite large considering an annual turnover probability of .084; a one unit increase of job satisfaction reduces turnover probability by over 45% (3.8 percentile points out of 8.4 percentile points). Finally, supporting Hypothesis 6, we find a positive association between BMI and turnover probability ( $b = .002, p < .05$ ), indicating that deterioration in health increases the probability of turnover among RNs.

[Table 4 about here]

## DISCUSSION

Healthcare employees operate in a highly demanding work environment that affects both organizational and employees' outcomes. Many of the work demands employees in healthcare organizations face are beyond the direct control of the individual or organization. Healthcare professionals are exposed to hazardous materials and diseases; and, unlike other service providers, healthcare professionals provide service to stakeholders who do not choose to get service but are rather in need of it—and often in emergency situations—resulting in increased stress and burnout among healthcare professionals compared to other professional services providers. In this study we focus on work hours and work schedule, two central work demands

that are, at least partially, controlled by employees and organizations, and examine their effect on employees' physical health, satisfaction, and turnover over time. In addition, we focus specifically on turnover out of the profession among RNs, which is a critical issue being confronted by healthcare organizations across the U.S. (Jones 2008).

Studying the complex relationships between work demands, physical health, job satisfaction, and turnover presents researchers with many difficult challenges. Individual health is affected by multiple factors, many of them beyond the control of the employee (e.g., genetic disposition) and the employer (e.g., lifestyle and behaviors outside of work). Similarly, the decision to leave one's occupation develops over time and its antecedents cannot be clearly deciphered using cross-sectional data. Adding to the difficulty of studying the relationship between work demands, individual health, job satisfaction, and turnover is that many health problems take time to develop and can only be observed over an extended period of time. We try to address the limitations of previous studies by providing evidence supporting the relationship between work demands, physical health, job satisfaction, and turnover using a nationally representative sample of RNs over an 18-year period.

We find evidence that the long-term physical health of individuals, estimated by the change in BMI over time, is negatively affected by RNs' work schedule. Specifically, we find a between-person difference and a within-person effect of work schedule on BMI. RNs who work a regular day shift tend to have higher BMI than RNs who work irregular shifts. In addition, RNs who experience a change in work schedule from an irregular shift to a regular day shift experience an increase in the growth trajectory of their BMI over time. While these findings contradict our hypotheses, they are not unexpected given the work environment in which RNs operate. In the general population of employees, working irregular shifts is associated with

negative health outcomes such as sleep deprivation, daytime sleepiness, insomnia, difficulty getting to sleep, and lower quality of sleep (Åkerstedt 2003; Härmä et al. 1998; Ohayon et al. 2002). However, for RNs, and healthcare employees in general, working irregular shifts and rotating shifts may allow “time off” from the higher demands that many RNs face during regular day shifts. Rotating shifts, night shifts and evening shifts may allow RNs time to “recharge” their energy resources more efficiently; in comparison, RNs who only work day shifts are likely to be under much more time pressure and experience higher demands from patients and family members (Unruh and Nooney 2011). It is also possible that the RNs in our sample who only work a regular dayshift enjoy less flexibility in determining their shifts compared to RNs who work a more flexible shift schedule. The ability to schedule one’s shift may allow RNs to better preserve, balance, and replenish their resources at work and outside work more efficiently. In turn, the ability to better manage limited resources may result in better health and lower turnover. For example, better management of their resources may allow RNs to invest more time and effort in health-promoting behaviors and be less engaged in withdrawal from work.

RNs in our study had a relatively high job satisfaction and we find only a small effect of work hours on RNs’ job satisfaction. In addition, work schedule had no effect on job satisfaction. This finding may be a result of the higher base rate of job satisfaction among RNs in our sample; or, as a result of the tendency of dissatisfied RNs to leave their job, but not their occupation and therefore not have the chance for their dissatisfaction to be captured or quantified within our data sampling. Alternatively, it is possible that most RNs are able to choose, within a certain range, the number of hours they work as well as their work schedule. If this is true, work hours and schedule will not have a meaningful effect on job satisfaction. Finally, it is possible that the effect of work demands on individual outcomes varies between different demands and different

outcomes. For example, some work demands, like excessive hours, may have a small effect on job satisfaction, while other types of work demands, like emotional demands and cognitive demands, may be more strongly related to job satisfaction (McLoughlin, Taylor, and Bohle 2011). Considering that RNs' work environment requires high level of cognitive and emotional demands, their job satisfaction may be more affected by cognitive or emotional work demands rather than by weekly work hours and shift schedule.

We do find support for the relationship between job satisfaction, physical health, and turnover. While the job satisfaction-turnover relationship is well established, less attention has been devoted to studying the relationship between slow changes in individual health over time and turnover, especially among healthcare professionals. With turnover costs of nurses increasing rapidly and burdening healthcare systems, these results have important implications for healthcare organizations that are interested in minimizing RN turnover rates, particularly those who are experienced and therefore more costly to replace (Jones 2008).

We estimate that BMI increases among RNs at a yearly rate of .169 (Table 2, Model 1). As an example, we estimate that an average female nurse would have a BMI of 26.68 in 1992 and would weigh (based on an average height of five feet and five inches) 160.5 pounds. A yearly increase of .169 in BMI over the entire period translates to a gain of 3.04 units of BMI for the average nurse by 2010, which is equivalent to a gain of 18 pounds. Such significant health changes, from being slightly overweight to being close to obese, have implications not only for organizations and their health-related costs, but also for employees who experience deterioration in their quality of life because of the dramatic association between weight gain and other morbidities. Organizations may want to consider more carefully how work conditions affect their

employees' health and may offer health and wellbeing policies and programs that will improve both employees' health and organizational outcomes (Lavoie-Tremblay et al. 2014).

Our longitudinal data that covers 18 years of work experience using a nationally representative sample is limited in its ability to fully encompass the multitude of work demands that many RNs face, the individual health problems they may encounter, and the different organizational performance measures that exist in various healthcare systems. Future studies may examine the relationship between work demands, health, job satisfaction, and turnover over time using samples of healthcare employees beyond RNs while expanding on previous research with more detailed analyses of work demands and health outcomes. In addition, it is very likely that any deterioration in the physical health of employees can affect organizational performance measures and individual outcomes that go well beyond turnover costs. We call for future studies to further investigate the role that employees' physical health plays in individual, organizational, and societal outcomes.

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Table 1. Intercorrelations, Means, and Standard Deviations

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10
1 Female	.50	-	-									
2 Age in 2010	48.87	-	.05***	-								
3 Black	.29	-	.03	.03	-							
4 Hispanic	.14	-	-.04*	.00	-.26***	-						
5 Other race	.57	-	.00	-.03	-.74***	-.46***	-					
6 Time	8.27	5.94	.00	.00	.00	.00	.00	-				
7 Work hours	36.43	11.55	-.12***	-.01	.11***	.03	-.12***	.05**	-			
8 Irregular shift	.67	-	-.03	.01	-.01	-.04*	.03*	.49***	-.00	-		
9 Job satisfaction	3.42	.71	.03	.02	-.10***	.01	.09***	.02	-.03	.02	-	
10 BMI	28.07	6.26	.08** *	-.03	.20***	-.09***	-.12***	.18***	.15***	-.04**	.01	-
11 Turnover	.08	-	-.01	.06***	.08***	-.07***	-.03	.00	-.07***	.00	-.11***	.02

\*  $p < .10$ ; \*\*  $p < .05$ ; \*\*\*  $p < .01$ .

Table 2. Multilevel Modeling Results Predicting Between- and Within-Person Change in BMI by Change in Work Demands

		Model 1		Model 2		Model 3	
Fixed Effects		Coefficient	SE	Coefficient	SE	Coefficient	SE
Composite model	Intercept (initial status)	26.680***	.397	27.944***	8.335	28.167***	8.343
	Time	.169***	.016	.178***	.017	.149***	.027
	Female			1.621	1.449	1.648	1.451
	Black			3.195***	.828	3.120***	.828
	Hispanic			-.168	.359	-.167	.359
	Age in 2010			-.079	.160	-.080	.170
	Work hours			.002	.004	-.000	.006
	Irregular shift			-.265*	.146	.267	.230
	Work hours by Time					.000	.001
	Irregular shift by Time					-.105***	.035
Variance Components							
	var (residual)	4.521***	.154	4.510***	.153	2.469***	.027
	var (intercept)	35.596***	3.444	32.844***	3.198	23.532***	.571
	var (time)	.043***	.005	.043***	.006	.042***	.002
Goodness-of-fit							
	Deviance		10,818.7		10,796.7		10,786.8
	AIC		10,830.7		10,820.7		10,814.8
	BIC		10,864.9		10,889.0		10,894.5
Number of observations (Individuals)			2,192 (235)		2,192 (235)		2,192 (235)

\*  $p < .10$ ; \*\*  $p < .05$ ; \*\*\*  $p < .01$ .

Note: AIC = Akaike Information Criterion statistics; BIC = Bayesian Information Criterion statistics.

Table 3. Multilevel Modeling Results Predicting Change in Job Satisfaction by Work Demands

		Model 1		Model 2	
Fixed Effects		Coefficient	SE	Coefficient	SE
Composite model	Intercept (initial status)	3.404***	.034	2.989***	.577
	Time	.003	.003	.001	.003
	Female			.092	.101
	Black			-.164***	.057
	Hispanic			-.004	.025
	Age in 2010			.008	.012
	Work hours			.002*	.001
	Irregular shift			.059	.037
Variance Components					
	var (residual)	.365***	.012	.364***	.012
	var (intercept)	.164***	.026	.156***	.025
	var (time)	.001***	.000	.001***	.000
Goodness-of-fit					
	Deviance		4,488.6		4,474.1
	AIC		4,500.6		4,498.1
	BIC		4,534.8		4,566.6
Number of observations (Individuals)			2,225 (245)		2,225 (245)

\*  $p < .10$ ; \*\*  $p < .05$ ; \*\*\*  $p < .01$ .

Note: AIC = Akaike Information Criterion statistics; BIC = Bayesian Information Criterion statistics.

Table 4. Multilevel Modeling Results Predicting Change in Turnover Probability by Work Demands, Job Satisfaction and Health

		Model 1		Model 2		Model 3	
Fixed Effects		Coefficient	SE	Coefficient	SE	Coefficient	SE
Composite model	Intercept (initial status)	.084***	.011	-.040	.177	-.072	.178
	Time	.000	.001	.002*	.001	.002	.001
	Female			-.049	.032	-.056*	.030
	Black			.057***	.017	.044**	.017
	Hispanic			-.010	.008	-.010	.007
	Age in 2010			.008**	.004	.010***	.003
	Work hours			-.007***	.001	-.007***	.001
	Irregular shift			-.009	.014	-.008	.014
	BMI					.002**	.001
	Job Satisfaction					-.038***	.008
Variance Components							
	var (residual)	.064***	.002	.058***	.002	.054***	.002
	var (intercept)	.013***	.003	.010***	.003	.011***	.003
	var (time)	.000***	.000	.000**	.000	.000**	.000
Goodness-of-fit							
	Deviance		512.0		213.1		90.4
	AIC		444.0		241.1		118.4
	BIC		478.0		308.9		196.4
Number of observations (Individuals)			2,112 (245)		2,112 (245)		1,938 (235)

\*  $p < .10$ ; \*\*  $p < .05$ ; \*\*\*  $p < .01$ .

Note: AIC = Akaike Information Criterion statistics; BIC = Bayesian Information Criterion statistics.

Figure 1. Theoretical Model

