Examining paid sickness absence by shift workers

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Background
Shift workers are at greater risk than day workers with respect to psychological and physical health, yet little research has linked shift work to increased sickness absence.

Aims
To investigate the relationship between shift work and sickness absence while controlling for organizational and individual characteristics and shift work attributes that have confounded previous research.

Methods
The study used archive data collected from three national surveys in Canada, each involving over 20,000 employees and 6000 private-sector firms in 14 different occupational groups. The employees reported the number of paid sickness absence days in the past 12 months. Data were analysed using both chi-squared statistics and hierarchical regressions.

Results
Contrary to previous research, shift workers took less paid sickness absence than day workers. There were no differences in the length of the sickness absence between both groups or in sickness absence taken by female and male workers whether working days or shifts. Only job tenure, the presence of a union in the workplace and working rotating shifts predicted sickness absence in shift workers. The results were consistent across all three samples.

Conclusions
In general, shift work does not seem to be linked to increased sickness absence. However, such associations may be true for specific industries. Male and female workers did not differ in the amount of sickness absence taken. Rotating shifts, regardless of industry, predicted sickness absence among shift workers. Consideration should be given to implementing scheduled time off between shift changes.

Key words
Physical health; rotating shifts; shift work; sickness absence; work-life balance.

Introduction
Shift work is normally defined as any arrangement of daily working hours that differs from standard daylight hours [1]. Shift work is scheduled work completed outside the parameters of the traditional day shift [2]; it refers to work done at different times over the day or at the same time outside the standard working hours of 6:00 a.m. to 6:00 p.m. [3]. Approximately 20–25% of employees in manufacturing industries are engaged in shift work [4]. Shift work may have a negative impact on the health of workers [5]. Smith et al. [1] concluded that shift workers were at greater health risk than comparable day workers. Shift work is associated with accidents and injuries and the development of psychological and physiological disorders [6] including sleep disorders [7]. These negative shift work effects [1,8–10] may manifest as shift workers taking more time off work to cope with illness or recovery than day workers. Such a link would have practical significance in that sickness absence (SA) could be used as a proxy for shift work-related illness [11,12]. Surprisingly, little research has examined this relationship.

Absence from work that is attributed by an employee to illness, when accepted by the employer, is defined as SA [13]. Verification of SA may require certification by a physician, more so in the case of European countries than in North America. Most employers in North America allow SA days to be taken without verification. Verification is reserved for lengthier illnesses or where an employee is suspected of abusing the system. There may be reasons other than illness why employees take SA; e.g. they view SA days as an entitlement or they need time off for personal or family matters. Despite these
possibilities, SA may still be a good objective indicator of illness [11,12] in shift workers.

In their systematic review based on 24 studies, Merkus et al. [14] concluded that fixed evening work was associated with SA among female healthcare workers. This conclusion was based on two high-quality longitudinal studies. The evidence for an association between shift work and SA was inconclusive even when shift work characteristics, such as rotating shifts, were examined. Merkus et al. [14] proposed that the reasons for their failure to link shift work to SA were due to differences in population characteristics between studies, including relatively healthy individuals in the analyses and the presence of many methodological confounders, specifically failure to control for shift work characteristics or including them in their analyses. Confounders in SA studies may include use of cross-sectional data, lack of standardized measures, single occupational groups, participants who are ‘shift work survivors’, no control of organizational size or type, union or non-union environment, limited geographical locations, small sample sizes in single occupation studies and no control for occupational differences, job type or shift work characteristics [6,15]. Merkus et al. [14] called for research to include shift work characteristics and population demographics when examining the relationship between shift work and SA.

We examined data from three separate administrations of a national Canadian survey collected from large numbers of employees in different occupations and industries located in different geographical regions. The repeated administrations of the survey allowed us to assess stability across the three time periods [16].

Using archive data from the national surveys, we examined three research questions:

1. The percentage of SA among shift workers compared with non-shift workers.
2. The percentage of SA among female shift workers compared with male shift workers and female day workers.
3. The amount of unique variance in SA by shift workers that is attributable to shift work characteristics, such as weekend work, number of shift rotations and lack of knowledge of shift schedules, after controlling for age, job tenure, gender, dependents, partner, unionized environment and employer size.

Methods

Our study is based on data obtained from the 2001, 2003 and 2005 Workplace and Employee Survey (WES) conducted by Statistics Canada. The WES surveyed approximately 6000 private-sector firms and 20 000 employees on each occasion. The same private businesses were surveyed on each occasion, but the employees surveyed at each site were randomly sampled in each wave so that fresh samples of employees were obtained every 2 years. The use of random sampling makes it likely that some employees were included in more than one survey. Information on the development of the WES, sampling procedures and availability of the WES data are available from Statistics Canada [17], including information on the appropriate ethical procedures used in collecting the data. The 2001 survey had an employer response rate of 86% (n = 5289) and an employee survey response rate of 87% (n = 20 377); in 2003 the employer response rate was 94% (n = 6565) and that of employees was 83% (n = 20 834); in 2005 the response rates were 85% (n = 6693) and 81% (n = 24 197), respectively. A maximum of 24 employees were sampled in each participating company. The Research Ethics Board of St Mary's University, Halifax, Nova Scotia, gave approval for use of the WES data.

Employees and employer representatives were contacted by telephone by Statistics Canada staff. Employees answered a series of 60 questions including several on shift work and its characteristics along with demographic questions and questions related to the nature of the organization. Respondents also provided information on topics such as work arrangements, promotion, recruitment sources and selection procedures, among others. Most questions required ‘Yes/No’ answers, e.g. ‘Do you work outside the hours of 6.00 a.m. to 6.00 p.m. on a regular basis?’ Others asked for a choice from a list of several alternatives, e.g. ‘How far in advance do you know your overtime schedule?’, which had seven possible responses, and some asked for specific information, e.g. ‘How many different shifts do you work in a full rotation?’ The survey asked employees to report the number of days that they were on SA in the past 12-month period but did not ask them to specify the reasons for their SA. SA was differentiated from other leave, such as for education, bereavement, union business, jury duty, disability or marriage. Shift workers reported how far in advance they had knowledge of their schedules: less than 2 weeks; 2 weeks to a month; and more than a month. Participants indicated whether they were employed on a casual or on-call status; seasonal basis; contractually limited term or full-time basis with no termination date.

We used chi-squared analyses to make comparisons among the percentage of respondents falling into the different demographic categories and to examine research questions 1 and 2 with respect to the percentage of workers taking SA. We used a significance level of $P < 0.05$; i.e. a 5% chance of accepting false positive results, in evaluating the results of the chi-squared analyses.

For research question 3, we used hierarchical regressions to examine those factors that predicted SA among shift workers. On the first two steps, we entered employer size, sex, childcare responsibilities, partner, age, job tenure and union as control variables. On the third step, we entered shift characteristics of weekend work, rotating
shifts, advance knowledge of work schedule and job stability. Because of the possibility of type I errors (false positives), we accepted only those results with \( P < 0.001 \) as indicating significance.

**Results**

Table 1 presents the characteristics for sex (52% female on average), age category (median 31–40 years) and job tenure (median 2–5 years) for day and shift workers for each of the three samples. The percentage of female and male workers was fairly constant over the three samples for both day and shift work. Age and job tenure on the other hand tended to be skewed toward younger and less experienced employees working shifts in all three samples. The age distributions for day and shift workers were significantly different for the 2001 sample \( (\chi^2 = 9.54, df = 4; P < 0.05) \) but not for the 2003 and 2005 samples. There were no significant differences in the distributions of day and shift workers based on job tenure in each of the three samples.

Table 2 presents the percentage of employees in each of 14 industrial categories included in the WES. The distribution of responses from within the industry types remained fairly constant over the three data sets. In all three samples, most respondents were employed in retail trade and consumer services (24%), followed by education and health services (21%) and combined manufacturing (17%). In addition employers were categorized according to the number of employees, which ranged from 10 or less to more than 500, and whether the employees belonged to a trade union.

We classified employees who consistently worked outside the hours of 6.00 a.m. to 6.00 p.m., or who worked between these hours on rotating shifts, as shift workers. Day workers were employees who worked only between 6.00 a.m. and 6.00 p.m. The percentages of shift workers in the three samples are consistent with those reported by Smith et al. (1999); i.e. 2001: 24%; 2003: 20%; 2005: 22%. A majority of shift workers worked at weekends (2001: 68%; 2003: 73%; 2005: 73%), but a majority of day workers usually worked on Mondays to Fridays (2001: 62%; 2003: 68%; 2005: 59%). The vast majority of shift workers, about 75% in each sample, worked a fixed shift with the remaining employees rotating over two or three shifts. Of those who worked rotating shifts, approximately 12% rotated across two shifts with 12% working three different shifts.

To comply with Statistics Canada requirements, the data were recoded into four SA groups: 0 SA days, 1–3, 4–10 and 11 or more days. Table 3 shows that the percentage of shift workers taking SA was significantly lower than the percentage of day workers taking SA in each of the three samples. There were no significant differences in the percentage distributions of SA for shift and day workers for the three samples.

Table 3 also shows the percentages of male and female employees taking at least one SA day. There were no significant differences in the percentages of female and male shift and day workers taking SA in any of the three samples. The percentage of female workers taking at least one SA day (Table 3) was approximately the same as the percentage of females performing shift or day work (Table 1) in each of the three samples.

### Table 1. Sex, age and job tenure characteristics of day and shift workers

<table>
<thead>
<tr>
<th></th>
<th>Day work (6.00 a.m.–6.00 p.m.)</th>
<th>Shift work (6.00 p.m.–6.00 a.m.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2001 n (%) 2003 n (%) 2005 n (%)</td>
<td>2001 n (%) 2003 n (%) 2005 n (%)</td>
</tr>
<tr>
<td><strong>Employees</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7649 (49) 7816 (47) 9082 (48)</td>
<td>2424 (50) 1947 (47) 2482 (47)</td>
</tr>
<tr>
<td>Female</td>
<td>7898 (51) 8884 (53) 9799 (52)</td>
<td>2405 (50) 2187 (53) 2834 (53)</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤25</td>
<td>1493 (10) 1620 (10) 3134 (17)</td>
<td>1275 (26) 943 (23) 1526 (29)</td>
</tr>
<tr>
<td>26–30</td>
<td>1741 (11) 1854 (11) 2001 (11)</td>
<td>1275 (26) 943 (23) 1526 (29)</td>
</tr>
<tr>
<td>31–40</td>
<td>4617 (30) 4509 (27) 4796 (25)</td>
<td>1198 (25) 881 (21) 1068 (20)</td>
</tr>
<tr>
<td>41–50</td>
<td>4726 (30) 5294 (32) 5475 (29)</td>
<td>1178 (24) 1133 (27) 1345 (25)</td>
</tr>
<tr>
<td>≥51</td>
<td>2970 (19) 3407 (20) 2643 (18)</td>
<td>758 (16) 752 (18) 904 (17)</td>
</tr>
<tr>
<td><strong>Job tenure (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤1</td>
<td>2783 (18) 4476 (27) 5343 (28)</td>
<td>1467 (30) 1339 (32) 1701 (32)</td>
</tr>
<tr>
<td>2–5</td>
<td>4944 (32) 6613 (40) 7099 (38)</td>
<td>1579 (33) 1546 (37) 2036 (38)</td>
</tr>
<tr>
<td>6–10</td>
<td>2612 (17) 2605 (16) 3285 (17)</td>
<td>758 (16) 604 (15) 712 (13)</td>
</tr>
<tr>
<td>11–15</td>
<td>2129 (14) 1436 (9) 1378 (7)</td>
<td>444 (9) 302 (7) 372 (7)</td>
</tr>
<tr>
<td>≥16</td>
<td>3093 (20) 1570 (9) 1605 (10)</td>
<td>584 (12) 343 (8) 494 (9)</td>
</tr>
</tbody>
</table>
As Table 4 illustrates, the regression equations accounted for small but significant amounts of variance in SA by shift workers. Longer serving and unionized shift workers had significantly more SA in each sample. With respect to firm size and individual characteristics, only sex predicted SA among shift workers in 2001 when female shift workers had significantly more SA. With respect to shift characteristics, only rotating shifts predicted SA by shift workers in each sample.

**Discussion**

The three samples taken at 2-year intervals showed very consistent results, particularly that shift workers did not have more SA than day workers and that shift and day workers did not differ in length of SA taken. In fact day workers had more SA. Across all organizational settings, there was no difference in SA between female shift and female day workers. A greater percentage of female shift workers had SA compared to male shift workers, but the difference was not significant. Rotating shifts were the only shift work characteristic that consistently predicted SA in shift workers.

The strength of our study lies in the fact that it is free of most confounders present in shift work research, i.e. unreplicated results obtained from a limited number of participants from one location, industry or profession and a failure to control shift characteristics [14]. Our study is based on three different samples, each involving over 6000 private-sector companies and more than 20000 workers coming from a wide variety of occupations in 14 different industries. The samples were mostly balanced on sex and included age and job tenure distributions that reflected those characteristics in the Canadian population [17]. This study makes an important contribution to the understanding of shift work with respect to the occurrence of SA.

There are two issues that may affect the results reported here. Firstly, in the WES survey employees reported the number of SA days taken in the past year, leaving the accuracy of their reports open to possible...
recall errors. Statistics Canada [17], which carried out the surveys, uses computer-assisted technology to evaluate responses, and questionable responses are followed up with telephone interviews to protect the coherence of the data. Although these procedures may minimize recall errors, they do not eliminate them entirely and the possibility of recall error must be considered with respect to the data reported here.

Secondly, the large sample sizes in this study could produce type I errors, which we controlled by using a stringent significance level. Nonetheless, the regressions were small in terms of their effect sizes questioning the meaningfulness of those relationships. The predictors we examined accounted for only 4 or 5% of variance in SA. These small effects are likely to be due to the vast heterogeneity of organizations and employees involved in the study. What is perhaps more surprising is the consistency of the effects across such diverse organizations and workers. The failure to find any significant effects in the regressions cannot be attributed to type II error due to insufficient power.

Previous research on shift work has found factors such as working weekends, having foreknowledge of shift schedules, having a stable job or working on rotating shifts were linked to SA [10,18,19], but Merkus et al. [14] found these associations to be inconclusive. We examined these four factors in predicting SA among shift workers, controlling for company and worker characteristics. Only working rotating shifts predicted SA in all three samples. Rotating shifts explained unique variance of 0.6% of the 4 or 5% explained by all the predictors. These results support previous results demonstrating the impact of rotating shifts on shift workers [18–20]. Karlson et al. [19] found that scheduled time off between shift changes led to a decrease in health problems. The use of SA may be an attempt on the part of shift workers on rotating shifts to cope with the health problems associated with the shift changes.

We assumed that health problems associated with shift work would result in greater SA, but our data did not support this assumption. This does not however mean that shift workers do not have more health problems than day workers, as self-reported SA without verification may not be a viable proxy for health problems in shift workers. If shift work consistently has adverse effects on workers’ health, our results do not support the amount of self-reported SA as a proxy for health status. If SA is used as an indicator of illness associated with shift work, then the SA must be certified as related to illness although such certifications may not always indicate illness. Future research should explore these concerns.

Many of the health concerns associated with shift work are systemic and may not result in SA of short duration. Less than 3% of workers in our samples reported SA of 11 days or longer. Like Tuchsen et al. [21] we did not see any differences between shift and day workers in taking longer term SA, but unlike them we could not find any evidence that female workers were more predisposed to take longer term SA. Those employees with more serious health problems associated with working shifts may have been transferred to long-term disability by their employer and not have participated in the surveys. Furthermore,
as Rosa and Colligan [22] note, shift employees with long-term health problems may have transferred to day work, where possible, or changed jobs. These systematic factors may result in the ‘healthy worker effect’, with progressive exclusion from shift work of employees susceptible to illness. Additionally younger workers, who should be healthier than older workers, may be more likely to start employment working shifts, particularly in unionized workplaces, and change to day work with increased seniority, which is correlated with age, or if they become unfit for shift work. Table 1 shows that about 35% of shift workers were under 30 years of age compared with 20% of day workers.

There are three major conclusions from this study. Firstly, in general, shift work does not lead to increased SA in either males or females compared with day workers. However, there may be exceptions in specific industries. Secondly, our results suggest that self-reported SA cannot necessarily be taken as an indication of illness unless the SA has been verified as illness related. Undocumented and/or unverified SA may be of limited value to occupational physicians researching determinants of SA. Our third conclusion involves rotating shifts, which were the only shift work characteristic that predicted SA in this study, suggesting in our view that employers should give serious consideration to measures to ameliorate the impact of rotating shifts [15,20], including allowing 24 h rest before rotating to a different shift and keeping the shift schedules regular and predictable.

### Key points
- In general, in our study shift work was not linked to self-reported sickness absence; however, such an association may occur in some specific industries.
- Male and female workers, regardless of working days or shifts, did not differ in their sickness absence.
- Rotating shifts predicted sickness absence among shift workers.

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### Conflicts of interest
None declared.

### References


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**Fifty years ago: ‘The first group occupational health service in Scotland’**

W. M. Dixon  
*Medical Director Dundee & District Occupational Health Service*

*Given at the Annual Provincial Meeting on 15 July 1964*

Development of group occupational health services in Britain, at least in modern times, began in 1947 with Slough and was followed in 1955 by Harlow (Taylor, 1959) and later by Dr Garland’s service around the Central Middlesex Hospital. Dundee, Rochdale and Smethwick thus represent the second generation of such services founded with the help of the Nuffield Foundation.

In July 1960, it was announced by the Minister of Labour in the House of Commons that £250 000 had been set aside by the Nuffield Foundation, largely to encourage the formation of such services in old, established industrial areas. Professor A. Mair of the University of St Andrews felt that Dundee would be a suitable place for such a venture. He and the District Factory Inspector, Mr T. Graham, worked hard for many months to drum up enthusiasm for the scheme amongst local employers, at the same time drawing the attention of the Ministry of Labour and the Nuffield Foundation to Dundee’s claims. Independently, the Foundation and the Ministry of Labour had together arrived at the conclusion that Dundee would indeed be an eminently suitable choice in relation to a number of other possibilities.

Dundee is a city standing on the north shore of the River Tay in the east of Scotland, about halfway between Edinburgh and Aberdeen (Figure 1). With a population of 190 000, it is Scotland’s third largest city, but the second in industrial importance. Of the insured working population of 90 000 some 18 000 are jute workers. The remainder work in a wide variety of industries, some of which are housed in new factory buildings on industrial estates on the outskirts of the city. The rest are in older factories, some of which have been modernized, but many remain as they were before the war.

Efforts to promote an industrial health service in Dundee suffered many setbacks but finally in the spring of 1962, these were successful. A group of 14 employers agreed to the formation of a service, but their employees totalled only 3500. The Nuffield Foundation felt that unless 5000 people were forthcoming, it would be unwise to begin. At that time the University in Dundee was looking for a new Student Health Officer, as their existing arrangements were only temporary. When Queen’s College agreed to join the Service, the minimum of 5000, which the Nuffield Foundation felt to be essential, was reached. Amongst the founders, therefore, there was a unique one in the shape of the University itself.

The founder members formed a limited liability non-profit-making company, and a Council of Management was elected. The Council is composed of 10 members elected from those firms who founded the service. A third will retire in October and be replaced by election each year. An equal number of Council members are invited from organizations representative of the Dundee business community, the trade unions, the National Health Service, the University and the Nuffield Foundation.
