The relationship between shift work and body mass index among Canadian nurses

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Abstract

Aim: The aim of this study was to examine the relationship between shift schedule and body mass index (BMI) among a sample of Canadian Nurses.

Background: Higher BMI values have been reported for employees working non-standard shifts compared to those working a regular daytime schedule. Little is known about the pathways through which shift work is associated with higher BMI.

Methods: This study was a secondary analysis of a sample from National Survey on the Work and Health of Nurses (\(N=9291\)).

Results: We found a small, but statistically significant, difference in BMI scores across shift schedule categories with higher BMI scores reported among female nurses working night or mixed shift schedules, compared with those working a regular daytime schedule. Adjustment for working conditions and employer supported facilities did not attenuate the association between shift work and BMI scores.

Conclusions: The potential public health importance of this relationship requires further investigation given the small, but statistically significant, differences observed in this sample.

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1. Introduction

The health effects of non-standard shift work are gaining increasing attention, in particular in relation to the development of cancer and cardiovascular disease (Costa, 2003; Knutsson & Boggild, 2000; Wang, Armstrong, Cairns, Key, & Travis, 2011). A proposed pathway linking shift work to each of these diseases is via higher rates of obesity among shift workers (Fritschi et al., 2011; van Drongelen, Boot, Merkus, Smid, & van der Beek, 2011). The exact mechanisms linking shift work to obesity are still developing, but proposed pathways include reduced leisure time physical activity, increases in alcohol consumption, difficulty in maintaining a healthy diet or increased consumption of energy-dense foods to combat fatigue, and reduced amount and/or quality of sleep (Antunes, Levandovski, Dantas, Caumo, & Hidalgo, 2010; Lowden, Moreno, Holmbäck, Lennernäs, & Tucker, 2010; Marshall, Glozier, & Grunstein, 2008; Wong, Wong, Wong, & Lee, 2010).

There is also some evidence of a selection effect, where respondents with higher BMI values select into shift work preferentially (Nabe-Nielsen, Garde, Tuchsen, Hogh, & Diderichsen, 2008). Shift work has also been associated with increased levels of smoking (van Amelsvoort, Schouten, & Kok, 2004), which is not commonly associated with obesity.

Workplace health promotion is a potential avenue for addressing obesity. Advantages to the employer include lower absenteeism, and lower medical costs (Finkelstein,
A recent systematic review identified six practices where there was some evidence of effectiveness in preventing and/or controlling obesity in the workplace (Archer et al., 2011). These were: enhanced access to opportunities for physical activity combined with health education; exercise prescriptions (a planned physical activity regime given to an individual); multi-component educational practices (health education combined with exercise prescriptions); weight loss competitions and incentives; and behavioural practices such as participation in workshops focused on the development of skills such as goal setting, both with and without incentives (Archer et al., 2011). However, none of the studies included in this review concentrated specifically on the effect of health promotion programs on reducing the prevalence of obesity among shift workers compared to employees working a regular shift. It may be that such interventions are impractical or more difficult to implement for shift workers.

The objectives of this study are to address two research gaps. We wish to examine the relative contribution of health behaviours, psychosocial working conditions, and employer supported facilities in mediating the relationship between shift schedule and body mass index (BMI) among a sample of Canadian nurses. Second, we examine if the relationship between shift work and BMI differs among nurses who have employer supported facilities available to them versus those that do not.

We have the following series of hypotheses related to these objectives:

1. Non-regular shift schedules will be associated with higher BMI scores;
2. Non-regular shift work will be associated with increased smoking and alcohol consumption, and a poorer psychosocial work environment;
3. Non-regular shift work will be associated with a lower prevalence of employer supported facilities for physical activity or healthy eating;
4. Health behaviours, psychosocial work environment and non-presence of employer supported facilities will mediate the relationship between non-regular shift work and increased BMI; and
5. The relationship between shift work and BMI will differ for respondents with access to employer supported facilities from those that do not, with smaller differences in BMI across shift work groups among respondents with access to physical activity facilities and healthy eating options.

2. Methods

This study was a secondary analysis of the National Survey of the Work and Health of Nurses (NSWHN), a national, cross-sectional survey conducted in 2005 in all 10 Canadian provinces and three territories, by Statistics Canada, together with the Canadian Institute for Health Information and Health Canada (Statistics Canada, 2009). Briefly, the survey collected information on nurses who were registered with a provincial nursing college, association or council, and either working as a nurse or temporarily absent from a position in nursing at the time the survey was conducted. Nurses were selected at random to participate in the survey, using a stratified design to ensure adequate sample sizes in each province and territory, and for each type of nurse. A total of 24,443 nurses were selected to participate in the survey. Of this number 1015 were not employed in nursing and therefore not eligible to participate. A total of 18,876 nurses completed the telephone interview, equalling a response rate of 80% of the eligible sample. For the purpose of this analysis we selected nurses who were working in direct care in a hospital or long-term care facility (N=12,218). We additionally removed those nurses who were currently pregnant as self-reported weight was not collected from these participants (n=276), and those working multiple jobs (n=2401), given difficulties in assessing exposure to shift work in the non-main job, leaving a final sample of 9541 respondents.

2.1. Main outcome: body mass index (BMI)

BMI scores were calculated based on self-reported height and weight. The skew and kurtosis estimates for BMI (skew=1.3, kurtosis=2.9 for females; skew=1.9, kurtosis=9.9 among males) in our sample indicated that its distribution was roughly normal (Kline, 1998), and as such was included in models as a continuous variable without transformation.

2.2. Main independent variable: shift schedule

Shift schedule was based on the question “Do you usually work days, evenings, or nights?” From this respondents were grouped into the following categories: regular day schedule, regular evening schedule, regular night schedule, and mixed schedules. We also had information available on each respondent’s tenure in their current job, and if the respondent has a choice in the hours or days that they worked, which were both included in a series of sensitivity analyses.

2.3. Mediating variables

2.3.1. Working conditions

We included two measures of the psychosocial work environment: job strain and effort–reward imbalance. Both have been previously associated with higher BMI values (Kivimaki et al., 2006; Lallukka et al., 2008). Job strain was assessed with an abbreviated measure of the Karasek and Theorell job content questionnaire (Karasek & Theorell, 1990). We included measures of job control (five questions) and psychological demands (two questions). We also separately examined a combined measure of the ratio of psychological demands to job control, referred to as job strain (Karasek & Theorell, 1990).

Respect and support was based on the following three items from the original scale developed by Siegrist (1996): “I receive the respect I deserve from my superiors” “I receive
the respect I deserve from my colleagues"; and "Consid-
ering all my efforts and achievements, I receive the respect
and prestige I deserve". Responses are on a four point
scale (strongly disagree to strongly agree). Responses to
each question were combined to form a measure of effort–
reward imbalance.

We also included measures of whether the respondent
was working full-time (30 or more hours of work a week) or
part-time, and if they were in a temporary or permanent
employment relationship.

2.3.2. Health behaviours

There are two health behaviour measures contained in the
NSHWN: smoking and alcohol consumption. Respondent’s
level of smoking was grouped into one of the following four
categories: daily smoker, occasional smoker, former smoker,
and never smoker. Alcohol consumption was reported over
the previous 12-months and grouped into one of the
following five categories: more than once per week, once a
month to once per week; less than once a month; former
drinker; and never drinker.

2.3.3. Employer supported facilities

Respondents were asked about facilities provided by their
employer related to physical activity (on-site and off-site)
and places for staff to purchase healthy food. From these
questions we created the following categories related to
physical activity facilities: employer provides facilities and
facilities are used; employer provides facilities, but facilities
are not used; and employer does not provide physical activity
facilities. The following three groups were defined for
services for availability of healthy eating options: employer
provides a place where staff can purchase healthy food and
service is available during shifts worked; employer provides
a place where staff can purchase healthy food, but service is
not available during hours worked; employer does not
provide a place where staff can purchase healthy food.

2.4. Covariates

The following variables were included in analyses as
potential confounders in the relationship between shift work
and BMI: age (grouped); marital status and children (single
without children less than 5 years, single with children less
than 5 years, cohabitating with children less than 5 years;
cohabitating without children less than 5 years); restrictions
due to pain (no pain restrictions; mild or moderate pain
restrictions; severe or unbearable pain); whether the
respondent identifies as an aboriginal person; a self-reported
episode of major depression in the previous 12 months based
on the Composite International Diagnostic Interview—Short
Form (Kessler & Ustun, 2004); province of residence; type
of nurse (registered nurse; licensed practical nurse; regis-
tered psychiatric nurse); type of workplace (hospital; long-
term care facility); and if the respondent has a choice over
the days worked (yes/no) or a choice of the type of hours
worked (yes/no).

2.5. Analysis

Our original sample of non-pregnant respondents with one
main job, working in direct care in hospitals or long-term care
facilities totalled 9541. Of this sample two respondents
(0.02%) were missing information on shift work; 238 were
missing information on BMI; 540 were missing information
on one or more of our mediators (health behaviours, working
conditions or employer supports), and 96 were missing
information on one or more covariates, leaving a final sample
of 8665 (91% of our original sample). A logistic analysis
including shift schedule, age, gender, type of workplace and
type of nurse examined the probability of missing responses
for BMI. Respondents working night shifts were more likely
to be missing responses for BMI compared with those
working day schedules, and respondents 25 to 34 years were
less likely to be missing responses for BMI compared to those
35 to 44 years of age. No differences were observed across
gender, hospital or nurse type. An additional model including
BMI examined the probability of missing responses for our
mediating variables and confounders. Respondents working
night shifts were again more likely to be missing values for
our mediating variables. No differences were observed for
missing responses for covariates.

An initial series of analyses examined the distribution of
BMI scores across our main independent variable, mediating
variable and covariates. We then examined the relationships
between our main independent variable and each of our
proposed mediating pathways to BMI: via working condi-
tions; via health behaviours; and via employer supported
facilities. We then ran a series of nested linear regression
models examining the association between shift work
categories and BMI scores after separate adjustment for
confounders, work conditions, health behaviours and
employer supported facilities. We then ran a fully adjusted
model including all confounders and potential mediators. All
regression models were stratified by gender as work tasks
can differ between men and women, even within similar
occupations (Messing, 1998).

A series of models then examined if the relationship
between shift work and BMI scores differed among
respondents with employer supported facilities or services,
separately for fitness facilities and the availability of healthy
food. Differences between coefficients in each series of
stratified models were tested using methods previously
outlined (Allison, 1999; Austin & Hux, 2002). We also ran
an additional series of sensitivity analyses to examine if the
relationship between shift work and BMI differed across
tenure in the current job (less than 3 years; 3 to 9 years; 10 to
19 years, and 20 or more years); or if the respondent had a
choice in the hours they worked, or the days they worked. We
found no statistically significant differences in coefficients for
shift schedule and BMI across employer supported facilities
groups or tenure in current job. As such, we have only
reported our gender stratified models in this paper (results
from stratified models are available on request). All analyses
were completed in SAS version 9.2 (The SAS Institute, 2010). To account for the complex sample design of the NSHWN, in line with guidelines from Statistics Canada, the confidence intervals around each point estimate have been adjusted using a bootstrap technique (Yeo, Mantel, & Liu, 1999). All analyses were weighted for the original probability of selection into the sample, and for non-response.

3. Results

Table 1 presents levels of BMI scores across our main independent variables (levels of BMI across other study variables are available from authors on request). Levels of BMI were statistically higher among respondents working night or mixed shift schedules than among day workers, although the differences in mean BMI scores were within one point across all shift schedule categories. Differences in BMI scores were also observed across our potential mediating variables. Higher levels of job strain were associated with higher BMI scores, although the relationship between effort–reward and BMI appeared to be more curvilinear. Higher BMI scores were observed among former and non-smokers and among very occasional (less than once a month) and former drinkers. Although all these differences were statistically significant, the actual differences in terms of the mean BMI were minimal.

Table 2 presents the relationship between shift work categories and our potential mediating variables. Nurses working in direct care in hospitals or long-term care facilities (n=8665).

Table 1
Descriptive information and mean BMI scores and associated standard errors (SE) for independent, mediating and potential confounding variables

<table>
<thead>
<tr>
<th>Main independent variable</th>
<th>n</th>
<th>% of sample</th>
<th>BMI</th>
<th>SE</th>
<th>p-value for diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift schedule</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days</td>
<td>2,825</td>
<td>32.6</td>
<td>25.2</td>
<td>0.09</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Evenings</td>
<td>830</td>
<td>9.6</td>
<td>25.0</td>
<td>0.17</td>
<td></td>
</tr>
<tr>
<td>Nights</td>
<td>899</td>
<td>10.4</td>
<td>25.8</td>
<td>0.16</td>
<td></td>
</tr>
<tr>
<td>Mixed</td>
<td>4111</td>
<td>47.5</td>
<td>25.7</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Mediating variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respect and support</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highest quintile</td>
<td>2148</td>
<td>24.8</td>
<td>25.5</td>
<td>0.10</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Second</td>
<td>1174</td>
<td>13.6</td>
<td>25.2</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>Third</td>
<td>1442</td>
<td>16.7</td>
<td>25.3</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>Fourth</td>
<td>2180</td>
<td>25.2</td>
<td>25.4</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Lowest quintile</td>
<td>1722</td>
<td>19.9</td>
<td>25.8</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td>Job strain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lowest quintile</td>
<td>1746</td>
<td>20.2</td>
<td>25.1</td>
<td>0.12</td>
<td>.004</td>
</tr>
<tr>
<td>Second</td>
<td>1825</td>
<td>21.1</td>
<td>25.6</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td>Third</td>
<td>1838</td>
<td>21.2</td>
<td>25.6</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td>Fourth</td>
<td>1654</td>
<td>19.1</td>
<td>25.5</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td>Highest quintile</td>
<td>1602</td>
<td>18.5</td>
<td>25.8</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td>Permanent employment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>7683</td>
<td>88.8</td>
<td>25.2</td>
<td></td>
<td>.006</td>
</tr>
<tr>
<td>No</td>
<td>982</td>
<td>11.4</td>
<td>24.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily smoker</td>
<td>1081</td>
<td>12.5</td>
<td>25.2</td>
<td>0.15</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Occasional smoker</td>
<td>467</td>
<td>5.4</td>
<td>24.8</td>
<td>0.22</td>
<td></td>
</tr>
<tr>
<td>Former smoker</td>
<td>3488</td>
<td>40.3</td>
<td>25.6</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Non-smoker</td>
<td>3629</td>
<td>41.9</td>
<td>25.6</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than once a week</td>
<td>1456</td>
<td>16.8</td>
<td>24.5</td>
<td>0.13</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Once a month or less</td>
<td>4061</td>
<td>46.9</td>
<td>25.3</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Less than once a month</td>
<td>2027</td>
<td>23.4</td>
<td>26.5</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td>Former drinker</td>
<td>699</td>
<td>8.1</td>
<td>26.0</td>
<td>0.18</td>
<td></td>
</tr>
<tr>
<td>Non-drinker</td>
<td>422</td>
<td>4.9</td>
<td>25.4</td>
<td>0.23</td>
<td></td>
</tr>
<tr>
<td>Workplace supports: food</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy food available</td>
<td>806</td>
<td>9.3</td>
<td>25.3</td>
<td>0.17</td>
<td>.022</td>
</tr>
<tr>
<td>Healthy food available, but not during shifts worked</td>
<td>4292</td>
<td>49.6</td>
<td>25.7</td>
<td>0.07</td>
<td></td>
</tr>
<tr>
<td>Healthy food not available</td>
<td>3567</td>
<td>41.2</td>
<td>25.4</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Workplace supports: fitness facilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilities available and have been used</td>
<td>511</td>
<td>5.9</td>
<td>26.0</td>
<td>0.21</td>
<td>.018</td>
</tr>
<tr>
<td>Facilities available, but not used</td>
<td>2619</td>
<td>30.3</td>
<td>25.6</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>Facilities not available</td>
<td>5535</td>
<td>64.0</td>
<td>25.4</td>
<td>0.07</td>
<td></td>
</tr>
</tbody>
</table>

Nurses working in direct care in hospitals or long-term care facilities (n=8665).
working mixed shifts reported higher levels of job strain and greater effort–reward imbalance. Nurses working evening and night shifts were more likely to be in temporary employment relationships. Levels of smoking were highest among nurses in evening or night shift; however levels of alcohol consumption were highest among nurses working a regular daytime schedule. The relationship between shift schedule and employer supported facilities was not clear, with nurses working night shifts having the highest prevalence of healthy eating options being available, but not so for nurses working evening or mixed shift schedules. Nurses working a regular daytime schedule reported greater utilisation of fitness facilities.

Table 3 presents the series of nested regressions examining each potential mediating pathway between shift work and BMI, stratified by gender. After adjustment for all potential confounders night schedule and mixed shift schedule were associated with higher BMI scores among female nurses. Adjustment for working conditions and employer supported facilities did not attenuate this relationship. Adjustment for health behaviours resulted in both coefficients (night schedule and mixed schedule) being no longer statistically significant. This attenuation was driven by association between very occasional alcohol consumption and higher BMI scores (see Table 1), with very occasional alcohol consumption being more prevalent among nurses working non-daytime shift schedules (see Table 2). The coefficients associated with night shift schedule and BMI scores were similar between men and women, although not statistically significant in our male sample where there was a smaller sample size.

4. Discussion

The objective of this study was to examine the relationship between shift schedule and BMI, and investigate the role of health behaviours, psychosocial working conditions, and employer supported facilities as mediators in this relationship. We had proposed a series of five hypotheses of which two were supported, one was partially supported and two were not supported. We found a small, but statistically significant difference in BMI scores across shift schedule categories, after adjustment for a series of
potential confounders among female nurses in our sample, with higher BMI scores reported among nurses working night or mixed shift schedules, compared with those working a regular daytime schedule (confirming hypothesis 1). Non-regular shift schedule was associated with higher job strain, greater effort reward imbalance, and higher levels of daily smoking; supporting hypothesis 2. Non-regular shift schedules were associated with a lower utilisation of physical activity facilities, but no clear relationship was observed between shift schedule and availability of healthy eating options, offering only partial support to hypothesis 3. The addition of variables describing the psychosocial work environment, the presence of employer supported facilities, and smoking did not attenuate the relationship between shift work groups and BMI scores (not supporting hypotheses 4). The exception was adjustment for alcohol consumption, which attenuated the relationship between shift schedule and BMI to non-statistical significance, via an increased level of very occasional drinking (less than once a month) among nurses working night and rotating shifts, compared with those working a regular daytime schedule. Taken together these findings suggest that night and mixed shift schedules are associated with higher BMI among female nurses, and this relationship is not mediated by differences in working conditions, employer supported facilities or health behaviours that are traditionally thought to be associated with weight gain.

The results of our study, however, should be interpreted given the following limitations. We did not have a direct measure of diet or physical activity in our data source, which are potentially important confounders in the relationship between shift schedule and BMI. The inclusion of these variables in our model may have explained more of the association between shift schedule and BMI. The cross-sectional design of the NSHWN limits conclusions about causality in our models (Nabe-Nielsen et al., 2008). However, a recent systematic review that examined the effect of shift work on changes in weight in longitudinal studies found strong evidence for a relationship between changes in body weight and shift work (van Drongelen et al., 2011). We also had a higher percentage of respondents working night shift with item level non-response for BMI and mediating variables in our analyses. It is hard to determine the likely impact of this non-response on the results reported in this paper.

We also examined if the relationship between shift work and BMI is moderated by the presence of employer supported facilities (specifically fitness facilities and the

| Table 3 | Beta estimates and SE for shift schedule categories on BMI values, stratified by gender |
|---------|----------------------------------|------------------|------------------|------------------|
|         | **Females**                      | **Males**        |                  |
|         | \( \beta \) | SE | T-stat | p-Value | \( \beta \) | SE | T-stat | p-Value |
| Model 1: adjusted for age and work hours |         |     |        |         |         |     |        |         |
| Days    | Ref |     |        |         | Ref |     |        |         |
| Evenings | -0.125 | 0.280 | 0.45 | .656 | -0.560 | 0.721 | 0.78 | .437 |
| Nights   | 0.681 | 0.305 | 2.23 | .026 | 0.156 | 1.092 | 0.14 | .886 |
| Mixed    | 0.516 | 0.196 | 2.64 | .008 | -0.023 | 0.580 | 0.04 | .968 |
| Model 2: adjustment for all confounders |         |     |        |         |         |     |        |         |
| Days    | Ref |     |        |         | Ref |     |        |         |
| Evenings | -0.268 | 0.286 | 0.94 | .349 | -0.647 | 0.701 | 0.92 | .356 |
| Nights   | 0.666 | 0.304 | 2.19 | .029 | 0.533 | 1.088 | 0.49 | .625 |
| Mixed    | 0.444 | 0.195 | 2.28 | .023 | 0.015 | 0.578 | 0.03 | .979 |
| Model 3: model two plus health behaviours |         |     |        |         |         |     |        |         |
| Days    | Ref |     |        |         | Ref |     |        |         |
| Evenings | -0.392 | 0.287 | 1.36 | .172 | -0.656 | 0.697 | 0.94 | .346 |
| Nights   | 0.523 | 0.304 | 1.72 | .086 | 1.031 | 1.090 | 0.95 | .345 |
| Mixed    | 0.286 | 0.193 | 1.48 | .139 | -0.080 | 0.590 | 0.13 | .893 |
| Model 4: model two plus work stress variables and permanent employment |         |     |        |         |         |     |        |         |
| Days    | Ref |     |        |         | Ref |     |        |         |
| Evenings | -0.273 | 0.286 | 0.95 | .340 | -0.888 | 0.705 | 1.26 | .208 |
| Nights   | 0.680 | 0.304 | 2.24 | .025 | 0.535 | 1.095 | 0.49 | .625 |
| Mixed    | 0.441 | 0.194 | 2.27 | .023 | -0.043 | 0.560 | 0.08 | .939 |
| Model 5: model two plus employer supported facilities |         |     |        |         |         |     |        |         |
| Days    | Ref |     |        |         | Ref |     |        |         |
| Evenings | -0.234 | 0.287 | 0.82 | .415 | -0.778 | 0.726 | 1.07 | .283 |
| Nights   | 0.744 | 0.305 | 2.44 | .015 | 0.803 | 1.062 | 0.76 | .449 |
| Mixed    | 0.431 | 0.195 | 2.21 | .027 | -0.066 | 0.578 | 0.11 | .909 |
| Model 6: fully adjusted model |         |     |        |         |         |     |        |         |
| Days    | Ref |     |        |         | Ref |     |        |         |
| Evenings | -0.354 | 0.290 | 1.22 | .221 | -1.012 | 0.685 | 1.48 | .140 |
| Nights   | 0.599 | 0.303 | 1.97 | .048 | 1.190 | 1.090 | 1.09 | .275 |
| Mixed    | 0.273 | 0.192 | 1.42 | .155 | -0.224 | 0.558 | 0.40 | .688 |

Nurses working in direct care in hospitals or long-term care facilities \( (n=8665) \). Statistically significant estimates \( (p<.05) \) are bolded.
availability of health eating options during the shifts worked). Although we hypothesised (hypothesis 5) that the association between shift work and BMI would be less prominent among nurses with access to employer supported facilities, our results did not support this hypothesis, with no difference in estimates for shift schedules on BMI scores across employer supported facility groups (results not presented, but available on request). This result is not entirely surprising, with previous studies reporting that the introduction of environmental interventions (e.g. an onsite physical activity area) can result in a negative change in physical activity profiles (Heirich, Foote, Erfurt, & Konopka, 1993). A 2005 review by Engbers and colleagues has also reported inconclusive evidence of an effect on physical activity of workplace environmental interventions including access to onsite physical activity areas (Engbers, van Poppel, Chin, & van Mechelen, 2005). It may be that both individual (incentives, exercise prescriptions) and environmental level interventions (the presence of physical activity facilities) may need to be introduced in combination in order for a positive effect on obesity to be observed (Emmons, Linnan, Shadel, Marcus, & Abrams, 1999).

Unfortunately the most recent systematic review, by Archer et al. (2011), found an insufficient number of high-quality studies examining enhanced access to physical activity opportunities without health education programs to determine if enhanced access to physical activity opportunities needed to be combined with health education for the greater effects on obesity to be observed.

We did find small differences in the use of physical activity facilities among respondents in workplaces where facilities were available across shift schedule, with those working a regular daytime schedule more likely to use facilities that those working evenings (6.9% versus 3.6%; see Table 2). This supports previous qualitative work suggesting that a non-regular shift schedule hours can be perceived as a barrier to participating in work-site physical activity programs, even when they are available (Fletcher, Behrens, & Domina, 2008).

Differences in BMI across shift schedule groups, while statistically significant, were modest. After adjustment for all confounders, female respondents working night shifts had BMI scores 0.67 points higher than those working regular daytime schedules, with respondents working mixed shift schedules having BMI scores 0.44 point higher (see Table 3). To help put this difference into perspective, we also ran a series of models using self-reported weight (in kilograms) as our outcome, with self-reported height (in centimeters) included as a covariate. In these models, female respondents working night shifts were 1.66 kg (3.65 lb) heavier than respondents working a regular day-time schedules, and those working mixed shift schedules were 1.11 kg (2.44 lbs) heavier (both differences statistically significant). These differences are similar to the weight reductions reported in a 2009 systematic review and meta-analysis by Anderson et al. (2009) (who reported a pooled reduction of 1.27 kg) 6 to 12 months after the introduction of workplace diet nutrition and physical activity interventions (Anderson et al., 2009).

5. Conclusions

In this representative sample of Canadian nurses we found that night and mixed shift schedules were associated with small, but potentially important elevation in BMI among female nurses. The relationship between shift schedule and BMI is not mediated by differences in working conditions, employer supported facilities or health behaviours that are traditionally thought to be associated with weight gain, although we did observe that drinking less than once a month was associated with night shift schedule and higher BMI scores. Given the high prevalence of non-regular shift schedules among labour force participants, future work should attempt to better understand the pathways through which shift schedule is related to obesity, and the potential future health implications of this relationship.

References


