Evening Shift Can Be Detrimental, But Morning People Often Have Better Mental Health

Irrespective of Shift: An Investigation of Shift and Chronotype Across Three Different Nursing Contexts

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ABSTRACT
This paper investigates the effects of circadian preference and shift schedule on job satisfaction and mental health outcomes for nurses from three sites: two hospitals and a group of aged care facilities. The findings include main effects indicating better outcomes for nurses with a morning preference (irrespective of shift worked) and for those working afternoon or evening shifts (regardless of circadian preference). The stronger mechanism of the impact of shiftwork appears to be by chronotype, although both chronotype and shift effects varied by nursing context. A key contribution of this study is that the mechanisms of the impact of shiftwork vary by context.

Keywords: Work organisation (HRM&D), Personnel psychology (HRM&D), Stress and stress management (OB), healthcare management (PS&NFP)

Shiftwork affects the health and wellbeing of millions of workers around the world, yet we still do not properly understand the mechanisms underlying shiftwork’s effects on health (Kantermann, Juda, Vetter & Roenneberg 2010), effects that extend to depression (Takahashi, Nakata, Haratani, Otsuka, Kaida & Fukasawa 2006). The shift system in healthcare is a major factor leading to increased stress, reduced performance and job satisfaction, increased rates of absenteeism and turnover and ultimately to higher health care costs (Burch, Tom, Zhai, Criswell, Leo & Ogoussan 2009). Nurses working night shifts report greater levels of stress (Barton and Folkard 1991). There is also contrary evidence suggesting that night workers may experience less stress than those working other shifts (Coffey, Skipper & Jung 1988; Skipper, Jung & Coffey 1990) and nurse-specific studies that have found that night work is not significantly related to either the nurses' physical health or mental depression, after considering background variables (Skipper et al. 1990), nor psychological wellbeing (Pisarski, Brooke, Bohle, Gallois, Watson & Winch 2006).

To be able to explain these occasional contrasting results the field needs to clarify the mechanisms of the impact of working night shifts. The two most likely mechanisms of the impact of night work appear to be through either circadian rhythm desynchronization that disrupts the body’s biological rhythm (Moore-Ede & Richardson, 1985), or the impact of circadian preference, thereby accounting for key interindividual differences (Kantermann et al. 2010), either of which may vary depending on the context, that is, by the nature of the work itself (Coffey et al. 1988; Skipper et al. 1990).
Conflicting Internal and External Time

The most widely investigated reason for health problems in night work is the conflict between displaced work hours and the nature of the person’s internal biological clock, with its pronounced 24 hour oscillation, known as a circadian rhythm, in virtually all physiological and psychological functions (Akerstedt 2003). Under normal conditions circadian clocks have a rhythm that is synchronized through a process called entrainment to signals from the environment (zeitgebers), among which the light-dark cycle is the most important (Roenneberg et al. 2007). In short, when there is a conflict between internal and external time, detrimental health effects often occur.

More generally this internal desynchronization is observed in people with seasonal affective disorder, who had depressive symptoms during winter when daylight was short, where their condition could be treated with bright light (e.g., Lewy, Sack, Miller & Hoban 1987). Subsequently, perhaps the largest potential conflict between internal and external time occurs for night shift workers. More specifically, health care workers on night shift have generally reported poorer health, more absenteeism and less job satisfaction than day workers (Burch et al. 2009; Korompeli, Sourtzi, Tzavara & Velonakis 2009), although other studies have found that the extent of this conflict between internal and external time shows large interindividual effects due to the individual’s chronotype (Kantermann et al. 2010).

Circadian Preference

Circadian preference (chronotype) is associated with the diurnal timing of numerous psychological and physiological processes including sleep patterns, body temperature, blood pressure, melatonin and cortisol (Burch et al. 2009; Kerkhof 1985; Roenneberg et al. 2007). Individuals’ chronotypes vary along a morningness-eveningness continuum, reflecting their tendency to be active early or late in the day. Although chronotype is receiving increased attention, it is still largely ignored by shiftwork studies, particularly field studies in real-life shift-work situations (Kantermann et al. 2010).

Chronotype has been linked to a variety of outcomes. Evening types are more likely to report they were not in good health (Paine et al. 2006), with greater levels of depression (Chelminski, Ferraro,
Petros & Plaud 1999; Hirata et al. 2007; Kim, Lee, Kim, Cho, Lee & Cho 2010; Kitamura et al. 2010). In contrast, morningness has been linked to a number of positive characteristics such as life satisfaction (Randler 2008), well-being (Buschkens, Graham & Cottrell 2010) and emotional stability (DeYoung, Hasher, Djikic, Criger & Peterson 2007).

Overall, the pattern of findings from previous research indicates that evening types may have higher stress reactivity resulting in difficulty coping with demands as well as reporting more affective symptoms (Willis, O'Connor & Smith 2008; Buschkens et al. 2010). A related mechanism is that eveningness may be associated with potentially damaging health behaviours such as consuming larger amounts of alcohol and smoking more cigarettes (Wittmann, Dinich, Merrow & Roenneberg 2006).

Similarly, it has been suggested that under many work schedules eveningness may be associated with problems synchronizing internal and external timing, whereas morningness may confer an advantage (Wittmann et al. 2006). However evening types appear to adapt better (in terms of sleep quality, fatigue and physical fitness) to shift work (Ostberg 1973) than morning types who appear to have poorer sleep flexibility (Cavallera & Giudici 2008; Tankova, Adan & Buela-Casal 1994), where evening types experience better sleep regardless of shift (Khaleque 1999). Clearly, further research is required to try to clarify these results (Willis et al. 2008).

Some of the inconsistency in previous findings may also be a result of one or more research issues: the variation in the ways that key concepts have been conceptualised and operationalized, the impact of age, and the work context investigated. For example, most studies have used measures of morningness-eveningness that categorise individuals as morning or evening types (or neither type). Many studies recognize extreme morning and evening chronotypes (Ostberg 1973; Smith, Reilly & Midkiff 1989), however, morningness–eveningness may be better viewed as a continuous characteristic (Buschkens et al. 2010; Caci, Adan, Bohle, Natale, Pornpitakan & Tilley 2005). Since circadian preference has been shown to closely approximate a normal distribution (Chelminski et al. 1997; Koscec, Radojevic-Vidacek & Kostovic 2001) and a continuous measure would enhance the
power of statistical analyses relative to a dichotomous or ordinal measure (Altman & Royston 2006) it would be more appropriate to utilise preference as a continuous measure.

The mixed results may also be due to potential influences among the shift and chronotype relationships due to age. That is, a special form of the self-selection effect that may operate in parallel to the shift and chronotype interaction mentioned above is known as the survivor effect, where the older workers may be more adapted to the profession, work and shifts (Burch et al. 2009; Winwood, Winefield & Lushington 2006). This age-based selection effect has been found for shiftworkers as a general group (cf non-shiftworkers) in terms of their having less health complaints, although the possible covariate of age by work category inherent to that analysis needs to be tested in further studies (Raediker, Janben, Schomann & Nachreiner 2006).

Perhaps one of the more likely reasons for the variation in findings on the impact of shift and chronotype is the work context. That is, the reasons for differences by shift may be found in the social organization of hospital work because the type of work performed by nurses on each shift differs considerably (Coffey et al. 1988). The approach of looking to moderators and context when unclear patterns of results emerge is common in other fields (e.g., Judge et al. 2001, regarding the job satisfaction-performance relationship).

Within the general acute hospital context, commentators have argued that the day shift nurses, in contrast to night shifts, have more help available in terms of support and resources, but face more stressors in terms of the higher potential for interpersonal conflict due to their higher rate of contact with other staff, greater frequency of patient care activities, unit management and because it is during the day shift that most examinations, diagnostic testing, and surgery takes place - with the associated higher proportion of instrumental activities (Coffey et al. 1988). Yet these differences inherent to the work of the shifts are, along with most of the shiftwork in nursing studies, looking at nurses in hospitals, typically general acute hospitals. Shiftwork research needs to adopt a more “comparative” research approach, explicitly noting the role of context (Johns 2006), by intentionally analysing
different nursing situations that vary in terms of prestige, the nature of the work and the patient type, such as elderly care contexts. Residential care of the elderly receives little attention in nursing shiftwork research despite the rapidly aging population in most Western developed countries and subsequent demand for aged care nurses (Kennedy 2005).

The contrasting results on the impact and moderators of night work, especially for nurses, may be due to the variety of mechanisms that determine the impact of shiftwork and that these mechanisms may vary depending on the specific context investigated and covariates such as age. The two most likely mechanisms for the impact of shiftwork appear to be through either circadian rhythm desynchronization, or the impact of circadian preference, either of which may vary depending on the context. The present study, therefore, will examine the impact of shift, chronotype, age and the interaction between shift and chronotype to predict organisational and psychological outcomes.

**METHOD**

**Sample**
A total of 506 nurses working at three hospital and aged care facilities within a medium to large Australian healthcare organisation were recruited (124 from a large hospital facility, 149 from a medium sized hospital facility and 233 from aged care facilities). From the large facility, 38 were excluded as they had missing data from important study variables and another 15 were excluded as they reported working ‘some other kind of shift’ which provides no information as to the time of day worked (see measure of “Work Schedule” below). Follow-up interviews confirmed that ‘other’ primarily consisted of emergency department staff and casual staff. The broad qualitative background of these three contexts (as recommended by Johns 2006) is that there were two different types of hospitals, a large specialist maternity hospital with more intrinsically rewarding work, a medium-sized general acute hospital and a group of similar facilities providing residential care for the elderly. The sites in this study reflected the broader trends in the industry in that the average age of nurses in the aged care context (M=47.78, SD=10.67) and in the large hospital (M=45.09, SD=11.20) were older (F(2,502)=15.913, p<.001) than those in the medium general acute hospital (M=41.52, SD=10.67)
using Tukey post-hoc tests of an ANOVA, a result that was confirmed non-parametrically using a
Kruskal-Wallis test. The average age for the nurses in the aged care context tended (p=.06) to be
higher than in the large hospital.

Measures

_Circadian Preference_ was measured using the 12-item Early/Late Preferences Scale developed by
Smith, Folkard, Schmeider, Parra, Spelten and Almirall (1993). Respondents were asked at which
time during the day they would prefer to perform a number of activities. Responses were recorded on
a 5-point scale (1 = ‘much earlier than most people, 5 = ‘much later than most people’). Thus, higher
scores indicated a greater evening preference. _Work schedule_ was measured by asking respondents to
indicate which of four statements best described their workday over the previous month: ‘I worked
morning shifts’; ‘I worked afternoon shifts’; ‘I worked night shifts’; ‘I worked some other type of
shifts’. _Age_ was included as a predictor variable and median coded with seven age categories: less than
25 years (=23), 25-34 years (=30), 35-39 years (=37), 40-44 years (=42), 45-49 years (=47), 50-54
years (=52) and 55 years or more (=60). _Job satisfaction_ was measured using a shortened, six-item
version of Brayfield and Rothe’s (1951) index of job satisfaction. Responses were made on a five-
point scale (1= ‘strongly disagree’, 5= ‘strongly agree’). _Wellbeing_ was measured using the General
Health Questionnaire - 12 (GHQ-12) (Goldberg & Williams 1988). This scale measures self-rated
psychological health over the past month. Respondents rated the twelve items on a scale of 0 (‘not at
all’) to 3 (‘much more than usual’). Six of the items were reverse coded, for example: ‘Been feeling
reasonably happy all things considered’. _Psychological distress_ was measured with the Kessler –
10/K10 (Kessler & Mroczek 1994). This scale measures self-reported psychological distress over the
last month. The ten items were rated on a five-point scale (1 = ‘all of the time’, 5 = ‘none of the time’).
_Depression_ was measured using a shortened, nine-item version of the Centre for Epidemiological
Studies Depression Scale, the CES-D (Radloff 1977). Respondents were asked to rate the extent to
which the nine statements reflected their feelings over the previous week on a scale of 0 (‘rarely or
none of the time’) to 3 (‘most or all of the time’). Two of the items were reverse coded.
RESULTS

Multiple regression within Predictive Analytics SoftWare (PASW) 17.0 (SPSS Inc. 2010) was used to analyse the data. To create a dichotomous measure of work schedule for the regressions, respondents were classified as (1) morning or (2) afternoon/evening shift. Separate regression analyses were conducted for each of the three facilities. The variables used to create the interaction terms were mean-centred for each of the facilities respectively.

The vast majority of nurses working in both the large (98.4%), and medium (93.2%) hospital facilities were female, and in both cases, more than half were aged 40 years and over (63.8% and 55.1%, respectively). In aged care facilities, 94.4% of nurses were female and the majority (62.8%) were aged 40 years or over. The means, standard deviations and Cronbach’s alphas for all continuous study variables are presented in Table 1.

Table 2 presents the results for nurses working in the large hospital facility. There was a significant interaction between circadian preference and work schedule. Nurses working morning shifts with an evening preference had lower job satisfaction than those with a morning preference, as shown in Figure 1. For nurses working afternoon or evening shifts, there was little difference. There were no significant results for the other dependent variables.

Table 3 shows the results for the medium-sized hospital: there were significant main effects of circadian preference and work schedule for several of the dependent variables. Having a higher
evening preference was associated with higher psychological distress, higher depression scores and a tendency toward lower job satisfaction. Working afternoon/evening shifts led to higher wellbeing.

Insert Table 3 about here

The results from aged care facilities are presented in Table 4; working afternoon/evening shifts was associated with greater wellbeing. There was also a main effect of age, indicating that older nurses experienced greater wellbeing and less psychological distress. There were no significant effects of circadian preference, nor was there a shift by preference interaction.

Insert Table 4 about here

DISCUSSION

The present study examined the impact of shift, chronotype, age and the interaction between shift and chronotype to predict organisational and psychological outcomes in three nursing contexts. There was some evidence in this study that working afternoon or evening shifts may result in better psychological health regardless of one’s circadian preference. This runs counter to much previous research indicating that working night shifts entails a risk of negative health and social outcomes, such as greater levels of stress (Barton & Folkard 1991), poorer health and less job satisfaction than day workers (Burch et al. 2009; Korompeli et al. 2009). However, it does support a few studies that suggest that night workers may experience less stress than those working other shift times (Coffey et al. 1988; Skipper et al. 1990), at least for psychological wellbeing (Pisarski et al. 2006). These two sets of studies have some similarities in their samples, other than, perhaps, the degree of choice allowed for their shifts and that the studies with poorer health at night tended to have more specialised roles rather than general roles (e.g., 83% of the staff in Skipper et al. 1990 choose their shift and Korompeli et al. 2009 was on ICU staff). Those nurses working afternoon or evening shifts that had chosen those shifts to fit in with family or other commitments have previously been found to report reduced health, sleep and social complaints compared with those who did not choose (Barton 1994).
Circadian Preference

The most consistent pattern of results in this study suggests the importance of morning preference in predicting positive outcomes. In the medium hospital facility morningness was a strong predictor of high psychological wellbeing and lower psychological distress and depression regardless of shift schedule. These results agree with previous studies that morningness has been linked to a number of positive characteristics such as life satisfaction (Randler 2008), well-being (Buschkens et al. 2010) and evening types being more likely to report they were not in good health (Paine et al. 2006), with greater levels of depression (Chelminski et al. 1999; Hirata et al. 2007; Kim et al. 2010; Kitamura et al. 2010).

The only interaction effect was observed in the large hospital facility, where those with an evening preference expressed greater job satisfaction when working the afternoon or evening shift, but that there was little difference due to preference for those with a morning chronotype. This pattern of results appears to clarify the findings of Wittmann et al. (2006) that eveningness may be associated with problems synchronizing internal and external timing, whereas morningness may confer an advantage, in that evening types have a problem synchronizing with morning shifts. This study’s results contradict those of papers that have argued that morning types appear to have poorer sleep flexibility (Cavallera & Giudici 2008; Tankova et al. 1994), where evening types experience better sleep regardless of shift (Khaleque 1999). Notably all three of these studies are reviews and are not based on nurses specifically, potentially highlighting the impact of occupational differences.

Further, the pattern of findings appears to support previous research (e.g., Buschkens et al. 2010; Willis et al. 2008) wherein evening types have higher stress reactivity resulting in difficulty coping with demands as well as reporting more affective symptoms. This effect may be due to evening types accumulating a sleep debt when working regular hours, for which they compensate by sleeping late on free days (Roenneberg, Wirz-Justice & Merrow 2003).
An interesting twist to this study’s examination of context effects is that the only context where there were significant age effects, on job satisfaction and psychological distress, is the aged care context – the context with the highest average age of the three contexts examined here. The older nurses working in aged care had higher job satisfaction and reduced psychological distress. That is, this study’s results appear to provide some support for the survivor effect, where older workers may be more adapted to the profession, work and shifts, an effect that acts as a special form of self-selection (Burch et al. 2009; Winwood et al. 2006). This age effect is particularly notable given that age is also a risk factor in its own right for poor mental health (Kitamura et al. 2010), although the current results flag that that general tendency toward ill health by age may be more applicable to non-shiftworkers (Raediker et al. 2006), particularly if a healthy worker effect is the driver of this result, where workers that had health problems moved out of shiftwork, particularly in aged care, leaving the healthiest older workers (Knutsson & Akerstedt 1992).

Study Limitations

This study contains some limitations in that it did not allow for a detailed examination of the process by which shift schedule and circadian preference exert their effects, and perhaps the identification of situations in which this interaction is more or less important. Measures of how long nurses had been working a particular shift were not included, thus, we were unable to distinguish participants who may have adapted to a shift over time. Conversely, nurses who had recently begun working a particular shift may have expressed less job satisfaction or general wellbeing due to the change rather than any shift or circadian preference effects.

Conclusion

The field of shiftwork often has apparently contradictory results. To be able to explain the occasional contrasting results the field needs to clarify the mechanisms of the impact of shiftwork. The two most likely mechanisms of the impact of shiftwork are usually proposed to be through either circadian rhythm desynchronization that disrupts the body’s biological rhythm (Moore-Ede & Richardson 1985), or the impact of circadian preference, thereby accounting for key interindividual differences.
(Kantermann et al. 2010). This study found that the circadian preference, or chronotype, had the more consistent impact of the two main mechanisms examined.

However the largest influence on the impact of shiftwork in this study was the context of the nurse and their work. That is, this study provides strong support for the idea that shiftwork research needs to adopt a more comparative research approach, explicitly noting the role of context (Johns 2006). The context had received some recognition in the nursing literature, particularly in terms of the social organization of hospital work where the type of work performed by nurses on each shift differs considerably (Coffey et al. 1988). Yet these differences inherent to the work of the shifts are, along with most of the nursing shiftwork studies, looking at nurses in hospitals, typically general acute hospitals. Subsequently, the results of this study also suggest that shiftwork research needs to consider a broader range of contexts, including aged care – a sector of healthcare that is growing rapidly due to, in most Western developed countries, the ageing population, with its subsequent demand for aged care nurses (Kennedy 2005).

Overall, we would recommend that in analysing or addressing shiftwork that researchers and managers start with the broader issues of human resources practices and shift discretion that vary by context and then work down to more individual factors such as alignment with chronotype and entrainment procedures. Once we have a more detailed understanding of the impact of context on shiftwork researchers and mangers will be able to do more tailored practices and procedures for the management of shiftwork.

REFERENCES


Table 1. Means, Standard Deviations and Cronbach’s Alphas For Study Variables

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<td>1.61</td>
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Table 2. Regression Analyses For Nurses in The Large Hospital Facility

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<thead>
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<td>.33*</td>
<td>-65.07</td>
</tr>
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</table>

* p <.05
Figure 1. Interaction Between Circadian Preference and Shift For Job Satisfaction

Table 3. Regression Analyses for Nurses in the Medium Hospital Facility

<table>
<thead>
<tr>
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<th>Wellbeing</th>
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<td>.09</td>
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† p<.10 * p<.05
Table 4. Regression Analyses for Nurses in the Aged Care Facilities

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<td>β</td>
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*p<.05  **p<.01