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Article

Does non-standard work mean non-standard health? Exploring links between non-standard work schedules, health behavior, and well-being

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ABSTRACT

The last century has seen dramatic shifts in population work circumstances, leading to an increasing normalization of non-standard work schedules (NSWSs), defined as non-daytime, irregular hours. An ever-growing body of evidence links NSWSs to a host of non-communicable chronic conditions; yet, these associations primarily concentrate on the physiologic mechanisms created by circadian disruption and insufficient sleep. While important, not all NSWSs create such chronobiologic disruption, and other aspects of working time and synchronization could be important to the relationships between work schedules and chronic disease. Leveraging survey data from Project EAT, a population-based study with health-related behavioral and psychological data from U.S. adults aged 25–36 years, this study explored the risks for a broad range of less healthful behavioral and well-being outcomes among NSWS workers compared to standard schedule workers (n = 1402). Variations across different NSWSs (evening, night/rotating, and irregular schedules) were also explored. Results indicated that, relative to standard schedule workers, workers with NSWSs are at increased risk for non-optimal sleep, substance use, greater recreational screen time, worse dietary practices, obesity, and depression. There was minimal evidence to support differences in relative risks across workers with different types of NSWSs. The findings provide insight into the potential links between NSWSs and chronic disease and indicate the relevancy social disruption and daily health practices may play in the production of health and well-being outcomes among working populations.

Introduction

Non-standard work schedules (NSWSs) are a pervasive phenomenon across economically-developed nations. Similar to other national estimates, 29% of the U.S. workforce is currently employed in a NSWS (Alterman, Luckhaupt, Dahlhamer, Ward, and Calvert, 2013; Eurofound, 2016), and with every U.S. industry relying on NSWSs (Alterman et al., 2013), nearly 90% of adults report working a NSWS by the age of 40 (Presser & Ward, 2011). In comparison to standard work schedules, which involve regular and predictable daytime hours (e.g., Monday-Friday 0900–1700), NSWSs consist of hours that are typically non-daytime (outside of 0600–1800), irregularly-scheduled, or both.

Over the last century, several changes have contributed to the progression and increasing normalization of NSWSs, including transformations in demography (e.g., increases in dual-earner households), technology (e.g., ability to be "on call" at all hours), globalization (e.g., global competition and corporate supply chains outsourcing production to the cheapest worldwide vendor), and legislation favoring deregulated international markets (i.e., neoliberal policies; Dixon et al., 2014;

Peckham, Baker, Camp, Kaufman, & Seixas, 2017; Presser, 2003; Schrecker & Bambra, 2015). These factors, along with other changes, such as growing expectations for 24/7 services, have rearranged the types of jobs and thus work schedules available in the U.S. (Church et al., 2011; Presser, 2003). For instance, a century ago, jobs in the goods-producing sector, including mining, construction, and manufacturing, comprised 46% of the U.S. workforce, and today only comprise 14% (Statistics & Labor, 2016). In contrast, the service sector now constitutes over 80% of U.S. jobs (Henderson, 2015) and appears more reliant on NSWSs than the goods-producing industries (Alterman et al., 2013). Moreover, the proportion of traditionally white- (e.g., Management, Sales and office) to blue-collar (e.g., Production, Transportation) occupations working a NSWS appears to have reversed, with white-collar occupations currently making-up the majority of NSWS workers (DOL, 1982; McMenamin, 2007). Such dramatic shifts, along with other supporting evidence (McMenamin, 2007; Presser, 2003), seem to suggest that the persistence of NSWSs in the U.S. is an artifact of job-constraining or industry-promoting circumstances rather than driven by workers' personal preferences for NSWSs (Dixon et al., 2014; Schnall,

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Dobson, & Landsbergis, 2016).

Concurrent with these changes in work circumstances have been notable increases in non-communicable chronic diseases, and an extensive body of evidence suggests links between the timing of work schedules and a host of chronic conditions, including type 2 diabetes, coronary heart disease, and breast, prostate, and colorectal cancer (Gan et al., 2015; Rao, Yu, Bai, Zheng, & Xie, 2015; Vyas et al., 2012; Wang et al., 2013; Wang et al., 2015). Health behaviors and various psychosocial factors are important contributors to these chronic conditions. Yet, most of the health research on NSWSs has concentrated on illuminating the chronobiological, physiological, and insufficient sleep mechanisms with less attention provided to other potentially relevant behavioral (e.g., dietary behavior, activity, substance use) and psychological (e.g., unmanaged stress) pathways (Antunes, Levandovski, Dantas, Caumo, & Hidalgo, 2010; Buchvold, Pallesen, Oyane & Bjorvatn, 2015; Kecklund & Axelsson, 2016; Pilcher, Lambert, & Huffcutt, 2000; Ramin et al. 2015; Vogel, Braungardt, Meyer, & Schneider, 2012). Knowing more about relationships NSWSs have with a wide range of behaviors and psychological factors will advance understanding of other potential pathways linking NSWSs to chronic disease.

Across the health literature, the conceputalization of NSWSs has been primarily constrained to work schedules associated with circadian disruption (e.g., night and rotating shift work). However, NSWSs also encompass schedules, such as regular evenings and irregularly-scheduled daytime hours, that do not necessarily create chronobiological disruption, but like all types of NSWSs, do create some degree of social disruption. Work schedules that are asynchronous with the majority of society or are incongruous with the daily schedules of a worker's household, may lead to time constraints, feelings of time scarcity, routine disruption, and/or social and psychological distress (Colligan & Rosa, 1990; Costa, 2003; Kantermann, Juda, Vetter, & Roenneberg, 2010; Kecklund & Axelsson, 2016; Vogel et al., 2012). Consequently, the ability to prioritize, schedule, and allocate sufficient time for daily health behaviors may be compromised (Dixon et al., 2014; Jabs & Devine, 2006; Rangel, 2013; Schneiderman, Ironson, & Siegel, 2005). At the same time, workers with schedules that are vulnerable to both chronobiological and social disruption (e.g., night shift), likely possess worse behavioral and well-being profiles than workers with schedules only causing routine disruption (e.g., split shifts). To date, research has not fully examined differences across various types of NSWSs, thus it remains unclear whether health behavior and psychological risks differ depending on the specific NSWS experienced.

We conducted a secondary data analysis from Project EAT (Eating and Activity in Teens and Young Adults)—a study collecting a comprehensive range of health-related behavioral and psychological data from a U.S. based cohort of young adults (25–36 years). Based on the literature reviewed above, we hypothesized that NSWS workers would have an elevated risk for a broad range of unfavorable behavioral, well-being, and weight status outcomes relative to standard (regular, daytime) schedule workers. We also hypothesized that when examining these risks across different types of NSWSs, night and rotating work schedules would consistently demonstrate a worse outcome profile than other types of NSWSs (evening schedules, irregular schedules).

Methods

Study design and population

Data for this study were collected in the fourth wave (2015–2016) of Project EAT, a population-based study examining multi-level factors associated with weight status, dietary intake, physical activity, weight control and other behaviors from adolescence through young adulthood. The original sample of 4746 adolescents was recruited in 1998–1999 from 31 public schools in the Minneapolis-St. Paul metropolitan area of Minnesota, United States (Neumark-Sztainer et al.,

2002a; Neumark-Sztainer et al., 2002b). Participants that completed the 2015-2016 survey include 1830 young adults, representing 66.1% of the original participants who could be contacted (n = 2770). The developmental age of participants provided the opportunity to examine the links between NSWSs and behavioral and well-being outcomes among workers well into their working years, but prior to the development of most age-related chronic conditions.

Survey development for the 2015-2016 survey was informed by theory, surveys from prior data collection waves (Neumark-Sztainer et al., 2002b), along with input from young adults about the life experiences and circumstances, such as work, that are increasingly important in the transition to adulthood. A semi-quantitative food frequency questionnaire (FFQ) was also administered to evaluate usual past intake of various food groups and macronutrients (HSPH, 2017). Previous studies have reported on the reliability and validity of these intake estimates (Feskanich et al., 1993).

At the time of data collection, participants were 31.0 ± 1.6 years old, and 85.9% (n = 1572) reported currently working for pay across a range of occupational industries (e.g., retail, law enforcement, health care, manufacturing). For the current study, we limited our analysis to workers meeting the U.S. Internal Revenue Service definition of full-time employee (at least 30 hours of service per week; IRS, 2017), facilitating comparisons across workers (n = 1402) with a relatively similar degree of work schedule exposure. All protocols used were approved by the University of Minnesota's Institutional Review Board Human Subjects Committee.

Measures

Work schedule

Work schedule was assessed with the question: "Which of the following categories best describes the hours you work for pay?" Responses included: "Regular day shift;" "Regular evening shift;" "Regular night shift;" "Shift rotates;" "Split shift;" and "Irregular schedule or hours" (test-retest percent agreement = 92%). Matching other investigations (Alterman et al., 2013; Bae et al. 2017; Dorrian & Skinner, 2012; Presser & Ward, 2011), we operationalized NSWSs as any worker that said they worked a schedule other than regular day shift and defined a standard schedule as workers selecting the regular day shift option.

To examine differences across different types of NSWSs, we created a 4-level variable, including evening (workers selecting "regular evening shift"), night or rotating (workers selecting "regular night shift" or "shift rotates"), irregular (workers selecting "irregular schedule or hours" or "split shift"), and standard work schedules. Each NSWS type represents variations in chronobiological disruption, predictability, and the number of daily transitions from non-work to working hours. For instance, regular night or rotating NSWSs primarily represents workers with predictable schedules but at risk for chronobiological disruption, and irregular NSWSs largely represents workers experiencing either unpredictable hours or multiple daily transitions from non-working to working hours.

Behavioral outcomes

Behaviors assessed on the survey included *sleep duration, substance use, physical activity, recreational screen time, food consumption patterns*, and *unhealthy weight control. Sleep duration* was measured with two items asking "What time do you go to bed (to go to sleep)?" and "What time do you get out of bed?" which was asked for a typical weekday and weekend day (r = 0.61–0.86; Pasch et al., 2010). Weekly averages were calculated and dichotomized into optimal (between 7–9 hours/day) versus less optimal (< 7 or > 9 h/day) sleep categories, as both too little and too much sleep has been associated with unfavorable health and well-being outcomes (Patel et al., 2004; Patel & Hu, 2008; Patel, Malhotra, Gottlieb, White, & Hu, 2006).

Substance use, including cigarettes and alcohol, was also assessed.

Table 1
Distribution of sociodemographic characteristics by standard and non-standard work schedules among full-time working adults[†].

		% (N)				
		Standard	Non-standard			
	Total sample N = 1402	Regular daytime N = 1073	Evening[a] N = 51	Night/Rotating[b] N = 153	Irregular[c] N = 125	P value[d]
Gender						
Male Workers	47.2 (659)	45.1 (482)	68.6 (35)	52.3 (80)	49.6 (62)	0.006,
Female Workers	52.8 (738)	54.9 (586)	31.4 (16)	47.7 (73)	50.4 (63)	0.004
Family socioeconomic status						
Low	25.1 (345)	24.6 (260)	41.7 (20)	27.7 (41)	19.7 (24)	0.726,
Middle	23.8 (328)	23.9 (253)	29.2 (14)	23.0 (34)	22.1 (27)	0.032
High	51.1 (704)	51.6 (546)	29.2 (14)	49.3 (73)	58.2 (71)	
U.S. nativity status						
Born in U.S.	91.1 (1266)	90.7 (968)	88.0 (44)	92.7 (139)	93.5 (115)	0.395,
Born outside U.S.	8.9 (124)	9.3 (99)	12.0 (6)	7.3 (11)	6.5 (8)	0.552
Ethnicity/Race[f]						
White workers	69.3 (967)	70.5 (753)	60.8 (31)	65.6 (99)	67.2 (84)	0.082,
Workers of color	30.7 (428)	29.5 (315)	39.2 (20)	34.4 (52)	32.8 (41)	0.293
	Mean (SD)	Mean (SE)				P Value[e]
Age (years)	31.1	31.1	30.8	30.9	31.2	0.202,
	(1.6)	(0.05)	(0.22)	(0.13)	(0.14)	0.152

[†] Reports working ≥ 30 h per week for pay.
[a] Reports working regular evening shift work schedule.
[b] Reports working regular night shift or rotating shift work schedule.
[c] Reports working irregular schedule/hours or split shift work schedule.
[d] Significant differences (P < 0.05) assessed by chi-square; comparisons made across standard v. non-standard work schedules (top value) and across all four work schedules (bottom value)
[e] Significant differences (P < 0.05) assessed by ANOVA; comparisons made across standard v. non-standard work schedules (top value) and across all four work schedules (bottom value).
[f] White Workers (n = 967 Non-Hispanic White) and Workers of Color (n = 101 Non-Hispanic Black, n = 61 Hispanic, n = 197 Non-Hispanic Asian, n = 4 Non-Hispanic Pacific Islanders, n = 17 Non-Hispanic Native Americans, n = 48 Non-Hispanic Mixed).

Smoking cigarettes was assessed with the item "How often have you used the following [cigarettes] during the past year" with responses ranging from "Never" to "Daily" (r = 0.87; Sherwood et al., 2002). The percent reporting daily, or habitual, smoking was compared to all other responses. *Heavy drinking* was calculated using the reported daily intake of alcohol (grams/day) on the FFQ, and defined as consuming > two drinks/day (> 28 g/day)—a cut-off where the beneficial associations of moderate alcohol consumption with mortality, diabetes, healthy eating, and depression symptoms appear to wane (Baliunas et al., 2009; Breslow, Guenther, & Smothers, 2006; Di Castelnuovo et al. 2006; Lang, Wallace, Huppert, & Melzer, 2007).

Moderate to vigorous physical activity (MVPA) was measured with two survey items asking how many hours are spent in a usual week doing strenuous (e.g., jogging, swimming laps) and moderate (e.g., walking quickly, easy bicycling) exercise (Godin & Shephard, 1997). Responses ranged from "None" to "6 + hours a week" (test-retest r = 0.84), and weekly hours of MVPA was categorized into workers who met or did not meet current recommendations of 150 min per week of MVPA (HHS, 2008). *Recreational screen time* was assessed with the item "Over the past month, on average, how many hours of recreational screen time do you have a day? This is in addition to work- or school-related screen time" (test-retest r = 0.60). Percent of workers reporting two or more daily hours was calculated, as this quantity has been associated with non-communicable chronic diseases (Hu, Li, Colditz, Willett, & Manson, 2003; Stamatakis, Hamer, & Dunstan, 2011).

Food consumption patterns were assessed across several items. Recommendations and evidence from the *Dietary Guidelines for Americans (2010, 2015)* and its associated scientific report were used to inform behavior categorization (USDA & USDHHS, 2010; USDHHS & USDA, 2015a, 2015b). *Daily fruit and vegetable recommendations* were assessed using a series of FFQ items. The percent of workers not meeting minimum, gender-specific recommendations for vegetables (not including potatoes) and fruit were calculated. *Daily added sugar*

intake was also assessed on the FFQ, and the percent of workers exceeding maximum guidelines (10% of daily calories) was calculated. *Breakfast skipping* was measured with the item, "During the past week, how many days did you eat breakfast?" Response options ranged from "never" to "every day" (test-retest = 0.82) and were combined into skips and never skips breakfast categories. *Eating fast food* was assessed with the question, "In the past week, how often did you eat something from a fast food restaurant?" (test-retest = 0.54), and percent reporting one or more fast food meals was calculated. Lastly, *binge eating,* was assessed with the question "In the past year, have you ever eaten so much food in a short period of time that you would be embarrassed if others saw you (binge-eating)?" with response options 'yes' or 'no' (Percent agreement = 90%).

The final health behavior was *unhealthy weight control behavior* (UWCB), which was measured with the question, "Have you done any of the following things in order to lose weight or keep from gaining weight during the past year" (Neumark-Sztainer et al., 2002b). Participants responded "yes" or "no" to any of the nine behaviors listed, such as fasted, took diet pills, used laxatives, and skipped meals (test-retest r = 0.87). Percent reporting at least one behavior was calculated.

Well-being and weight status outcomes

Depression was measured with 6 items assessing depressive symptoms (Cronbach's alpha = 0. 84, test-retest r = 0.77). Scores ranged from 10–30, and the percent of workers with clinically-relevant depressive symptoms (score ≥ 23) was calculated (Kandel & Davies, 1982). *Unmanaged stress* was assessed with two items asking participants to rate their average level of stress (test-retest r = 0.85) and their ability to manage their stress (r = 0.73) in the past 30 days (Nelson et al., 2008). Dividing stress scores by stress management scores provided an index where a score of > 1 was defined as unmanaged stress, (i.e., stress being greater than ability to manage it). Lastly, the Centers for Disease Control and Prevention classifications for *Grade I obesity*

Table 2

Relative risks of behavioral outcomes by standard and non-standard work schedules among full-time working adults.

	Prevalence % (N)	Unadjusted risks RR (95% CI)	Adjusted risks[a] RR (95% CI)
Sleep duration (< 7 or > 9 h)			
Standard	23.8 (252)	1 (reference)	1 (reference)
Non-Standard	34.2 (106)	1.43 (1.19, 1.73)	1.43 (1.18, 1.74)
Smokes cigarettes (daily)			
Standard	9.3 (99)	1	1
Non-Standard	14.7 (48)	1.58 (1.15, 2.18)	1.45 (1.04, 2.01)
Heavy drinking[b] (> 2 drinks/day)			
Standard	7.4 (69)	1	1
Non-Standard	11.5 (33)	1.56 (1.05, 2.31)	1.58 (1.07, 2.32)
Does not meet MVPA recommendations			
Standard	35.6 (382)	1	1
Non-Standard	32.5 (107)	0.92 (0.77, 1.09)	0.95 (0.80, 1.14)
Daily recreational screen time ≥ 2 h			
Standard	74.4 (798)	1	1
Non-Standard	79.9 (262)	1.07 (1.01, 1.15)	1.07 (1.00, 1.14)
Does not meet vegetable recommendation[b]			
Standard	89.0 (830)	1	1
Non-Standard	84.4 (243)	0.95 (0.90, 1.00)	0.94 (0.90, 0.99)
Does not meet fruit recommendation[b]			
Standard	85.0 (793)	1	1
Non-Standard	85.8 (247)	1.01 (0.96, 1.07)	1.00 (0.95, 1.04)
Exceeds % sugar recommendation[b]			
Standard	42.4 (398)	1	1
Non-Standard	48.6 (140)	1.15 (1.00, 1.32)	1.13 (0.98, 1.31)
Skips breakfast (≥ 1 time/week)			
Standard	55.8 (599)	1	1
Non-Standard	67.5 (222)	1.21 (1.10, 1.33)	1.17 (1.07, 1.28)
Eats fast food (≥ 1 time/week)			
Standard	56.6 (607)	1	1
Non-Standard	64.0 (210)	1.13 (1.03, 1.25)	1.10 (1.01, 1.21)
Binge eating			
Standard	22.0 (236)	1	1
Non-Standard	26.3 (86)	1.20 (0.97, 1.48)	1.21 (0.97, 1.50)
Unhealthy weight control behavior			
Standard	43.2 (462)	1	1
Non-Standard	47.2 (154)	1.09 (0.96, 1.25)	1.12 (0.98, 1.27)
	Range	Mean (95% CI)	Mean (95% CI)
Overall Behavior Score[b, d]			
Standard	0–11	5.4 (5.3, 5.6)	5.5 (5.3, 5.7)
Non-Standard	1–11	5.9 (5.7, 6.2)[c]	5.9 (5.6, 6.2)[c]

MVPA, moderate-to-vigorous physical activity; RR, Relative Risk.

[a] Models adjusted for age, gender, race/ethnicity (Workers of Color v. White Workers), nativity status, and family socioeconomic status.

[b] Food frequency questionnaires were not completed by all full-time workers (n = 1226).

[c] Adjusted mean score is significantly different from Standard (regular daytime) work schedule (P < 0.05).

[d] Summed score of each adult's less healthful behaviors (Range = 0–12).

(body mass index [BMI] ≥ 30) and *Grade II obesity* (BMI ≥ 35) were calculated using self-reported height and weight (r = 0.98 and 0.97, respectively).

Covariates

Covariates included participants' gender, ethnicity/race, age, U.S. nativity status, and family socioeconomic status, which were based on self-report. Covariates represent different social identities that are associated with certain life opportunities and barriers in the U.S. and may therefore serve as important determinants of both adult work circumstances and behavioral and well-being outcomes. Participant gender and age were assessed at the fourth wave of data collection and ethnicity/race, family socioeconomic status, and U.S. nativity status were assessed at the first. *Ethnicity/race* was categorized into white workers (only selecting "White" response) and workers of color (selecting one or more of the following: "Black or African American," "Hispanic or Latino," "Asian American," "Hawaiian or Pacific Islander," or "American Indian or Native American"). *Family socioeconomic status (SES)* was based on the highest level of educational attainment of either parent of the participant. In cases where educational attainment of parent(s) was missing, other socioeconomic variables were used to

impute the value and implausible values were corrected based on a previously described algorithm (Sherwood et al., 2009). This variable was categorized as low, middle, and high family socioeconomic status. *U.S. nativity status* was assessed with the question "Were you born in the United States?" with response options "yes" or "no."

Statistical Analyses

We examined distributions of participant characteristics across work schedules and examined differences using the chi-square or F-tests to test the equality of means. We used log-binomial models to estimate relative risks (RRs) for each behavior and outcome as a function of work schedules, comparing workers with NSWSs to those with a standard work schedule. In addition, to summarize the overall pattern of health and well-being behaviors, we created a cumulative behavioral risk score by summing the presence of each of the 12 examined behaviors for each worker (range 0–11; mean = 5.53, SD = 1.97) and examined this score as a function of non-standard versus standard work schedule using linear regression.

To explore whether risks were consistent across all types of NSWSs, we performed additional regressions using the 4-level work schedule

Table 3
Relative risks of well-being and weight status outcomes by standard and non-standard work schedules among full-time working adults.

	Prevalence % (N)	Unadjusted risks RR (95% CI)	Adjusted risks[a] RR (95% CI)
Clinically-relevant depressive symptoms			
Standard	13.2 (141)	1 (reference)	1 (reference)
Non-Standard	18.7 (61)	1.41 (1.08, 1.86)	1.42 (1.07, 1.89)
Unmanaged stress			
Standard	36.1 (374)	1	1
Non-Standard	34.1 (109)	0.95 (0.80, 1.12)	1.00 (0.84, 1.19)
Obesity: Grade 1 (BMI ≥ 30 kg/m^2)[b]			
Standard	24.4 (249)	1	1
Non-Standard	28.8 (90)	1.18 (0.96, 1.45)	1.13 (0.91, 1.39)
Obesity: Grade 2 (BMI ≥ 35 kg/m^2)[b]			
Standard	10.3 (105)	1	1
Non-Standard	14.4 (45)	1.40 (1.01, 1.94)	1.42 (1.02, 1.98)

BMI, body mass index; RR, relative risk.
[a] Models adjusted for age, gender, race/ethnicity (Workers of Color v. White Workers), nativity status, and family socioeconomic status.
[b] Currently pregnant full-time workers (N = 54) not included.

variable (evening, night/rotating, and irregular NSWSs compared to standard schedules as the referent). We also compared risk estimates and 95% confidence intervals across the three different types of NSWSs and identified significant differences by non-overlapping confidence intervals. All models used complete cases and were adjusted for gender, ethnicity/race, age, nativity, and family socioeconomic status. Significance was set to P < 0.05, and all analyses were conducted using SAS (version 9.3, 2010, Cary, NC, USA).

Results

Work schedules among full-time workers

Approximately 24% (n = 329) of full-time workers reported working a NSWS at the time the survey was completed. Among NSWS workers, 15.5% (n = 51) worked regular evening shift, 46.5% (n = 153) worked regular night or rotating shift, and 38.0% (n = 125) worked an irregular or split shift schedule. Differences in those who reported a NSWS were observed across gender, with more men than women reporting a NSWS (particularly evening or night/rotating schedules), and across family socioeconomic status, with more workers from low versus high socioeconomic backgrounds reporting an evening schedule. Differences in NSWSs were not identified across U.S. nativity status or age, though there was some indication that workers of color were more likely to work a NSWS than white workers (p = 0.082; Table 1).

Behavioral, well-being, and weight status outcomes across non-standard and standard work schedules

Numerous differences were observed in the adjusted relative risks of behavioral outcomes among those in NSWSs versus standard schedules (Table 2). Compared to standard schedule workers, NSWS workers had a significantly higher adjusted risks of less healthful sleeping, smoking, alcohol consumption, screen time, breakfast, and fast food behaviors. Elevated risks were also observed among NSWS workers relative to standard schedule workers for exceeding daily sugar recommendations, binge eating, and engaging in UWCBs (p < 0.10), though values did not reach statistical significance. Insufficient daily vegetable consumption was the only behavior for which NSWS workers experienced a reduced risk. Based on the overall behavioral risk score, NSWS workers cumulatively demonstrated a greater number of less healthful behaviors (β =

0.46, SE = 0.14, P < 0.001) than standard schedule workers.

For well-being and weight status outcomes (Table 3), NSWS workers reported a higher prevalence of both clinically-relevant depressive symptoms and Grade II obesity (BMI ≥ 35) after adjustment for covariates, demonstrating a 42% higher prevalence of both relative to standard schedule workers. In general, NSWS workers displayed an overall pattern of elevated risks for a broad range of unfavorable behaviors, well-being, and weight status outcomes.

Behavioral, well-being, and weight status outcomes across types of NSWSs (Evening, night/Rotating, and irregular schedules)

Similar risks for several behavioral outcomes were observed across workers with different types of NSWSs relative to standard schedule workers (Table 4). For instance, a similar elevated risk was observed for less healthful sleep, screen time, and breakfast, across all NSWS types, although some estimates did not achieve conventional statistical significance. Likewise, there was a similar null risk for fruit and vegetable consumption across NSWS types. However, some variations in relative risks were observed across the types of NSWSs. For example, elevated relative risks were observed for exceeding daily sugar recommendations, fast food consumption, and binge eating among workers with night/rotating and evening NSWSs, but not among workers with irregular NSWSs.

A comparable pattern was also observed among the well-being and weight status outcomes (Table 5). Relative to standard workers, a similar elevated risk for depression and a similar null risk for unmanaged stress was identified across all types of NSWSs. However, Grade I obesity (BMI ≥ 30) significantly differed by NSWS type, with night/rotating schedule workers having an elevated risk (RR = 1.52, 95% CI = 1.20, 1.93) and irregular schedule workers having a lower risk (RR = 0.77, 95% CI = 0.53, 1.13).

Discussion

Work plays a central role in the daily lives of most young adults, and prior evidence consistently connects work schedules to a variety of health consequences. The findings presented in this study help to provide some indication of the relevant behaviors and psychological factors in young adulthood that may link non-standard work schedules (NSWSs) to the health outcomes of working populations. Among full-time young adult workers, those with a NSWS had elevated risks for a wide range of unfavorable behavioral, well-being, and weight status outcomes relative to workers with standard (regular, daytime) schedules. However, contrary to our expectations, we found limited support for a distinctly worse profile of outcomes among night/rotating NSWS workers and instead observed estimated relative risks that were consistently similar to other NSWS types.

With the wide range of chronic diseases previously linked with NSWSs, we hypothesized that NSWSs would be associated with a broad assortment of unfavorable behavioral, well-being, and weight status outcomes, and results of this study support this hypothesis. Like other investigations, we found evidence that NSWS workers have less optimal sleep, substance use, sedentary activity, weight status, and depressive symptoms than standard schedule workers (Angerer, Schmook, Elfantel, & Li, 2017; Bae et al., 2017; Bushnell, Colombi, Caruso & Tak, 2010; de Assis, Kupek, Nahas & Bellisle, 2003; Dorrian & Skinner, 2012; Kecklund & Axelsson, 2016; Lee et al. 2017; Pilcher et al., 2000; Proper et al., 2016; Ramin et al., 2015; Vandelanotte et al., 2015). However, much of this literature is limited to associations with night and/or rotating shift work. Our study advances on this past work by examining a broader definition of any NSWS. We also found support for links between NSWSs and several unfavorable dietary practices, adding to the limited literature on NSWSs and diet, which largely focuses on timing of food consumption (Atkinson, Fullick, Grindey, & Maclaren, 2008; Lowden, Moreno, Holmback, Lennernas, & Tucker, 2010). While

Table 4
Relative risks[a] of behavioral outcomes by work schedule among full-time working adults.

Behavior	Work schedule	Prevalence % (N)	Unadjusted risks RR (95% CI)	Adjusted risks[a] RR (95% CI)
Sleep duration (< 7 or > 9 h)				
	Standard (Regular daytime)	23.8 (252)	1 (reference)	1 (reference)
	Evening	38.0 (19)	1.59 (1.10, 2.31)	1.47 (0.99, 2.21)
	Night/ rotating	31.9 (45)	1.34 (1.03, 1.74)	1.34 (1.02, 1.77)
	Irregular	35.3 (42)	1.48 (1.14, 1.93)	1.51 (1.15, 1.99)
Smokes cigarettes (daily)				
	Standard (Regular daytime)	9.3 (99)	1	1
	Evening	12.0 (6)	1.29 (0.59, 2.80)	0.99 (0.42, 2.33)
	Night/ rotating	19.1 (29)	2.05 (1.41, 2.99)	1.96 (1.34, 2.85)
	Irregular	10.5 (13)	1.13 (0.65, 1.95)	0.98 (0.54, 1.78)
Heavy drinking‡ (> 2 drinks/day)[b]				
	Standard (Regular daytime)	7.4 (69)	1	1
	Evening	9.1 (4)	1.24 (0.47, 3.23)	1.16 (0.45, 3.01)
	Night/ rotating	10.1 (13)	1.37 (0.78, 2.41)	1.45 (0.84, 2.52)
	Irregular	13.9 (16)	1.89 (1.14, 3.14)	1.87 (1.14, 3.06)
Does not meet MVPA recommendations				
	Standard (Regular daytime)	35.6 (382)	1	1
	Evening	43.1 (22)	1.21 (0.88, 1.68)	1.21 (0.90, 1.64)
	Night/ rotating	30.1 (46)	0.85 (0.66, 1.09)	0.85 (0.65, 1.10)
	Irregular	31.2 (39)	0.88 (0.67, 1.15)	0.96 (0.74, 1.25)
Daily recreational screen time ≥ 2 h				
	Standard (Regular daytime)	74.4 (798)	1	1
	Evening	86.3 (44)	1.16 (1.03, 1.30)	1.11 (0.99, 1.25)
	Night/ rotating	80.3 (122)	1.08 (0.99, 1.18)	1.07 (0.99, 1.16)
	Irregular	76.8 (96)	1.03 (0.93, 1.14)	1.04 (0.94, 1.15)
Does not meet vegetable recommendation[c]				
	Standard (Regular daytime)	89.0 (830)	1	1
	Evening	88.6 (39)	1.00 (0.89, 1.11)	0.94 (0.84, 1.05)
	Night/ rotating	85.3 (110)	0.96 (0.89, 1.03)	0.97 (0.91, 1.04)
	Irregular	81.7 (94)	0.92 (0.84, 1.01)	0.91 (0.84, 0.99)
Does not meet fruit recommendation[c]				
	Standard (Regular daytime)	85.0 (793)	1	1
	Evening	86.4 (38)	1.02 (0.90, 1.15)	0.95 (0.85, 1.07)
	Night/ rotating	85.3 (110)	1.00 (0.93, 1.08)	1.02 (0.95, 1.08)
	Irregular	86.1 (99)	1.01 (0.94, 1.10)	1.00 (0.94, 1.07)
Exceeds % sugar recommendation[c]				
	Standard (Regular daytime)	42.4 (398)	1	1
	Evening	56.8 (25)	1.34 (1.02, 1.75)	1.22 (0.93, 1.60)
	Night/ rotating	51.2 (66)	1.21 (1.00, 1.45)	1.20 (1.00, 1.44)
	Irregular	42.6 (49)	1.00 (0.80, 1.26)	1.01 (0.80, 1.27)
Skips breakfast				
	Standard (Regular daytime)	55.8 (599)	1	1
	Evening	68.6 (35)	1.23 (1.01, 1.49)	1.11 (0.91, 1.35)
	Night/ rotating	68.0 (104)	1.22 (1.08, 1.37)	1.18 (1.05, 1.33)
	Irregular	66.4 (83)	1.19 (1.04, 1.36)	1.18 (1.03, 1.35)
Eats fast food				
	Standard (Regular daytime)	56.6 (607)	1	1
	Evening	70.6 (36)	1.25 (1.04, 1.50)	1.20 (0.95, 1.41)[d]
	Night/ rotating	67.3 (103)	1.19 (1.05, 1.35)	1.16 (1.01, 1.30)[d]
	Irregular	57.3 (71)	1.01 (0.86, 1.19)	0.99 (0.83, 1.14)[d]
Binge eating				
	Standard (Regular daytime)	22.0 (236)	1	1
	Evening	31.4 (16)	1.43 (0.94, 2.17)	1.62 (1.07, 2.46)
	Night/ rotating	27.6 (42)	1.26 (0.95, 1.66)	1.25 (0.94, 1.66)
	Irregular	22.6 (28)	1.03 (0.73, 1.45)	1.01 (0.71, 1.44)
Unhealthy weight control behavior				
	Standard (Regular daytime)	43.2 (462)	1	1
	Evening	52.9 (27)	1.22 (0.94, 1.60)	1.30 (1.00, 1.68)
	Night/ rotating	47.0 (71)	1.09 (0.91, 1.31)	1.10 (0.93, 1.31)
	Irregular	45.2 (56)	1.05 (0.85, 1.28)	1.07 (0.88, 1.31)

Overall Behavior Risk Score[c, e]	Work Schedule	Range	Mean (95% CI)	Mean (95% CI)[a]
	Standard (Regular daytime)	0–11	5.4 (5.3, 5.6)	5.5 (5.3, 5.7)
	Evening	3–10	6.3 (5.7, 6.9)[f]	6.1 (5.5, 6.7)[f]
	Night/ rotating	1–11	6.0 (5.6, 6.3)[f]	6.0 (5.6, 6.4)[f]
	Irregular	2–10	5.8 (5.4, 6.1)	5.8 (5.4, 6.2)

MVPA, moderate-to-vigorous physical activity; RR, relative Risk.

[a] Models adjusted for age, gender, race/ethnicity (Workers of Color v. White Workers), nativity status, and family socioeconomic status

[b] Food frequency questionnaires were not completed by all full-time workers (n = 1226)

[c] Food frequency questionnaires were not completed by all full-time workers (n = 1226).

[d] Relative risk estimates calculated from predicted logistic regression equation using counterfactual method; standard errors estimated using the delta method and method of variances

estimates recovery (Zou, 2009)
[e] Summed score of each adult's less healthful behaviors (Range = 0–12).
[f] Adjusted mean score is significantly different from Standard (regular daytime) work schedule (P < 0.05).

Table 5
Relative Risks[a] of Well-being and Weight Status Outcomes by Work Schedule among Full-Time Working Adults.

Outcome	Work schedule	Prevalence % (N)	Unadjusted risks RR (95% CI)	Adjusted risks[a] RR (95% CI)
Clinically-relevant depressive symptoms				
	Standard (Regular daytime)	13.2 (141)	1 (reference)	1 (reference)
	Evening	19.6 (10)	1.49 (0.83, 2.64)	1.57 (0.86, 2.88)
	Night/ rotating	19.9 (30)	1.51 (1.06, 2.15)	1.49 (1.03, 2.16)
	Irregular	16.8 (21)	1.27 (0.84, 1.94)	1.29 (0.83, 1.99)
Unmanaged stress				
	Standard (Regular daytime)	36.1 (374)	1	1
	Evening	29.2 (14)	0.81 (0.52, 1.27)	0.94 (0.60, 1.46)
	Night/ rotating	35.6 (53)	0.99 (0.78, 1.24)	1.01 (0.80, 1.27)
	Irregular	34.2 (42)	0.95 (0.73, 1.23)	1.02 (0.79, 1.31)
Obesity: Grade 1 (BMI ≥ 30)[b]				
	Standard (Regular daytime)	24.4 (249)	1	1
	Evening	29.2 (14)	1.20 (0.76, 1.88)	1.14 (0.73, 1.77)
	Night/ rotating	37.1 (53)	1.52 (1.20, 1.93)	1.45 (1.14, 1.85)
	Irregular	18.9 (23)	0.77 (0.53, 1.13)	0.73 (0.48, 1.09)
Obesity: Grade 2 (BMI ≥ 35)[b]				
	Standard (Regular daytime)	10.3 (105)	1	1
	Evening	8.3 (4)	0.81 (0.31, 2.11)	0.89 (0.34, 2.30)
	Night/ rotating	21.0 (30)	2.04 (1.42, 2.94)	2.00 (1.37, 2.92)
	Irregular	9.0 (11)	0.88 (0.49, 1.59)	0.93 (0.52, 1.68)

BMI, body mass index; RR, relative risk.
[a] Models adjusted for age, gender, race/ethnicity (Workers of Color v. White Workers), nativity status, and family socioeconomic status
[b] Currently pregnant full-time workers (N = 54) not included.

relative risks were small and only marginally significant for some dietary behaviors, the overall pattern indicates that NSWSs are associated with less healthful dietary practices related to both when and what food is consumed.

Given different types of NSWS workers may experience other forms of disruption (e.g., chronobiological) in addition to social disruption, we hypothesized that different NSWS types would be characterized by significantly different patterns of behavioral, well-being, and weight status outcomes with night/rotating NSWS workers exhibiting a consistently worse profile. However, out of the 16 outcomes examined only obesity (BMI ≥ 30) was identified to significantly differ between NSWS types (i.e., estimated confidence intervals for night/rotating and irregular NSWSs did not overlap). Instead, across most outcomes, similar relative risks were observed for at least two of the three NSWS types with all three NSWS types often demonstrating a similar relative risk pattern. Because this lack of significant differences might relate to the limited sample sizes of different NSWS types, additional research is warranted to further explore whether nuances and complexities exist in the relationships between type of NSWSs and health behaviors, well-being, and chronic disease.

The similar behavioral and well-being risk patterns observed across different NSWSs also seem to suggest that whether someone works *any* NSWS might be more relevant to health and well-being than the *specific type* of NSWS worked. This finding is important as it highlights the potential for other aspects of working time and synchronization—beyond the chronobiological disruption of night and rotating shiftwork that has received most of the research attention—to relate to negative outcomes for working populations. Such working time and synchronization aspects might include the social disruption experienced by all NSWSs, which may lead some workers to social and psychological distress and others to real and perceived time constraints for health behaviors (Colligan & Rosa, 1990; Costa, 2003; Kantermann et al., 2010; Kecklund & Axelsson, 2016; Schneiderman et al., 2005; Vogel et al., 2012). Additional support for the importance of social disruption comes from recent reports from shift workers, who identified the most problematic aspects of work schedules to be those that create social

(e.g., short notice and split shifts) rather than chronobiological (e.g., rotating shifts) consequences (Åkerstedt & Kecklund, 2017). Such findings, in combination with those from this study, indicate a need for: further investigation into the socially disruptive aspects of NSWSs (e.g., time constraints, psychosocial distress) and the ways they connect to long-term health and well-being; additional development of interventions to better support the health of NSWS workers; and, further dialogue about the necessity of such work schedules across all U.S. industries and occupations (Alterman et al., 2013).

Strengths and limitations

As work exposures can have limited variance within a single occupation, a valuable strength of this investigation was the use of a large, population-based sample of workers from a diverse set of U.S. occupations and industries. In addition, we examined a broad range of behaviors and outcomes facilitating a more holistic view of how NSWSs may affect behavior, health, and well-being (Peckham et al., 2017). A limitation of our study was the cross-sectional design, which prevented the direction of influence to be established; however, the probability that health behaviors lead to NSWSs seems unlikely. Additionally, while the single-item measure of work schedules was similar to questions used in previous investigations (Alterman et al., 2013; Presser & Ward, 2011), the measure was limited, as it did not evaluate the duration of exposure to each work schedule, assess weekly work days (e.g., weekends versus Monday-Friday), nor provide definitions to clarify response options. Given a lack of definitions for work schedules may lead to misclassification and dilute effect estimates, future questionnaires should include more precise response items that allow workers to identify start and end clock times on most days of their current schedule.

Conclusion

Work is one of many social determinants that can affect health and well-being. Findings from this study indicate that workers with non-

standard work schedules experience an increased risk for a host of unfavorable behavioral, well-being, and weight status outcomes and that little difference in risks exists between the types of non-standard schedules worked. The associations found add to a growing literature of how one particular aspect of work, non-standard working time, may affect the health and well-being of working populations.

Conflict of interest

None to declare.

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References

Åkerstedt, T., & Kecklund, G. (2017). What work schedule characterisitics constitute a problem to the individual? A representative study of Swedish shift workers. *Applied Ergonomics, 59*, 320–325.

Alterman, T., Luckhaupt, S. E., Dahlhamer, J. M., Ward, B. W., & Calvert, G. M. (2013). Prevalence rates of work organization characteristics among workers in the U.S.: Data from the 2010 national health interview survey. *American Journal of Industrial Medicine, 56*(6), 647–659. http://dx.doi.org/10.1002/ajim.22108.

Angerer, P., Schmook, R., Elfantel, I., & Li, J. (2017). Night work and the risk of depression. *Dtsch Arztebl Int, 114*(24), 404–411. http://dx.doi.org/10.3238/arztebl.2017.0404.

Antunes, L. C., Levandovski, R., Dantas, G., Caumo, W., & Hidalgo, M. P. (2010). Obesity and shift work: Chronobiological aspects. *Nutrition Research Reviews, 23*(1), 155–168. http://dx.doi.org/10.1017/s0954422410000016.

de Assis, M. A. A., Kupek, E., Nahas, M. V. c, & Bellisle, F. (2003). Food intake and circadian rhythms in shift workers with a high workload. *Appetite, 40*(2), 175–183. http://dx.doi.org/10.1016/S0195-6663(02)00133-2.

Atkinson, G., Fullick, S., Grindey, C., & Maclaren, D. (2008). Exercise, energy balance and the shift worker. *Sports Medicine, 38*(8), 671–685.

Bae, M. J., Song, Y. M., Shin, J. Y., Choi, B. Y., Keum, J. H., & Lee, E. A. (2017). The association between shift work and health behavior: Findings from the Korean national health and nutrition examination survey. *Korean Journal of Family Medicine, 38*(2), 86–92. http://dx.doi.org/10.4082/kjfm.2017.38.2.86.

Baliunas, D. O., Taylor, B. J., Irving, H., Roerecke, M., Patra, J., Mohapatra, S., & Rehm, J. (2009). Alcohol as a risk factor for type 2 diabetes: A systematic review and meta-analysis. *Diabetes Care, 32*(11), 2123–2132. http://dx.doi.org/10.2337/dc09-0227.

Breslow, R. A., Guenther, P. M., & Smothers, B. A. (2006). Alcohol drinking patterns and diet quality: The 1999–2000 national health and nutrition examination survey. *American Journal of Epidemiology, 163*(4), 359–366. http://dx.doi.org/10.1093/aje/kwj050.

Buchvold, H. V., Pallesen, S., Oyane, N. M., & Bjorvatn, B. (2015). Associations between night work and BMI, alcohol, smoking, caffeine and exercise–a cross-sectional study. *BMC Public Health, 15*, 1112. http://dx.doi.org/10.1186/s12889-015-2470-2.

Bushnell, P. T., Colombi, A., Caruso, C. C., & Tak, S. (2010). Work schedules and health behavior outcomes at a large manufacturer. *Industrial Health, 48*(4), 395–405.

Church, T. S., Thomas, D. M., Tudor-Locke, C., Katzmarzyk, P. T., Earnest, C. P., Rodarte, R. Q., ... Bouchard, C. (2011). Trends over 5 decades in U.S. occupation-related physical activity and their associations with obesity. *PLoS One, 6*(5), e19657. http://dx.doi.org/10.1371/journal.pone.0019657.

Colligan, M. J., & Rosa, R. R. (1990). Shiftwork effects on social and family life. *Occupational Medicine, 5*(2), 315–322.

Costa, G. (2003). Shift work and occupational medicine: An overview. *Occupational Medicine, 53*(2), 83–88.

Di Castelnuovo, A., Costanzo, S., Bagnardi, V., Donati, M., Iacoviello, L., & de Gaetano, G. (2006). Alcohol dosing and total mortality in men and women: An updated meta-analysis of 34 prospective studies. *Archives of Internal Medicine, 166*(22), 2437–2445. http://dx.doi.org/10.1001/archinte.166.22.2437.

Dixon, J., Carey, G., Strazdins, L., Banwell, C., Woodman, D., Burgess, J., ... Sargent, G. (2014). Contemporary contestations over working time: Time for health to weigh in. *BMC Public Health, 14*(1), 1068. http://dx.doi.org/10.1186/1471-2458-14-1068.

Dorrian, J., & Skinner, N. (2012). Alcohol consumption patterns of shiftworkers compared with dayworkers. *Chronobiology International, 29*(5), 610–618. http://dx.doi.org/10.3109/07420528.2012.675848.

Eurofound (2016). *Sixth European working conditions survey – Overview report.* Luxembourg: Publications Office of the European Union.

Feskanich, D., Rimm, E. B., Giovannucci, E. L., Colditz, G. A., Stampfer, M. J., Litin, L. B., & Willett, W. C. (1993). Reproducibility and validity of food intake measurements from a semiquantitative food frequency questionnaire. *Journal of the American Dietetic Association, 93*(7), 790–796.

Gan, Y., Yang, C., Tong, X., Sun, H., Cong, Y., Yin, X., ... Lu, Z. (2015). Shift work and diabetes mellitus: A meta-analysis of observational studies. *Occupational and Environmental Medicine, 72*(1), 72–78. http://dx.doi.org/10.1136/oemed-2014-102150.

Godin, G., & Shephard, R. (1997). Godin leisure-time exercise questionnaire. *Medicine & Science in Sports & Exercise, 29*(6), 36–38.

Harvard School of Public Health Nutrition Department (HSPH) (2017). HSPH Nutrition Department's File Download Site. ⟨https://regepi.bwh.harvard.edu/health/nutrition.html⟩. (Accessed 08 March 2017).

Henderson, R. (2015 December). Industry employment and output projections to 2024 Monthly Lab. Rev. U.S. Bureau of Labor Statistics.

Hu, F. B., Li, T. Y., Colditz, G. A., Willett, W. C., & Manson, J. E. (2003). Television watching and other sedentary behaviors in relation to risk of obesity and type 2 diabetes mellitus in women. *Jama, 289*(14), 1785–1791. http://dx.doi.org/10.1001/jama.289.14.1785.

IRS (2017). Identifying full-time employees. from ⟨https://www.irs.gov/affordable-care-act/employers/identifying-full-time-employees⟩.

Jabs, J., & Devine, C. M. (2006). Time scarcity and food choices: An overview. *Appetite, 47*(2), 196–204. http://dx.doi.org/10.1016/j.appet.2006.02.014.

Kandel, D. B., & Davies, M. (1982). Epidemiology of depressive mood in adolescents: An empirical study. *Archives of General Psychiatry, 39*(10), 1205–1212.

Kantermann, T., Juda, M., Vetter, C., & Roenneberg, T. (2010). Shift-work research: Where do we stand, where should we go? *Sleep and Biological Rhythms, 8*(2), 95–105. http://dx.doi.org/10.1111/j.1479-8425.2010.00432.x.

Kecklund, G., & Axelsson, J. (2016). Health consequences of shift work and insufficient sleep. *Bmj, 355*. http://dx.doi.org/10.1136/bmj.i5210.

Lang, I., Wallace, R. B., Huppert, F. A., & Melzer, D. (2007). Moderate alcohol consumption in older adults is associated with better cognition and well-being than abstinence. *Age and Ageing, 36*(3), 256–261. http://dx.doi.org/10.1093/ageing/afm001.

Lee, A., Myung, S. K., Cho, J. J., Jung, Y. J., Yoon, J. L., & Kim, M. Y. (2017). Night shift work and risk of depression: Meta-analysis of observational studies. *Journal of Korean Medical Science, 32*(7), 1091–1096. https://www.ncbi.nlm.nih.gov/pubmed/28581264.

Lowden, A., Moreno, C., Holmback, U., Lennernas, M., & Tucker, P. (2010). Eating and shift work - effects on habits, metabolism and performance. *Scandinavian Journal of Work, Environment & Health, 36*(2), 150–162.

McMenamin, T. M. (2007). A time to work: Recent trends in shift work and flexible schedules. *Monthly Labor Review, 130*, 3.

Nelson, M. C., Lust, K., Story, M., & Ehlinger, E. (2008). Credit card debt, stress and key health risk behaviors among college students. *American Journal of Health Promotion, 22*, 400–407.

Neumark-Sztainer, D., Story, M., Hannan, P., & Moe, J. (2002a). Overweight status and eating patterns among adolescents: Where do youth stand in comparison to the Healthy People 2010 Objectives? *American Journal of Public Health, 92*, 844–851.

Neumark-Sztainer, D., Croll, J., Story, M., Hannan, P. J., French, S. A., & Perry, C. (2002b). Ethnic/racial differences in weight-related concerns andbehaviors among adolescent girls and boys: findings from Project EAT. *Journal of Psychosomatic Research, 53*, 963–974.

Pasch, K. E., Laska, M. N., Lytle, L. A., & Moe, S. G. (2010). Adolescent sleep, risk behaviors, and depressive symptoms: Are they linked? *American Journal of Health Behavior, 34*, 237–248.

Patel, S. R., & Hu, F. B. (2008). Short sleep duration and weight gain: A systematic review. *Obesity, 16*(3), 643–653. http://dx.doi.org/10.1038/oby.2007.118.

Patel, S. R., Malhotra, A., Gottlieb, D. J., White, D. P., & Hu, F. B. (2006). Correlates of long sleep duration. *Sleep, 29*(7), 881–889.

Patel, S. R., Ayas, N. T., Malhotra, M. R., White, D. P., Schernhammer, E. S., Speizer, F. E., ... Hu, F. B. (2004). A prospective study of sleep duration and mortality risk in women. *Sleep, 27*(3), 440–444.

Peckham, T. K., Baker, M. G., Camp, J. E., Kaufman, J. D., & Seixas, N. S. (2017). Creating a future for occupational health. *Annals of Work Exposures and Health, 61*(1), 3–15. http://dx.doi.org/10.1093/annweh/wxw011.

Pilcher, J. J., Lambert, B. J., & Huffcutt, A. I. (2000). Differential effects of permanent and rotating shifts on self-report sleep length: A meta-analytic review. *Sleep, 23*(2), 155–163.

Presser, H. B. (2003). *Working in a 24/7 economy: Challenges for American families.* New York, New York: Russell Sage Foundation.

Presser, H. B., & Ward, B. W. (2011). Nonstandard work schedules over the life course: A first look. *Monthly Labor Review, 134*(7), 3–16.

Proper, K. I., van de Langenberg, D., Rodenburg, W., Vermeulen, R. C. H., van der Beek, A. J., van Steeg, H., & van Kerkhof, L. W. M. (2016). The relationship between shift work and metabolic risk factors. *American Journal of Preventive Medicine, 50*(5), e147–e157. http://dx.doi.org/10.1016/j.amepre.2015.11.013.

Ramin, C., Devore, E. E., Wang, W., Pierre-Paul, J., Wegrzyn, L. R., & Schernhammer, E. S. (2015). Night shift work at specific age ranges and chronic disease risk factors. *Occupational and Environmental Medicine, 72*(2), 100–107. http://dx.doi.org/10.1136/oemed-2014-102292.

Rangel, A. (2013). Regulation of dietary choice by the decision-making circuitry. *Nature Neuroscience, 16*(12), 1717–1724. http://dx.doi.org/10.1038/nn.3561.

Rao, D., Yu, H., Bai, Y., Zheng, X., & Xie, L. (2015). Does night-shift work increase the risk of prostate cancer? A systematic review and meta-analysis. *OncoTargets and Therapy, 8*, 2817–2826. http://dx.doi.org/10.2147/ott.s89769.

Schnall, P. L., Dobson, M., & Landsbergis, P. (2016). Globalization, work, and cardiovascular disease. *International Journal of Health Services, 46*(4), 656–692. http://dx.

doi.org/10.1177/0020731416664687.

Schneiderman, N., Ironson, G., & Siegel, S. D. (2005). Stress and health: Psychological, behavioral, and biological determinants. *Annual Review of Clinical Psychology, 1*, 607–628. http://dx.doi.org/10.1146/annurev.clinpsy.1.102803.144141.

Schrecker, T., & Bambra, C. (2015). *How politics make us sick: Neoliberal epidemics*. Palgrave MacMillan.

Sherwood, N. E., Wall, M., Neumark-Sztainer, D., & Story, M. (2009). Effect of socio-economic status on weight change patterns in adolescents. *Preventing Chronic Disease, 6*, A19.

Sherwood, N. E., Neumark-Sztainer, D., Story, M., Beuhring, T., & Resnick, M. D. (2002). Weight-related sports involvement in girls: Who is at risk for disordered eating? *American Journal of Health Promotion, 16*, 341–344.

Stamatakis, E., Hamer, M., & Dunstan, D. W. (2011). Screen-based entertainment time, all-cause mortality, and cardiovascular events. *Journal of the American College of Cardiology, 57*(3), 292–299. http://dx.doi.org/10.1016/j.jacc.2010.05.065.

Statistics, B.O.L., & Labor, U.S.D.O. (2016, March). Employment by industry, 1910 and 2015. *The Economics Daily*. from ⟨https://www.bls.gov/opub/ted/2016/employment-by-industry-1910-and-2015.htm⟩.

U.S. Deptartmnet of Labor (DOL) (1982). *Labor force statistics derived from the Current population survey: A databook, Volume 1 (Bulletin 2096)*. U.S. Dept. of Labor, Bureau of Labor Statistics.

US Department of Health and Human Services (HHS) (2008). 2008 physical activity guidelines for Americans. Retrieved from ⟨https://health.gov/paguidelines/pdf/paguide.pdf⟩ (Accessed 08 February 2017).

USDA, & USDHHS (2010). *Dietary guidelines for Americans, 2010* (7th ed.). Washington D.C.: U.S. Government Printing Office.

USDHHS, & USDA. (2015a). 2015–2020 dietary guidelines for Americans (8th ed.).

USDHHS, & USDA. (2015b). Scientific report of the 2015 dietary guidelines advisory committee: Advisory to the secretary of health and human services and the secretary of agriculture.

Vandelanotte, C., Short, C., Rockloff, M., Di Millia, L., Ronan, K., Happell, B., & Duncan, M. J. (2015). How do different occupational factors influence total, occupational, and leisure-time physical activity? *Journal of Physical Activity & Health, 12*(2), 200–207. http://dx.doi.org/10.1123/jpah.2013-0098.

Vogel, M., Braungardt, T., Meyer, W., & Schneider, W. (2012). The effects of shift work on physical and mental health. *Journal of Neural Transmission, 119*(10), 1121–1132. http://dx.doi.org/10.1007/s00702-012-0800-4.

Vyas, M. V., Garg, A. X., Iansavichus, A. V., Costella, J., Donner, A., Laugsand, L. E., ... Hackam, D. G. (2012). Shift work and vascular events: Systematic review and meta-analysis. *Bmj, 345*, e4800. http://dx.doi.org/10.1136/bmj.e4800.

Wang, F., Yeung, K. L., Chan, W. C., Kwok, C. C., Leung, S. L., Wu, C., ... Tse, L. A. (2013). A meta-analysis on dose-response relationship between night shift work and the risk of breast cancer. *Annals of Oncology, 24*(11), 2724–2732. http://dx.doi.org/10.1093/annonc/mdt283.

Wang, X., Ji, A., Zhu, Y., Liang, Z., Wu, J., Li, S., ... Xie, L. (2015). A meta-analysis including dose-response relationship between night shift work and the risk of colorectal cancer. *Oncotarget, 6*(28), 25046–25060. http://dx.doi.org/10.18632/oncotarget.4502.

Zou, G. (2009). Assessment of risks by predicting counterfactuals. *Statistics in Medicine, 28*(30), 3761–3781.