Impact of a change in rostering practices on absenteeism: An observational descriptive study

Esther Monica Peijin Fan, Fazila Aloweni, Mei Ling Lim, Kelly Chai Yuen Woh and Shin Yuh Ang

Abstract
Background: There was a change in rostering practice from a regular three-shift system to an irregular three-shift system. Objective: This study observed the trend of absenteeism before and after a change in rostering practice. Methods: An observational design was used to collect sick-leave data from six months before the change in rostering practice to 12 months after. The average number of sick-leave days per month before and after the change were compared. Data for nursing hours per patient day (NHPPD) were also collected. Results: An increase in the number of sick-leave days was seen in three out of five wards following the change in rostering practice. Average sick leave across the five wards increased from 173.7 days per month before the change to 213.4 days per month after the change. Data for NHPPD showed no drastic change in manpower (e.g. resignation/training leave) during this period. Conclusions: There was an observed increase in absenteeism following the change in the rostering practice of nurses.

Keywords
Rostering, nursing management, nursing workforce, manpower planning

Introduction
Shift work has been shown to affect cardiovascular, gastrointestinal, endocrine systems and mental health adversely, with the disruption in circadian rhythm being the main culprit.1 However, not all shift systems are equally harmful, and many studies have been performed in an attempt to determine a shift system that has minimal harm to the health and well-being of the staff without compromising on patient safety. For instance, studies have explored 8- versus 12-hour shifts,2–4 forward or backward rotation of shifts,1 rotation interval for forward rotating shifts5,6 and lapses in patient care for 12-hour shifts7 among many other aspects of shift work.

Unfortunately, shift schedules can differ in direction and speed of rotation, shift start time and duration, location of days off and changeovers between shifts.6 This variability creates a challenge for systematic experimental studies. So, it is not yet clear how each of these parameters affects adaptation to shift work.6 Therefore, there is no recommendation for the ‘perfect’ shift solution system yet that supports the well-being of staff without compromising on patient safety.

In an attempt to promote a better work–life balance, the hospital where this study was conducted changed its rostering practice from a regular three-shift system to an irregular three-shift system. This hospital is an acute tertiary hospital in Singapore which provides a wide range of health-care services, including outpatient specialist clinics, accident and emergency services as well as inpatient care.

Details of the regular three-shift system (old)
- Morning shift duration: 0700 hours–1600 hours
- Evening shift duration: 1300 hours–2200 hours
- Night shift duration: 2130 hours–0730 hours (nurses will perform three to four night shifts in a row)

Nursing Division, Singapore General Hospital, Singapore

Corresponding author:
Esther Monica Peijin Fan, SingHealth Tower B, Level 15, 10 Hospital Boulevard, 168582, Singapore.
Email: esther.monica.fan.p.j@sgh.com.sg
• Off days: two days off per week
• Sleeping day: an additional sleeping day will be granted after a round of night shifts

Details of irregular three-shift system (new)
• Morning shift duration: 0700 hours–1400 hours/0700 hours–1500 hours/0700 hours–1600 hours
• Evening shift duration: 1230 hours–2130 hours/1330 hours–2130 hours
• Night shift duration: 2030 hours–0730 hours (nurses will perform one to two night shifts in a row)
• Off days: two days off per week
• Sleeping day removed: additional hours worked during the night shift will be taken into consideration, and shorter day shifts will be plotted so as to ensure that nurses only work 40 hours per week.

In order to measure any benefits or harm to the workforce that the change might have yielded, this study aimed to describe the trend in absenteeism before and after the change in the rostering practice of nurses.

Method
A observational descriptive study design was used to collect sick-leave data from five wards in which the rostering practice was changed from the regular three-shift systems to an irregular three-shift system. These five wards were of a variety of disciplines, including both medical and surgical wards. The wards also included different levels of care such as an intensive care unit, intermediate care area, high dependency as well as the general ward.

Sick-leave data were collected from six months before the change in rostering practice to 12 months after the change (inclusive of the month in which change took place). A longer duration of data collection after the change in rostering practice was carried out in order to take into consideration time needed for nurses to adjust to the change. These data were extracted from the TrendCare system (a patient acuity, workload management and workforce planning software solution). Nursing hours per patient day (NHPPD) data were also extracted from the TrendCare system for this period. NHPPD is a reflection of the nursing hours in the clinical areas, and major changes in this would indicate a change in nursing manpower.

Sick leave and NHPPD data for each ward were plotted onto graphs for a visual display of any changes before and after the change in rostering practice took place. The average number of sick-leave days per month taken by nurses before the change in rostering practice was compared to the average number of sick-leave days per month taken by nurses after the change. The total number of sick-leave days and NHPPD across the five wards were plotted on a graph for an overview of the pattern of change.

Approval from the centralised Institutional Review Board was not required, as there was no personal data used, nor was there any intervention performed as part of the study. This study is an evaluation of a change in roster pattern that would have been implemented regardless of whether the study took place.

Results
Five wards participated in this study, as they were the first wards to trial the new rostering system. Three out of five wards saw an increase in the average number of sick-leave days taken per month after the implementation of the new rostering practice. NHPPD data did not reflect any major shift in manpower (e.g. resignation or training leave) for these five wards during the period.

For ward A (medical – general), the change in rostering practice was initiated on 4 January 2015. Average sick leave per month more than doubled from 30.3 to 62.3 days after the change in rostering patterns. See Figure 1 for a graph representing the sick leave and NHPPD data for ward A.

A change in rostering practice was initiated in ward B (surgical – specialised) on 4 January 2015. Average sick leave
per month remained almost the same, changing from 29.8 to 28.3 days after the change in rostering patterns. See Figure 2 for a graph representing the sick leave and NHPPD data for ward B.

The change in rostering practice was initiated on 28 March 2016 for ward C (medical – general). Average sick leave increased from 55.2 to 62.3 days following the change in rostering practice. See Figure 3 for a graph representing the sick leave and NHPPD data for ward C.

The change in rostering practice was initiated in ward D (medical – specialised) on 28 March 2016. Average sick leave decreased slightly from 25.5 to 21.5 days after the change in rostering patterns. See Figure 4 for a graph representing the sick leave and NHPPD data for ward D.

The change in rostering practice was initiated in ward E (surgical – general) on 28 March 2016. Average sick leave increased from 37.3 to 48.2 days after the change in rostering patterns. A spike in the number of sick-leave days taken is observed the month after initiation. See Figure 5 for the graph representing the sick leave and NHPPD data for ward E.

The sick-leave data across the five wards were then summed up for each month for an overall analysis of the impact of the change in rostering practice on absenteeism. The sick-leave data across the five wards were then summed up for each month for an overall analysis of the impact of the change in rostering practice on absenteeism. Average sick leave increased from 173.7 to 213.4 days after the change in rostering patterns (see Figure 6). Despite the general increase in the average number of sick-leave days taken after the change in rostering practice, the trend in the number of days per month fluctuated, and no obvious pattern was observed.

Discussion

It is known that shift systems influence absenteeism. In a study performed among ground staff of an airline company, it was found that the group of employees that switched from other working schedules to a three-shift schedule showed a
significantly increased risk for long-term sickness absence (odds ratio=1.31, 95% confidence interval 1.02–1.69). Other groups of employees working the day shift only or two- or three-shift schedules, who were transferred out of a three-shift schedule or those with other kinds of transfers during the study period, did not show any significantly increased risk for long-term sickness absence.

To our knowledge, there are currently no studies on rostering patterns among nurses comparing regular or irregular three-shift systems. However, studies have been performed in other industries. An example would be the study by Åkerstedt and Gillberg comparing different occupations that work regular or irregular shift systems with respect to sleep and sleepiness. The authors reported that those working irregular shift systems (represented by train drivers) did not have worse sleep or more sleepiness than groups performing regular shift work (e.g. industrial workers). Conversely, Aguirre and Foret who performed a study among railway workers, found that individuals who worked an irregular shift system more frequently reported poorer digestive, respiratory, osteoarticular, nervous systems and sleep quality than those on the regular three-shift system. However, it is difficult to apply the results of such findings to the nursing workforce due to the difference in nature of the job as well as the time and duration of the shift.

In contrast to regular three-shift schedules, the start and finish times vary in an irregular shift system. Irregular shift systems are therefore much more unpredictable and possibly more difficult to cope with than regular shifts. Our results showed a drastic overall increase in absenteeism after the change in rostering practice from a regular three-shift system to an irregular one. The average number of sick-leave days taken per month across the five wards increased from 173.7 to 213.4 days after the change in rostering patterns. It is unclear if the irregular shift system is negatively affecting the health of the staff, causing insufficient rest and hence a drastic increase in the number of sick-leave days.
There are some advantages to the new rostering system. It offers nurses some shorter days. Instead of ending at 1600 hours for the morning shift, nurses can end their shift at 1400 hours or 1500 hours, allowing them a longer rest period before their next working day. It also allows nurses more free time to engage in personal errands or social activities.

The adjusted time for the afternoon shift (1230 hours/1330 hours to 2130 hours) is also preferred over the previous shift hours (1300 hours to 2200 hours). This is because starting at 1330 hours allows nurses more time before work, giving more time to run errands, rest or have lunch at midday rather than the late morning. Furthermore, as nurses do not have fixed shift patterns, they may do a morning shift right after an afternoon shift, ending 30 minutes earlier, which allows the nurses more rest before work the next morning shift.

A study by Dall'ora et al. found working long shifts to be associated with a higher risk of absence for registered nurses and health-care assistants. However, despite the shorter shift durations, there was an increase in absenteeism rates following the implementation of the new rostering system. This could be attributed to various factors. First, the early end to the morning shift may not take place as scheduled. A nurse may be scheduled to end at 1400 hours. However, he/she may feel guilty handing over tasks not completed during his/her shorter shift hours and end up staying back to complete the tasks. This culture of feeling guilty for handing over tasks to the nurse coming on duty seems not to be solely a local culture. A study performed by Maben et al. reported that nurses felt guilty for leaving tasks for the next shift and suggested that it may be a result of a culture for nurses to prove themselves efficient, not shirking their responsibilities. Hence, although the hours are adjusted such that the nurses are not assigned for more than 40 hours a week, they may be working longer hours in reality.

The change in night-shift duration from three or four nights in a row to one or two nights in a row may have a negative impact on the health of the nurses. Although most studies did not report health-related problems resulting from frequency of night shifts, Mayama et al. found that high frequency of night shifts increased the risk of irregular menstrual cycles and secondary amenorrhea. With the change in rostering system, although the duration of nights was shorter, nurses had their sleep cycles reversed more frequently. Previously, when the night-shift duration was three or four nights, the nurses commonly performed two to three rounds of nights per month. Now, the nurses perform up to four rounds of nights per month, meaning that their circadian rhythm may be disrupted every week. Furthermore, there is now no additional sleeping day (off day) for recovery after a night shift.

The differences in the changes in rates of absenteeism following the change in the rostering system among wards were not shown to be related to patient acuity or type of ward. All five wards nursed patients under the general ward status. Additionally, wards B and E nursed some patients with high-dependency status, and ward C nursed patients under high-dependency status, as well as those requiring intensive care. Wards caring for patients with a high acuity of care (wards B, C and E) did not show any similar patterns in absenteeism, neither did wards caring for patients with a lower acuity of care (wards A and D). Medical wards (wards A, C and D) and surgical wards (wards B and E) did not show any patterns in absenteeism either. Hence, the changes in the rates of absenteeism are unlikely to be related to patient acuity or type of ward.

The data on rates of absenteeism were collected for a year following the change in rostering practice. It was expected that the rates of absenteeism would be higher immediately after the change and would settle down thereafter. There was no such obvious pattern for the five wards in this study.
data showed no drastic change in manpower (e.g. resignation or training leave) during this period in the five wards. Hence, the increase in sick leave was not related to a manpower shortage. The increase in sick leave could have resulted from the change being detrimental to the health of the staff (resulting from potentially longer working hours and a lack of recovery time after a night shift) or for other reasons not collected in this study. In addition, the change in itself required adjustment from the staff in terms of their responsibilities at home and the more frequent disruption to their circadian rhythm. The general stress from the change could also have affected their health and well-being.

Unrelated to the increase in rates of absenteeism after the change in rostering practice, one challenge faced by nurses following the change in rostering practice is to find a common time for training. Previously, there was an overlapping timing in the afternoon between 1300 hours to 1600 hours where the morning and afternoon shift staff were on duty. The surplus of staff for a few hours meant that training sessions or meetings could be held during that period without any compromise to patient services. However, it is difficult to find such an overlapping time now.

As this study is a retrospective observation of the absenteeism rates and the staff were not approached for their thoughts regarding the new rostering practice, there could be other factors influencing the rates of absenteeism that are not mentioned in this study.

**Conclusion**

In conclusion, rostering is a key process that has an impact on staffing and hence patient outcomes. As can be seen from our study, there was an observed increase in absenteeism following the change in the rostering practice of nurses. If any changes are to be made to the rostering practice of a workforce, it should be kept in mind that absenteeism could result, even up to a year after the implementation of the change. Additionally, the frequency of disruption to the circadian rhythm and the reduction of recovery time after a night shift should be minimised as far as possible. Studies to find out the perception of nurses of the new rostering practice could be beneficial to improve the work schedule for nurses. Nurse leaders should also be open to adjusting work schedules according to the demographics of the workforce, as well as changes in societal values.

**Acknowledgements**

We would like to thank the Nursing Division of Singapore General Hospital for their support of this project.

**Authors’ contributions**

Esther Monica Peijin Fan and Fazila Aloweni were involved in drafting the manuscript. Lim Mei Ling contributed in the conception of the project and data collection. Woh Chai Yuen Kelly was involved in data collection. Ang Shin Yuh conceived the idea of the project and reviewed the manuscript.

**Availability of data and materials**

Not applicable.

**Conflict of interest**

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

**Ethical approval**

Singapore General Hospital does not require ethical approval for reporting individual cases or case series.

**Funding**

The authors received no financial support for the research, authorship and/or publication of this article.

**Informed consent**

Not applicable.

**ORCID iD**

Esther Monica Peijin Fan https://orcid.org/0000-0002-6325-154X

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