

What aspects of shiftwork influence off-shift well-being of healthcare workers?

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ABSTRACT

Characteristics of shiftwork schedules have implications for off-shift well-being. We examined the extent to which several shift characteristics (e.g., shift length, working Sundays) are associated with three aspects of off-shift well-being: work-to-family conflict, physical well-being, and mental well-being. We also investigated whether these relationships differed in four nations. The Survey of Work and Time was completed by 906 healthcare professionals located in Australia, Brazil, Croatia, and the USA. Hierarchical multiple regression analyses supported the hypothesis that shiftwork characteristics account for significant unique variance in all three measures of well-being beyond that accounted for by work and family demands and personal characteristics. The patterns of regression weights indicated that particular shiftwork characteristics have differential relevance to indices of work-to-family conflict, physical well-being, and mental well-being. Our findings suggest that healthcare organizations should carefully consider the implications of shiftwork characteristics for off-shift well-being. Furthermore, although our findings did not indicate national differences in the nature of relationships between shift characteristics and well-being, shiftwork characteristics and demographics for healthcare professionals differ in systematic ways among nations; as such, effective solutions may be context-specific.

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1. Introduction

Frequently, service industry workers, such as healthcare workers, must work nontraditional shifts. The negative impacts of continued work in these nontraditional shifts on work outcomes have been well-documented and include higher frequency of accidents and absenteeism, among others (cf. Costa, 1996). Relative to on-shift outcomes such as those mentioned, however, relatively less attention has been paid to the study of off-shift consequences of shiftwork such as work–family conflict (WFC), physical well-being and psychological distress. In addition, studies that have examined off-work (as well as traditional on-work) outcomes have typically conceptualized shiftwork in a way that lacks consideration for its multi-faceted nature. Finally, the few studies that have considered multiple shiftwork characteristics and their relationship with on- and off-shift outcomes have done so without consideration for potential cross-national

differences for such relationships. The general purpose of this study was to begin to address these apparent gaps in the literature.

Shiftwork is broadly defined as scheduled work that is completed outside the parameters of the traditional day shift; i.e. from 9 a.m. to 5 p.m. (Costa, 2003). Roughly 17% of all employees working full-time for wages are engaged in shiftwork, with employees in the service industry (e.g., restaurants, healthcare) working nontraditional shifts more frequently (Beers, 2000). Approximately one-fourth of all those employed in hospitals work nontraditional hours (Beers, 2000), making this an important concern for those employed in healthcare (Wilson, 2002). Due to the high frequency with which shiftwork is utilized in hospital settings, studying the potential impact of shiftwork on employees within the healthcare industry continues to be of utmost importance.

Costa (1996) conducted a review of the shiftwork literature in an attempt to summarize the potentially dire consequences of nontraditional scheduling. Consequences of direct interest to employers include a higher frequency of work-related accidents as well as higher rates of absenteeism among workers. Employees

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engaging in shiftwork are also prone to experience myriad physical disturbances such as sleep deprivation, chronic fatigue and gastrointestinal disorders (e.g., ulcers). Although it is clear that shiftwork can lead to harmful personal consequences, researchers have traditionally focused most of their attention toward the study of on-shift outcomes. On-shift outcomes of shiftwork are operationalized as those that pertain specifically to the work context and include work-related attitudes and behaviors (e.g., work accidents, absenteeism). On the other hand, off-shift outcomes are conceptualized as more general in nature (i.e., less context-specific) including psychological and psychosocial well-being. Empirical work also supports the link between nontraditional work scheduling and off-shift outcomes. For instance, Demerouti et al. (2004) investigated the impact of shiftwork characteristics on WFC, job attitudes, and health perceptions in a sample of military police. Not surprisingly, respondents working non-day or weekend shifts reported significantly greater WFC compared to respondents working day shifts. Likewise, Grosswald (2003) examined the relationship between shiftwork and WFC found a detrimental effect of shiftwork characteristics pertaining to time at work (e.g., work hours) on WFC. Takahashi et al. (2005) assessed differences in outcomes based on respondents' self-reported adaptation to shiftwork, with the poorly adapted group reporting significantly greater social and family disruption and worse psychological well-being than the well-adapted group. All told, the empirical evidence to date suggests that shiftwork is consistently related to a variety of negative on- and off-shift outcomes.

As noted earlier, shiftwork is a loosely defined term, and this has led to the use of a variety of operationalizations of the construct. Researchers commonly utilize one or two shiftwork characteristics in their research, but rarely more than two. For instance, in a study examining the relationship between shiftwork features and employee burnout, stress and health, Jamal (2004) utilized two aspects of shiftwork: working nontraditional days (i.e. weekend work) and working nontraditional hours (i.e., afternoon shift, night shift, rotating shift, split shift, or variable hours). Likewise, Costa et al (2006) examined the impact of shiftwork features on employee health and well-being, again utilizing two shiftwork characteristics: flexibility in working hours (i.e., scheduling at the discretion of the employee) and variability in working hours (i.e., scheduling at the discretion of the company). Although these recent works make significant contributions to the shiftwork literature, in each study the operationalization of shiftwork is limited, providing for an inability to investigate how multiple shiftwork features relate to outcomes uniquely and collectively.

As indicated, extensive research has demonstrated the harmful link between shiftwork and on- and off-shift consequences. However, the potential differential impact of shiftwork features on outcomes has been difficult to assess due to the lack of a multifaceted conceptualization of shiftwork. In the current study, our focus was an assessment of the overall and differential impact of multiple shiftwork features (i.e., hours worked weekly, days worked weekly, shift length, Sunday work, and shift schedule) on multiple off-shift outcomes (work-to-family conflict, physical well-being, and mental well-being). Previous research suggests that off-shift outcomes may be impacted differentially by various shiftwork features. For example, one source of WFC is time-based conflict; time in the work role logically reduces available time in the family role (Greenhaus and Beutell, 1985; Zedeck and Mosier, 1990). Consequently, shiftwork features relating to time spent at work (e.g., total weekly work hours) should relate most strongly with WFC. Grosswald (2003) provided some support for this assertion: Number of hours worked weekly and working the night shift each provided significant, unique variance in the explanation

of negative work-to-family spillover with number of hours worked weekly accounting for the largest unique contribution. A recent study by Portela et al. (2005) similarly offers evidence that long working hours (over 44 h per week) are associated with increased complaints about insufficient time for rest, leisure, and housework. Second, pertaining to perceptions of physical well-being, evidence suggests that characteristics of the shift schedule (e.g., working a rotating or night shift) are associated with a higher likelihood of health problems including trouble getting to sleep and headaches (Jamal, 2004) as well as physical exhaustion (Tepas et al., 2004). Accordingly, we expect that shift schedule should emerge as a salient predictor of physical well-being. Finally, it appears that both the time spent at work and characteristics of the shift schedule may potentially impact one's psychological well-being. This hypothesis is consistent with findings from work by Geiger-Brown et al. (2004), who studied the impact of shiftwork features on psychological well-being and reported that working more than 5 days each week, 50 or more hours each week, working two or more double shifts each month and rotating shifts significantly increased the odds of reporting psychological distress including depression and anxiety.

Based on the empirical evidence, the following predictions about the relationship between shiftwork features and off-shift outcomes were made: (H1) shift characteristics will account for unique variance in measures of off-shift well-being beyond that accounted for by other features of work demands and family demands; (H2) shiftwork features will differentially relate to WFC, physical well-being, and mental well-being.

Furthermore, shiftwork is prevalent throughout the industrialized world; however, limited research has examined the relative impact of multiple shiftwork features on outcomes in different national settings. Recent evidence suggests that one aspect of shiftwork (i.e., night work) may have a differential impact on well-being for employees working in different nations (Tepas et al., 2004). However, Tepas et al. (2004) limited their consideration to one feature of shiftwork and its relationship to end-of-day physical and mental well-being. It remains to be seen whether cross-national differences are evident in the relationship between other features of shiftwork and other outcomes, particularly off-shift outcomes. Consequently, this study proposes to examine whether the relationships of multiple shiftwork features with off-shift outcomes differ cross-nationally. With this in mind, we propose the following research question: (R1). Does national setting moderate the relationship between shiftwork characteristics and off-shift well-being?

2. Method

2.1. Participants and procedure

Researchers from Australia, Brazil, Croatia and the United States collaborated to develop and administer the Survey of Work and Time for Healthcare Workers (SWAT-Healthcare). SWAT-Healthcare is a modification and extension of a previous international collaborative survey, the Survey of Healthcare Professionals (Barnes-Farrell et al., 2002, 2004; Tepas et al., 2004). The survey was designed to measure healthcare worker reactions to a variety of issues on and off the job, including aspects of shift work, work-family relationships, and physical and psychological health. It also included items that assessed an assortment of demographic characteristics of survey participants.

Healthcare worker volunteers from the four participating countries completed the SWAT-Healthcare. Researchers from each of the four participating nations were responsible for recruiting convenience samples of volunteers from their respective countries

Table 1
Demographic variable descriptive statistics overall and by nation

Variable	Overall (N = 906)		Australia (N = 196)		Brazil (N = 133)		Croatia (N = 167)		United States (N = 410)	
	M	SD	M	SD	M	SD	M	SD	M	SD
Hours per week	39.5	8.9	36.1	6.7	38.0	6.2	42.8	6.7	40.4	10.5
Organizational tenure	8.9	8.3	8.5	7.6	4.5	3.9	16.0	10.6	7.7	7.0
Occupational tenure	15.6	11.0	17.8	11.3	6.1	5.2	19.8	10.6	16.0	10.6
Age	40.0	11.2	42.4	11.2	30.5	7.8	40.2	10.5	41.8	10.9
% Working second job		20.0		12.8		32.3		7.8		26.5
Gender (% female)		87.6		81.1		86.5		84.2		92.4
% Married/partnered		57.7		68.9		39.1		77.8		50.2
% w/Children age 0–5		19.2		14.4		14.7		31.1		20.5
% w/Children age 6–17		32.9		33.7		24.1		36.5		33.9
% w/Adult dependents		26.9		18.4		27.9		44.4		24.6

to complete an anonymous survey. A total of 1014 healthcare workers from the four countries completed the survey. Of these, 438 were from the USA, 217 from Australia, 189 from Croatia and 170 from Brazil. To ensure that responses reflected the reactions of individuals who devote a significant portion of their time to paid work, participants who reported working less than 20 h per week at their primary job were excluded from our analyses. A total of 906 healthcare workers from the four nations were included in the final sample for analysis: 410 from the USA, 196 from Australia, 167 from Croatia and 133 from Brazil.

Respondent demographics for the final analysis sample and for each nation are summarized in Table 1. Most respondents (83.1%) reported working in a hospital or acute care setting, 9.9% reported working in long-term care or a nursing home and 3.9% reported working in a physician's office. Typical of healthcare occupations, respondents were predominantly female. The majority were married or partnered and the majority had children or adult dependents inside or outside the home. Respondents reported that the average number of hours they work per week is 39.5, and one in five reported working another job for additional income.

2.2. Measures

2.2.1. Dependent variables

Work–family conflict was measured using the work-to-family conflict subscale from Frone et al. (1992a, b, 1994, 1996), which indicates the frequency with which one's work is seen as interfering with his/her family life. A six-point Likert-type response scale was used, ranging from (1) *never* to (6) *5+days per week*. Composite scores used for analysis were created using the mean of the two items that comprise the scale. Higher scores on this subscale indicated greater amounts of WFC, thus indicating lower well-being with respect to work–family functioning. Coefficient alpha reported for this scale in an independent sample indicated high internal consistency reliability (.90). A sample item is: "How often does your job or career keep you from spending the amount of time you would like to spend with your family?"

Physical well-being was measured using the Healthy Days—Physical scale from the quality of life measures developed by the US Centers for Disease Control (Centers for Disease Control, 2000). This index assessed how many days out of the past 30 days the respondent felt that he or she experienced poor physical health. ("Thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?") Responses could range

from 0 to 30 days; higher scores indicated poorer health. The item was then reversed so that higher scores indicate a greater number of physically healthy days.

Mental well-being was measured using the US Centers for Disease Control Healthy Days—Mental scale (Centers for Disease Control, 2000). This index assessed how many days out of the past 30 days the respondent felt that he or she experienced poor mental health. ("Thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?") Responses could range from 0 to 30 days; higher scores indicated poorer health. The item was then reversed so that higher scores indicate a greater number of mentally healthy days.

2.2.2. Predictors

Aspects of shiftwork were assessed in several ways. *Weekly work hours* was the average reported hours worked per week, *shift length* (in hours) was derived from reported shift start and end times, *days per week* was the reported typical number of days worked per week, and *Sunday work* was a self-report of whether the individual typically works on sundays (yes/no). *Shift schedule* was a categorical measure based on reported start and end times of current shift and responses to an item asking respondents how often the time of day of their shift changes, using an eight-point scale ranging from (1) *The time of day I am scheduled to work is unpredictable* to (8) *In general, I work the same time every day*. This information was used to categorize respondents as falling into one of the following schedules: (a) fixed (non-rotating) day shift; (b) fixed (non-rotating) afternoon/evening shift; (c) fixed (non-rotating) night shift; (d) slow rotation (one week or longer between schedule changes); (e) fast rotation (less than one week between schedule changes); (f) unpredictable work schedule. These six categories were then dummy coded for use in analyses.

2.2.3. Statistical controls

Additionally, characteristics of *work demands*, *family demands* and *personal characteristics* were included as controls in the analyses. *Work demands* were measured using the physical and psychological demands subscales of the Job Content Questionnaire (Karasek, et al., 1998, as cited in Quinn et al., 1973). In addition, alternate work demands were measured as hours per week worked at a second job for pay. *Family demands* were assessed as the total number of dependents (children and adults) the respondent reported, both inside and outside the home. *Personal characteristics* included age (in years) and marital status (married/partnered vs. not).

3. Results

The distributions of shift characteristics for the overall sample and for each nation are summarized in Table 2. In the total analysis sample, there is considerable variation in each of the shift characteristics that were included in the study. However, it can also be seen in Table 2 that the patterns of shift features that characterize samples from different nations are somewhat distinctive.

Descriptive statistics for all study variables and bivariate correlations for the total sample are summarized in Table 3. The mean overall score for work–family conflict was 3.51 (SD = 1.35, coefficient alpha = .84). Mean overall scores for physical well-being and mental well-being were 26.60 (SD = 5.66) physically healthy days and 24.47 (SD = 7.51) mentally healthy days, respectively. No evidence of multicollinearity among the study variables can be seen from the correlation matrix.

The general strategy for identifying the unique association between shiftwork characteristics and off-shift well-being was as follows. Setwise hierarchical multiple regression analyses (Cohen and Cohen, 1983) were conducted for each index of off-shift well-being. The first step in each regression analysis was a model that regressed well-being on the set of statistical controls (work demands, family demands, and personal characteristics). On the second step, the set of all shift characteristics (weekly work hours, days per week, shift hours, Sunday work, and a set of five

dummy variables representing the six shift schedules) was added to the model. The ΔR^2 at step two provides an omnibus assessment of the contribution of the set of shift characteristics to explaining well-being, after controlling for individual differences in work demands, family demands, and personal characteristics. *t*-tests for the regression weights of individual shift characteristics in the final model were used to identify salient shift characteristics relevant to each dependent variable. To assess the impact of shift schedule, the significance of ΔR^2 was examined for the set of shift schedule dummy variables when they were added to the model as a block. When shift schedule accounted for significant unique variance in well-being, an analysis of covariance (ANCOVA) was used to probe differences among specific shift schedules. Off-shift well-being served as the dependent variable; the set of all statistical controls and other shift characteristics were included as covariates; shift schedule served as the categorical predictor variable. Pairwise comparison of means (using a Bonferroni adjustment) was used to assess differences in well-being among the six shift schedules.

3.1. Work–family conflict

Table 4 summarizes the results of the regression analyses for all three indices of off-shift well-being. As seen in Table 4, Work demands, Family demands, and personal characteristics

Table 2
Shift variables descriptive statistics overall and by nation

Variable	Overall (N = 906)		Australia (N = 196)		Brazil (N = 133)		Croatia (N = 167)		United States (N = 410)	
	M	SD	M	SD	M	SD	M	SD	M	SD
Days per week	4.4	1.1	4.6	.9	4.4	1.0	4.8	1.0	4.2	1.2
Hours per week	39.5	8.9	36.1	6.7	38.0	6.2	42.8	6.7	40.4	10.5
Shift length (hours)	9.9	3.0	8.7	1.3	9.8	3.5	9.0	2.1	10.9	3.4
% Work Sundays		55.6		58.0		91.7		57.8		44.0
% Fixed day		23.9		30.8		25.4		2.5		28.8
% Fixed afternoon/evening		4.8		1.0		23.8		0.0		2.5
% Fixed night		9.8		2.1		46.9		0.0		5.5
% Slow rotation		12.8		4.6		2.3		20.9		16.9
% Fast rotation		24.5		42.1		0.0		41.1		17.1
% Irregular		24.2		19.5		1.5		35.6		29.3

Table 3
Study variable descriptive statistics and correlations

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
<i>Control variables</i>														
1. Psychological and physical job demands	2.81	.53	$\alpha = .67$											
2. Alternate work hours	.94	3.30	-.02	—										
3. Dependents (inside/outside home)	.99	1.25	.01	.00	—									
4. Age	39.98	11.22	-.09**	.13**	.02	—								
5. Marital status	n/a	n/a	.01	.02	.11**	.19**	—							
<i>Predictor variables</i>														
6. Shift length (hours)	9.91	3	.06	.04	.04	-.03	-.06	—						
7. Days per week	4.39	1.12	-.04	.01	-.13**	.07*	-.07*	-.26**	—					
8. Hours per week	39.54	8.88	.09**	.02	-.08*	.07*	.02	.16**	.38**	—				
9. Working Sundays	n/a	n/a	.19**	.00	-.02	-.17**	-.01	.16**	-.02	.06	—			
<i>Outcome variables</i>														
10. Work–family conflict	3.51	1.35	.35**	.05	.12**	-.08*	.14**	.03	.05	.16**	.24**	$\alpha = .84$		
11. Mental well-being	24.47	7.51	-.18**	.00	.06	.16**	.07*	.09**	-.09**	-.04	-.12**	-.28**	—	
12. Physical well-being	26.60	5.66	-.10**	-.03	.03	.02	.00	.06	-.10**	-.04	-.13**	-.21**	.43**	—

N = 906.

* Significant at the .05 level (two-tailed).

** Significant at the .01 level (two-tailed).

Table 4
Regression of off-shift well-being outcomes on statistical controls and shift characteristics

Variable	Standardized regression weights (β)		
	Work–family conflict ^a	Physical well-being ^b	Mental well-being ^c
<i>Step 1: Control variables</i>			
Psychological and physical job demands	.31***	-.10**	-.18***
Alternate work hours	.05	-.03	-.02
Dependents (inside/outside home)	.12***	.01	.05
Age	-.06*	-.03	.11**
Marital status	.14***	-.03	.02
$F^{a,b,c}$	33.99***	1.99	9.71***
Overall R^2	.173	.012	.057
Adjusted R^2	.168	.006	.051
ΔR^2	.173***	.012	.057***
<i>Step 2: Predictor variables</i>			
Shift length (hours)	-.02	.07	.13***
Days per week	.03	-.13**	-.08
Hours per week	.13***	.03	-.02
Working Sundays	.14***	-.04	-.03
Shift schedule dummy 1	.08*	.09*	.07
Shift schedule dummy 2	.04	-.08*	-.01
Shift schedule dummy 3	.06	-.15***	-.12**
Shift schedule dummy 4	-.04	.05	.03
Shift schedule dummy 5	-.01	.01	-.02
$F^{a,b,c}$	17.62***	4.53***	6.17***
Overall R^2	.235	.073	.098
Adjusted R^2	.221	.057	.082
ΔR^2	.062***	.061***	.041***

^a Step 1 df = 5,814; Step 2 df = 14,805.

^b Step 1 df = 5,815; Step 2 df = 14,806.

^c Step 1 df = 5,807; Step 2 df = 14,798.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

accounted for 17.3% of the variance in WFC. After statistically controlling for work demands, family demands, and personal characteristics, the set of all shift characteristics accounted for an additional 6.2% of the variance in WFC ($p < .001$), providing support for Hypothesis 1.

Examination of standardized regression coefficients for individual shift characteristics in the final regression model indicates that three characteristics—weekly work hours ($\beta = .13$, $p < .001$), working on Sundays ($\beta = .14$, $p < .001$), and shift schedule ($\Delta R^2 = .01$, $p < .05$) were each uniquely associated with WFC. In particular, higher weekly work hours and shift arrangements that include frequent Sunday work were each associated with increased levels of work-to-family conflict. An ANCOVA with WFC as the dependent variable, shift schedule as the between subjects variable, and all other predictors (statistical controls and other shift characteristics) as covariates was used to probe WFC for different shift schedules. Although the collection of shift schedules accounted for significant variance in WFC ($F = 2.44$, $df = 5,805$, $p < .05$, partial $\eta^2 = .02$), none of the differences between the various individual shift schedules were statistically significant.

3.2. Physical well-being

Work demands, family demands, and personal characteristics accounted for 1.2% of the variance in physical well-being. Consistent with hypothesis 1, the set of all shift characteristics

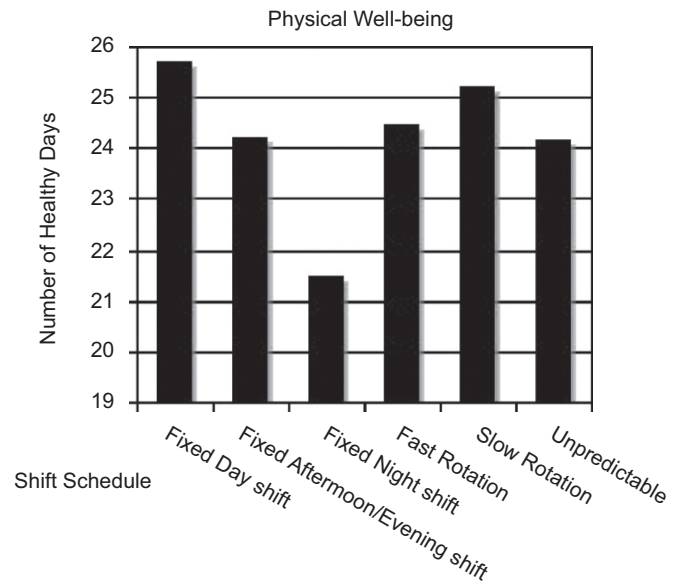


Fig. 1. Estimated marginal means on physical well-being for different shift schedules.

accounted for an additional 6.1% of the variance in physical well-being ($p < .001$). Among the shift characteristics, the number of days typically worked per week had a statistically significant regression weight in the final model ($\beta = -.13$, $p < .01$), and shift schedule accounted for 3.7% of the variance in well-being ($p < .001$). After accounting for contextual demands that may differ among workers and other shift characteristics, working more days per week was associated with reports of fewer physically healthy days during the previous month. When ANCOVA was used to examine the nature of the shift schedule effect, statistically significant differences in physical well-being were observed among several of the shift schedules. As illustrated in Fig. 1, those who were on fixed day shifts reported significantly better physical well-being than those on fixed afternoon shifts ($p < .05$) or those on fixed night shifts ($p < .001$). In addition, workers on fast rotating shifts ($p < .01$), slowly rotating shifts ($p < .001$), and unpredictable shifts ($p < .01$) all reported significantly better physical well-being than those who worked fixed night shifts.

3.3. Mental well-being

Work demands, family demands, and personal characteristics accounted for 5.7% of the variance in mental well-being, and the set of all shift characteristics accounted for an additional 4.1% of the variance in this measure of well-being ($p < .01$).

Of the set of shift characteristics, shift length ($\beta = .13$, $p < .001$) and shift schedule ($\Delta R^2 = .02$, $p < .01$) were the two characteristics that were uniquely associated with mental well-being. In the context of other shift characteristics, longer shift length was associated with *better* mental well-being. When ANCOVA was used to probe mental well-being for different shift schedules, those who were on fixed night shifts reported significantly lower mental well-being than workers on slowly rotating shifts and fixed day shifts, with those on other shift schedules generally reporting levels of mental well-being similar to day shift and slowly rotating shift workers (see Fig. 2).

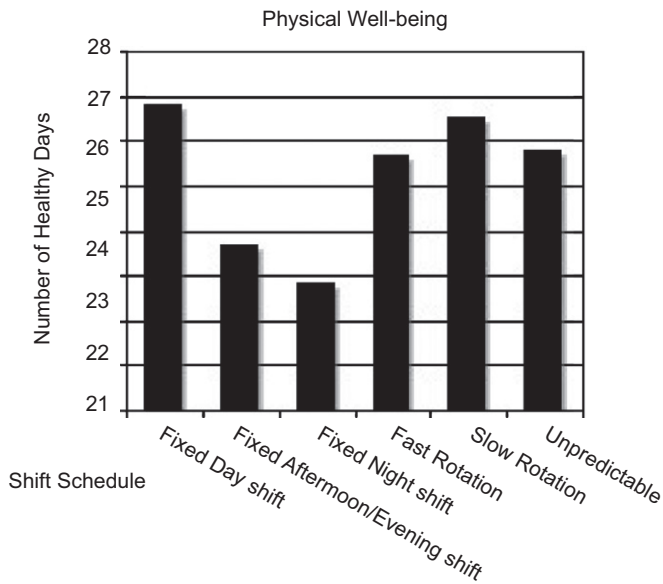


Fig. 2. Estimated marginal means on mental well-being for different shift schedules.

3.4. Interaction with nation

An examination of simple cross-national differences on our measures of off-shift well-being revealed national differences on all three measures of well-being. The variance accounted for by nation ranged from 3% for WFC ($F = 25.26$, $df = 2,743$) to 8% for mental well-being ($F = 23.48$, $df = 3,743$) and 9% for physical well-being ($F = 25.26$, $df = 3,743$).

To address R1, which asks whether national setting moderates relationships between shiftwork characteristics and off-shift well-being, we used the following analytic strategy. For shift characteristics that had statistically significant regression weights in the final step of each regression model, ANCOVAs of residual scores were used to examine evidence for shift characteristic \times nation interactions on off-shift well-being. Each measure of off-shift well-being, in turn, was used as the dependent variable, and residualized scores (adjusted for all statistical controls and all non-focal shift characteristics) for the shift characteristic of interest and nation served as independent variables in the analysis. None of the shift characteristic \times nation interactions were significant for any of the three measures of off-shift well-being ($p > .05$, ns for all analyses).

4. Discussion

Personal assessments of physical and mental well-being, as well as assessments of interference of work with family and personal life are relevant aspects of well-being for healthcare workers in their lives “off the job.” Physical and psychological aspects of task demands, as well as demands that emanate from family responsibilities and second jobs that are a part of many workers’ lives, undoubtedly contribute to these aspects of worker well-being. Furthermore, personal characteristics such as age and marital status are often associated with assessments of well-being. In our data, the joint contributions of these variables to explaining variance in well-being ranged from 1.2% (physical well-being) to 17.3% (WFC). Nonetheless, in support of Hypothesis 1, our data demonstrated that multiple characteristics of shift arrangements are uniquely associated with all three aspects of

off-shift well-being, beyond what can be accounted for by work task demands, family demands, and personal characteristics. Shift characteristics accounted for anywhere from 4.1% (mental well-being) to 6.2% (WFC) of the variance in well-being, beyond that accounted for by other aspects of the work and non-work demands that healthcare workers face in their daily lives. Inferences about these relationships must be tempered by recognition that they are based on cross-sectional survey data provided by convenience samples of healthcare workers drawn from diverse organizational and national settings. Nonetheless, support for Hypothesis 1 was consistent across three distinct indices of well-being. These results provide additional support for findings reported in recent work by Grosswald (2003), Geiger-Brown et al. (2004) and Costa et al. (2006) regarding the impact of shiftwork on various aspects of off-shift well-being.

An advantage of including assessments of multiple aspects of off-shift well-being and a broad array of shift characteristics in this study was the ability to examine preliminary evidence for Hypothesis 2, the proposed differential effects of various shift characteristics for different aspects of well-being. Consistent with Hypothesis 2, although the set of shiftwork characteristics accounted for variance in all three aspects of well-being, the particular characteristics that emerged as most relevant differed somewhat among WFC, physical well-being, and mental well-being.

The primary drivers of work-to-family conflict had to do with the number of days worked (number of days per week) and the inclusion of Sundays as a part of the normal work schedule. This is quite consistent with the idea that an important aspect of work interference with home responsibilities has to do with its structural interference—workers must frequently be “somewhere else” when family obligations occur. The number of days typically worked each week was likewise associated (negatively) with physical well-being. In contrast, the length of individual shifts influenced assessments of mental well-being (positively). In addition, for both physical well-being and mental well-being, the negative consequences of permanent night shifts (and, for physical well-being, permanent afternoon/evening shifts) emerged as relevant shift features. These patterns of findings reinforce the importance of recognizing the complexity of shift arrangements and the differential importance that various characteristics of shifts may have for aspects of a workers’ quality of life, both on the job and off the job. From a practical standpoint, these findings also have implications for targeting shift design interventions to particular worker outcomes.

Although most of the relationships between shift characteristics and our outcome measures were logically consistent with prior work concerned with shift features and worker health in general, some of our findings suggest the need for additional exploration of the dynamics by which shift features have influence. For example, in the context of other shift characteristics, longer shift length was associated with *better* mental well-being. One explanation for this finding is that we may be seeing a “healthy worker effect” in the sense that those healthcare workers who work long individual shifts are individuals who have the mental resilience to cope with extended work days. However, it is also important to keep in mind that the positive relationship between shift length and mental well-being does not imply that mental well-being is enhanced by long work hours per se. The relationship that we reported here statistically controls for weekly work hours, so shift length refers to the characteristic way that work hours are *arranged* during the week rather than total work load. Thus, although this finding was initially puzzling, we suspect it is an artifact of the fact that many nurses who work long individual shifts (especially those who work a compressed work week) do so by personal preference, and we may be seeing the

by-product of working preferred shift arrangements. Prior work by Barton (1994) suggests that working preferred shifts can mitigate some of the negative health consequences otherwise associated with those shift schedules. In her work, she highlighted the moderating influence that working preferred shift arrangements can have on tolerance for night work. In the healthcare samples we examined, anecdotal evidence suggests that long individual shifts are seen as attractive work schedules by many nurses, because they provide opportunities for them to manage other aspects of their lives. Furthermore, extended individual shifts are sometimes accompanied by extended off-time between shifts and by opportunities to sleep during scheduled work periods. Other work that focuses specifically on the impact of compressed work weeks reports that extended work days are often popular among workers for these very reasons (Rosa et al., 1989; Smith et al., 1998). Furthermore, in their review of empirical evidence comparing eight hour and 12 h shift systems, Smith et al. (1998) reported some negative shift well-being outcomes (e.g., attention and fatigue) for the 12 h shift systems, but they also reported evidence of better physical and psychological well-being, consistent with our findings regarding mental well-being. Unfortunately, we did not include measures in the survey that would allow us to specifically test explanations regarding shift arrangement preferences. Future research that includes this additional psychological characteristic of shift arrangements could provide valuable insight into this issue. We encourage other researchers to systematically incorporate worker shift arrangement preferences into their thinking about the multifaceted nature of shiftwork arrangements.

Although there has been some evidence presented suggesting that the impact of shift characteristics on some aspects of worker well-being may differ by nation (Tepas et al., 2004), examination of our data did not provide evidence of cross-national differences in the magnitude or direction of relationships between shift characteristics and indicators of off-shift quality of life (R1). It is likely that differences in the design of the two studies may account for this. In their interpretation of their findings, Tepas et al. pointed out that further research is needed to determine if the differences they observed reflect basic cultural differences or differences in occupational duties and work load. By design, in the current study we assessed and statistically controlled for several of these factors. Similar to the Tepas et al. findings for shift and personal well-being, we observed cross-national differences on all of the outcome variables assessed in this study. However, when work demands, family demands, and personal characteristics were included as controls in our analyses, nation did not moderate the impact of shiftwork characteristics on any of our off-shift measures of well-being.

It should also be noted that the patterns of shiftwork arrangements among healthcare professionals recruited from the four participating countries differed substantially. This can be seen very clearly in Table 2. Thus an advantage of the multinational sample that we recruited is that it provided the opportunity to explore the impact of shiftwork features that have restricted range within any single national sample. Relationships that would be masked when studies are carried out in the context of individual nations are illuminated when samples from nations with distinctly different patterns of typical arrangements are combined. Our samples were convenience samples and are not necessarily representative of the full distribution of shiftwork arrangements in each country. Nonetheless, to the extent that shiftwork characteristics differentially influence well-being, cross-national differences among the shiftwork arrangements typically encountered in healthcare work will produce cross-national differences in well-being. This suggests that examination of the shiftwork characteristics that typify healthcare work in different

organizational or national settings, combined with our findings regarding the relative impact of each shift characteristic, can be used to identify opportunities for rethinking shiftwork arrangements.

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