# Shift work and health

*Margot Shields*


## Abstract

***Objectives***

This article describes the characteristics of shift workers and compares stress factors and health behaviours of shift and regular daytime workers. Based on an analysis of people followed over four years, associations between the incidence of chronic conditions and changes in psychological distress levels are explored in relation to working shift.

***Data sources***

Data are from the 2000/01 Canadian Community Health Survey, the longitudinal (1994/95, 1996/97 and 1998/99) and cross-sectional (1994/95) components of the National Population Health Survey, and the Survey of Work Arrangements (1991 and 1995).

***Analytical techniques***

Cross-tabulations were used to profile shift workers and to compare some of their health behaviours and sources of stress with those of regular daytime workers. Multivariate analyses were used to examine associations between shift work and the incidence of chronic conditions and changes in psychological distress levels over four years, controlling for other potential confounders.

***Main results***

Men who worked an evening, rotating or irregular shift had increased odds of reporting having been diagnosed with a chronic condition over a four-year period. For both sexes, an evening shift was associated with increases in psychological distress levels over two years.



## Key words

work schedule tolerance, occupational health, job strain, health behaviour, stress, health status



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At any given time, approximately 30% of employed Canadians work shift; that is, non-standard hours. For most of them, shift work is not a choice, but a job requirement. Our society, which has long needed around-the-clock provision of medical, transportation and protection services, now also demands more flexible access to many commercial, industrial and financial services. While shift work may be critical to the economy, evidence indicates that it can take a physical and emotional toll on workers.[1,2]

The most common health complaint of shift workers is lack of sleep,[3-9] but shift work has also been associated with cardiovascular disease,[10-16] hypertension[17] and gastrointestinal disorders,[8,18,19] and for women, with reproductive health problems[20,21] and breast cancer.[22,23] Shift work may exacerbate conditions such as asthma, diabetes and epilepsy.[24] Mental health disorders such as anxiety and depression have also been linked to shift work.[25-30]

Researchers have proposed three potentially interrelated pathways that may explain the association between shift work and health problems: disruption of circadian rhythms, adoption or worsening of unhealthy behaviour, and stress.[10,13]

## Data sources

### Canadian Community Health Survey

The 2000/01 prevalence rates for non-standard work schedules in this article are based on cycle 1.1 of Statistics Canada's Canadian Community Health Survey (CCHS), which collects information at the health region level.[31] Data collection for cycle 1.1 began in September 2000 and was conducted over 14 months. The CCHS covers the household population aged 12 or older in all provinces and territories, except persons living on Indian reserves, on Canadian Forces Bases, and in some remote areas.

The CCHS uses the area frame designed for the Labour Force Survey as its primary sampling frame. A multistage stratified cluster design was used to sample dwellings within the area frame. A list of the dwellings was prepared, and a sample of dwellings was selected from the list. The majority (83%) of the sampled households came from the area frame, and face-to-face interviews were held with respondents randomly selected from households in this frame. In some health regions, a random digit dialing (RDD) and/or list frame of telephone numbers was also used. Respondents in the telephone frames, who accounted for the remaining 17% of the targeted sample, were interviewed by telephone.

In approximately 82% of the households selected from the area frame, one person was randomly selected; two people were randomly chosen in the remaining households. For households selected from the telephone frames, one person was randomly chosen. The response rate was 84.7%. The responding sample size for cycle 1.1 was 131,535. A total of 6.3% of interviews were obtained by proxy.

The CCHS sample used to produce prevalence rates for this article consists of 24,364 men and 22,398 women aged 18 to 54 living in the 10 provinces, who worked throughout the year before their interview.

### National Population Health Survey

The National Population Health Survey (NPHS), which began in 1994/95, collects information about the health of Canadians every two years. It covers household and institutional residents in all provinces and territories, except persons living on Indian reserves, on Canadian Forces bases, and in some remote areas. The NPHS has longitudinal and cross-sectional components.

*Cross-sectional sample*: The 1994/95 and 1996/97 (cycles 1 and 2) cross-sectional samples are made up of longitudinal respondents and other members of their households, as well as individuals selected as part of supplemental samples, or buy-ins, in some provinces. In 1994/95, the majority of interviews were conducted in person. Most of the 1996/97 interviews were conducted by telephone, and additional respondents for the buy-ins were chosen using random digit dialing. The 1998/99 (cycle 3) cross-sectional sample is made up mostly of longitudinal respondents and their cohabitants. Again, most of the interviews were conducted by telephone. Although no buy-ins were added to the cycle 3 sample, infants born in 1995 or later and immigrants who entered Canada after 1994 were randomly selected and added to keep the sample representative. To replace sample lost to attrition, individuals in dwellings that were part of the original sampling frame but whose household members did not respond in 1994/95 were asked to participate.

NPHS data are stored in two files. The General file contains socio-demographic and some health information for each member of participating households. The Health file contains in-depth health information, which was collected for one randomly selected household member, as well as the information in the General file pertaining to that individual.

In 1994/95, in each selected household, one knowledgeable person provided the socio-demographic and health information about all household members for the General file. As well, one household member, not necessarily the same person, was randomly selected to provide in-depth health information about himself or herself for the Health file.

Among individuals in the longitudinal component in 1996/97 and 1998/99, the person providing in-depth health information for the Health file was the randomly selected person for the household in cycle 1 (1994/95), and was usually the person who provided information on all household members for the General file in cycles 2 and 3, if judged to be knowledgeable to do so. In households added to the 1996/97 cross-sectional sample (buy-ins), one knowledgeable household member—not necessarily the randomly selected respondent for the Health file—provided information for all household members for the General file. For the 1998/99 cross-sectional sample (longitudinal respondents, immigrants, infants, and individuals in households that did not participate in cycle 1), the randomly selected respondent was usually the person who provided information for the General file, again, if judged knowledgeable.

The 1994/95 non-institutional sample for the 10 provinces consisted of 27,263 households, of which 88.7% agreed to participate. After application of a screening rule to maintain the representativeness of the sample, 20,725 households remained in scope. In 18,342 of these households, the selected person was aged 12 or older. Their response rate to the in-depth health questions was 96.1%, or 17,626 respondents.

## Data sources – concluded

In 1996/97, the overall response rate at the household level was 82.6%. The response rate for the randomly selected individuals aged 2 or older in these households was 95.6%.

In 1998/99, the overall response rate was 88.2% at the household level. The response rate for the randomly selected respondents (aged 0 or older) in these households was 98.5%.

*Longitudinal sample*: Of the 17,626 randomly selected respondents in 1994/95, 14,786 were eligible members of the longitudinal panel, along with 468 persons for whom only general information was collected. An additional 2,022 of the 2,383 randomly selected respondents under age 12 were also eligible for the longitudinal panel. Thus, 17,276 respondents were eligible for re-interview in 1996/97, and 16,677 were still alive in 1998/99. A response rate of 93.6% was achieved for the longitudinal panel in 1996/97, and a response rate of 88.9%, based on the entire panel, was achieved in 1998/99. Of the 16,168 participants in 1996/97, full information (that is, general and in-depth health information for the first two survey cycles or an outcome of death or institutionalization) was available for 15,670. The corresponding number for 1998/99 was 14,619. More detailed descriptions of the NPHS design, sample, and interview procedures can be found in published reports.[32,33]

The 1994/95 cross-sectional sample analyzed for this article consists of 6,856 respondents (3,583 men and 3,273 women) aged 18 to 54 living in the 10 provinces who worked throughout the entire year before their 1994/95 interview. Because of small sample sizes, night shift workers were excluded from some analysis (70 men and 42 women).

The longitudinal sample consists of records for which full information was collected in all three cycles and is based on the same target group (full-year workers who were 18 to 54 years old in 1994/95). In total, 4,877 longitudinal respondents were analyzed (2,520 men and 2,357 women). Again, night shift workers were excluded (49 men and 29 women). Weighted estimates based on the longitudinal sample are lower than those based on the 1994/95 cross-sectional file because individuals who died or were institutionalized by 1998/99 were excluded (Appendix Tables A to D).

### Survey of Work Arrangements

Results from the Survey of Work Arrangements, conducted in 1991 and 1995, were used to produce trends in working shift. Both surveys were supplements to the Labour Force Survey for the month of November. The response rates were 94% and 90%, respectively. Shift work prevalence rates among full-year workers aged 18 to 54 were estimated for 1991 from a sample of 27,377 workers, and for 1995, from a sample of 21,250 workers.

Under normal conditions, biological functions such as body temperature, cognitive performance and hormonal secretions follow a 24-hour cycle.[26,34] Shift workers, however, must prepare for sleep when their natural body rhythms are telling them to be active, and they must be alert and ready to work when their bodies are preparing them for sleep. Most shift workers return to normal hours on their days off,[20] so the circadian system never fully adapts. This disruption of circadian rhythms has been found to be related to a variety of physical and mental symptoms.[10,34,35]

The association between shift work and health may be mediated by unhealthy behaviour—most often smoking.[10-13,36] And although results are inconsistent, some studies have found shift workers to be more likely than regular daytime workers to drink heavily, eat poorly and have weight problems.[5,10,11,13,26]

Stress has repeatedly been shown to be linked with physical health. Recently, researchers have suggested that shift work is a stressor that should be included in models examining relationships between occupational and personal stress, personal factors and physical and mental health.[37,38] Although the exact mechanisms are not fully understood, it is believed that stress may increase susceptibility to disease and play a pivotal role in the onset and progression of autoimmune diseases such as rheumatoid arthritis.[39-41]

Using data from the 2000/01 Canadian Community Health Survey (CCHS), this article provides an up-to-date profile of shift workers (see *Data sources, Analytical techniques* and *Limitations*). Four

types of shift are considered: evening, night, rotating and irregular. The National Population Health Survey (NPHS) is used to study the physical and mental health of shift workers both cross-sectionally and over time. Because of small sample sizes, it was not possible to consider night shift workers using NPHS data, and therefore, that analysis is restricted to those working evening, rotating or irregular shifts. Relationships between shift work and work stress, psycho-social problems, health behaviours, chronic conditions and psychological distress are examined using the 1994/95 NPHS cross-sectional file. Four-year incidence rates of chronic conditions and changes in psychological distress levels in relation to working shift in 1994/95 are studied using the first three cycles (1994/95, 1996/97 and 1998/99) of the NPHS longitudinal file. In all cases, comparisons are made with workers who had a regular daytime schedule. The analysis is based on full-year workers—those employed throughout the year before the survey—and thus focusses on workers with more than a marginal attachment to the labour force. Because job profiles differ for men and women, analyses are conducted separately for each sex.

## More than a quarter work shift

In 2000/01, 30% of men and 26% of women aged 18 to 54 who were employed throughout the year had non-standard schedules (Table 1). About a quarter of them worked evening or night shifts. Rotating and irregular shifts were reported more frequently, each accounting for around 4 in 10 of these workers.

## Analytical techniques

To investigate 10-year trends in working shift, comparisons of prevalence rates were made between the 1991 Survey of Work Arrangements, the 1994/95 National Population Health Survey (NPHS), the 1995 Survey of Work Arrangements, the 1996/97 and 1998/99 NPHS and the 2000/01 Canadian Community Health Survey (CCHS). To ensure consistent comparisons across reference years, these trends were based on all current workers (as opposed to full-year workers).

Unless otherwise noted, variable definitions are based on the questions from the first cycle (1994/95) of the NPHS. Cases where the variable definitions for work and socio-economic factors differ for the CCHS are noted.

Descriptive statistics from the CCHS were used to profile the population who worked various types of non-standard work schedules in 2000/01.

Cross-tabulations based on the 1994/95 NPHS cross-sectional file were used to examine associations between various schedules and work stress, psycho-social factors and unhealthy behaviours. The 1994/95 file was used because the work stress and some of the psycho-social questions (for example, personal stress and mastery) were not asked in subsequent NPHS cycles or for all provinces in the CCHS.

The NPHS 1994/95 cross-sectional file was also used to examine the relationship between shift work and the prevalence of chronic conditions and psychological distress levels.

The NPHS longitudinal file was used to examine four-year incidence of chronic conditions and changes in psychological distress levels (between 1994/95 and 1998/99) in relation to working shift in 1994/95. Based on a review of the literature and availability in the NPHS, several factors believed to mediate the relationship between shift work and health were accounted for in the multiple logistic regression models, including psycho-social factors, work stress, and health behaviours, as well as personal and employment characteristics.[8,10,13,15]

NPHS data (both cross-sectional and longitudinal) were weighted to represent the population in the 10 provinces in 1994/95. Sample sizes and weighted distributions for all factors included in the regression models can be found in the Appendix (Tables A through D). CCHS cross-sectional data were weighted to represent the population in the 10 provinces in 2000/01. Separate analyses were conducted for men and women, based on the weighted data.

To account for survey design effects, standard errors and coefficients of variation for all data from the NPHS and CCHS were estimated with the bootstrap technique.[42-44] Standard errors for rates derived from the Survey of Work Arrangements (1991 and 1995) were estimated based on the formulas for simple random sampling with the incorporation of a conservative estimate of a design effect to account for the complex sampling design of these surveys.

Table 1
**Percentage of workers aged 18 to 54 employed throughout 2000/01 who worked shift, by sex and selected characteristics, Canada excluding territories**

| | Men | | | | | | Women | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Shift workers | | | | | | Shift workers | | | | |
| | Total workers | Total | Evening | Night | Rotating | Irregular | Total workers | Total | Evening | Night | Rotating | Irregular |
| | '000 | % | | | | | '000 | % | | | | |
| **Total** | 5,745 | 30 | 4 | 3 | 11 | 11 | 4,732 | 26 | 5 | 2 | 10 | 10 |
| **Occupation** | | | | | | | | | | | | |
| While-collar/Clerical† | 2,697 | 21 | 2 | 1 | 8 | 10 | 2,915 | 18 | 3 | 1 | 8 | 7 |
| Sales/Service | 911 | 40* | 9* | 4* | 12* | 15* | 1,172 | 41* | 10* | 2* | 14* | 15* |
| Blue-collar | 1,866 | 36* | 5* | 4* | 16* | 12* | 376 | 33* | 7*E1 | 5*E1 | 12* | 11* |
| **Weekly work hours** | | | | | | | | | | | | |
| 1-29 | 264 | 59* | 20* | 4E1 | 11 | 24* | 804 | 44* | 13* | 2 | 10 | 19* |
| 30-40† | 2,449 | 27 | 6 | 3 | 12 | 6 | 2,646 | 22 | 4 | 2 | 10 | 6 |
| More than 40 | 3,011 | 29* | 2* | 2* | 11 | 14* | 1,273 | 23 | 2* | 2 | 9* | 11* |
| **Weekend worker** | | | | | | | | | | | | |
| Yes† | 2,442 | 48 | 5 | 3‡ | 19 | 21 | 1,826 | 52 | 9 | 3 | 21 | 19 |
| No | 3,301 | 16* | 4* | 3* | 6* | 4* | 2,906 | 10* | 2* | 1* | 3* | 4* |
| **Self-employed** | | | | | | | | | | | | |
| Yes† | 1,018 | 32 | 1E1 | 1E1 | 4 | 26 | 519 | 34 | 3 | 1E2 | 4 | 26 |
| No | 4,727 | 30* | 5* | 3* | 13* | 8* | 4,212 | 25* | 5* | 2* | 11* | 8* |
| **Age group** | | | | | | | | | | | | |
| 18-24 | 669 | 46* | 13* | 6* | 14 | 14* | 621 | 46* | 14* | 2 | 14* | 15* |
| 25-34† | 1,493 | 30 | 4 | 4 | 12 | 11 | 1,147 | 26 | 5 | 2 | 11 | 8 |
| 35-44 | 1,995 | 28* | 3 | 3* | 11 | 11 | 1,611 | 23* | 4 | 2 | 9* | 9 |
| 45-54 | 1,588 | 25* | 3 | 2* | 10* | 11 | 1,354 | 21* | 3* | 2E1 | 8* | 9 |
| **Marital status** | | | | | | | | | | | | |
| Married† | 3,911 | 26 | 3 | 2 | 11 | 10 | 3,128 | 23 | 4 | 1 | 9 | 9 |
| Never or previously married | 1,831 | 37* | 8* | 5* | 12* | 13* | 1,600 | 32* | 7* | 3* | 12* | 11* |
| **Child(ren) under age 12 in household** | | | | | | | | | | | | |
| Yes† | 2,108 | 28 | 4 | 2 | 11 | 11 | 1,533 | 26 | 5 | 2 | 10 | 9 |
| No | 3,637 | 31* | 5* | 3* | 11 | 12 | 3,200 | 26 | 5 | 2 | 10 | 10 |
| **Postsecondary graduation** | | | | | | | | | | | | |
| Yes† | 3,255 | 25 | 3 | 2 | 10 | 10 | 2,788 | 24 | 4 | 2 | 10 | 9 |
| No | 2,445 | 37* | 6* | 4* | 13* | 13* | 1,913 | 30* | 7* | 2§ | 10 | 11* |
| **Household income** | | | | | | | | | | | | |
| Lower† | 991 | 35 | 7 | 5 | 9 | 14 | 943 | 35 | 8 | 3 | 11 | 13 |
| Higher | 4,347 | 28* | 4* | 2* | 12* | 11* | 3,430 | 24* | 4* | 2* | 10 | 8* |

***Data source**: 2000/01 Canadian Community Health Survey, Cycle 1.1*
***Notes:** Based on 24,364 male and 22,398 female respondents. Of the men, 875 worked evening shift, 606 night shift, 3,166 rotating shift, and 3,080 irregular shift. Sample sizes for women were 1,007 for evening shift, 397 for night shift, 2,501 for rotating shift, and 2,325 for irregular shift. Because of rounding, detail by type of shift may not add to total shift workers. Rates are not presented for cases where the value for a variable is missing.*
*† Reference category*
*‡ The percentage of men working weekends who were night shift workers (3.32%) was significantly higher than the rate for men who did not work weekends (2.54%).*
*§ The percentage of women with postsecondary graduation working the night shift (1.52%) was significantly lower than the rate for women without postsecondary graduation (2.31%).*
*E1 Coefficient of variation between 16.6% and 25.0%*
*E2 Coefficient of variation between 25.1% and 33.3%*
** Significantly different from reference category ($p < 0.05$)*

Not all workers were equally likely to work shift (see *Work factors*). Shift work was more common for individuals in blue-collar or sales and service occupations than for those in white-collar or clerical jobs. Men and women working less than 30 hours a week and men working more than 40 hours a week were more likely than those averaging 30 to 40 hours to have non-standard schedules. As well, people who worked on weekends were more likely than those who did not to be shift workers. Relatively few self-employed individuals had an evening, night or rotating schedule, but a considerable number worked irregular hours.

## Work factors

The data in this article dealing with work schedule, occupation, weekend work and self-employment are based on the respondent's main job; that is, the current or most recent job in the past year. If the respondent had more than one current or most recent job, the main job was defined as the one with the highest number of weekly work hours.

In the first National Population Health Survey (NPHS) cycle in 1994/95, "main job" was based on the respondent's perception of "main." In subsequent cycles and in the Canadian Community Health Survey (CCHS), the definition based on current or most recent job was implemented. Therefore, to establish a consistent definition across all cycles on the NPHS longitudinal file, the 1994/95 main job was re-derived based on the new definition. Because occupation and self-employment status were asked only for the main job in 1994/95, these variables were set to "non-stated" if the main job was different. All other employment variables were asked for all jobs held throughout the year before the interview, and could therefore be re-derived based on the new definition of main job.

*Work schedule* was derived based on the question, "Which of the following best describes the hours you usually work at this job?" There were eight possible responses: regular daytime schedule or shift; regular evening shift; regular night shift; rotating shift; split shift; on call; irregular schedule; or other. *Shift work* was defined as anything but a regular daytime schedule. Four categories of shift workers were used in this analysis: *evening shift, night shift*, *rotating shift*, and *irregular shift*. An irregular shift was defined to include split shift, on call, irregular schedule and other. For the analyses based on NPHS data, night shift workers were excluded because of small sample sizes. If respondents asked for clarification of the various shifts, the following definitions were given:

A *regular daytime schedule* or shift refers to work beginning after 6:00 a.m. and ending before 7:00 p.m.

A *regular evening shift* refers to work beginning after 3:00 p.m. and ending before midnight.

A *regular night shift* refers to work beginning after 11:00 p.m. and ending before 11:00 a.m.

A *rotating shift* changes periodically from days to evenings or to nights.

A *split shift* has two or more distinct periods each day; for example, a bus driver working from 6:30 a.m. to 10:30 a.m. and from 2:00 p.m. to 6:00 p.m.

For the NPHS, *occupation* was categorized as *white-collar* (administrative and professional); *clerical*; *sales or service*; and *blue-collar*, based on the 1980 Standard Occupational Classification (SOC). For the CCHS, *occupation* was derived based on the question, "Which of the following best describes your occupation?" The response categories were classified into the following three groups: *white-collar and clerical* (management; professional; technologist, technician, or technical occupation; administrative, financial or clerical), *sales or service*, and *blue-collar* (trades, transport or equipment operator; occupation in farming, forestry, fishing or mining; occupation in processing, manufacturing or utilities).

For the NPHS, respondents were asked how many hours per week they usually worked at each job they held in the year before their 1994/95 interview. In addition, dates were collected for each job so that it was possible to calculate the number of weeks the respondent worked at each job during the year. With this information, the average number of hours worked per week during the reference year was calculated across all jobs. Individuals' *weekly work hours* were classified into three categories based on the average number of hours worked: 1 to 29, 30 to 40, or more than 40. For the CCHS, hours of work was only asked for the current job(s) or the job(s) last held in the reference year. The derivation of hours was based on this job (or jobs, if more than one was held at the same time).

Respondents were classified as *weekend workers* if they indicated that they usually worked weekends at their main job.

Respondents who indicated that they "worked mainly in their own business, farm or professional practice" were classified as *self-employed*.

The likelihood of working shift decreased with advancing age (see *Socio-economic factors*). Older workers with seniority may have more choice in their hours than do younger, less experienced workers. As well, it is more difficult for older people to deal with shift work,[5,20,45] and consequently, many switch to jobs with regular daytime schedules. The progressive intolerance to shift work associated with aging may be due to the flattening of circadian rhythms that occurs as individuals reach their forties and fifties, or to a decline in the ability to cope with stress.[20,46,47]

Single or previously married workers were more likely than those who were married to have non-standard work schedules. This is not surprising, given that shift work is associated with problems in family life, lower marital satisfaction and higher domestic friction.[1,48]

Male workers living in households with children were less likely than those in childless households to work shift. There was no difference for female workers, which may be because women were more likely than men to cite caring for family as their main reason for shift work (see *Reasons for working shift*).

## Socio-economic factors

Four *age groups* were established for this analysis: 18 to 24, 25 to 34, 35 to 44, and 45 to 54.

Respondents were grouped into two *education* categories based on the highest level attained: postsecondary graduation and less than postsecondary graduation. Postsecondary graduation includes diplomas and certificates from trade, technical or vocational schools or business colleges; diplomas and certificates from community colleges, CEGEPs or nursing schools, and university degrees. Although the categories of this variable are common to both the National Population Health Survey and the Canadian Community Health Survey, the questions used to derive these groupings vary between the two surveys.

Respondents were asked their current *marital status*. Those who indicated "now married," "common-law" or "living with partner" were grouped as "married."

*Household income* was categorized into two groups based on the number of people in the household and total household income from all sources in the 12 months before the interview:

| Household income group | People in household | Total household income |
|---|---|---|
| Lower | 1 to 2 | Less than $30,000 |
| | 3 or 4 | Less than $40,000 |
| | 5 or more | Less than $60,000 |
| Upper | 1 or 2 | $30,000 or more |
| | 3 or 4 | $40,000 or more |
| | 5 or more | $60,000 or more |

## Reasons for working shift

According to the 2000/01 Canadian Community Health Survey, both male and female workers' main reason for non-standard hours was that it was a requirement of the job—they had no choice. Of the three types of non-standard work schedules considered—evening, rotating and irregular— men were more likely than women to cite "job requirement," and women were more likely than men to cite "caring for family." The percentage of workers reporting "no choice" were highest for the rotating shift (94% of men and 91% of women), and lowest for the evening shift.

**Reason for non-standard hours, by type of shift and sex, workers aged 18 to 54 employed throughout 2000/01, Canada excluding teritories**

| | Evening† | | Rotating | | Irregular | |
|---|---|---|---|---|---|---|
| | Men | Women | Men | Women | Men | Women |
| | % | | % | | % | |
| No choice | 65‡§ | 53‡§* | 94§ | 91§* | 84 | 73* |
| School | 16‡§ | 20‡§ | 2§E1 | 3§E1 | 4E1 | 6* |
| Likes it | 13‡§ | 13‡ | 3§ | 3§ | 7 | 10* |
| Caring for family | 3‡§E1* | 11‡§* | F | 2§E1* | F | 6* |

***Data source:*** *2000/01 Canadian Community Health Survey, Cycle 1.1*
***Note:*** *Rates not presented for cases where reason for non-standard hours was "other" or missing*
*† Excludes night shift*
*‡ Significantly different from rotating shift ($p < 0.05$, adjusted for multiple comparisons)*
*§ Significantly different from irregular shift ($p < 0.05$, adjusted for multiple comparisons)*
*E1 Coefficient of variation between 16.6% and 25.0%*
*F Coefficient of variation greater than 33.3%*
** Significantly different from men ($p < 0.05$)*

Workers who were postsecondary graduates were not as likely as those with less education to report non-standard schedules. Comparatively high percentages of workers in lower-income households reported an evening, night or irregular shift. However, rotating shifts were relatively common among men from more affluent households. This may partly be attributable to the tendency for men in health professions and protection services, whose incomes were quite high (data not shown), to work rotating shifts.

## Work stress

If people working shift are more likely than those with regular schedules to experience work stress, this may confound relationships between shift work and various health outcomes (see *Work stress*). Work stress has been linked to a variety of health problems such as depression, anxiety, migraine, high blood pressure and coronary heart disease.[49-56] In fact, failure to control for work stress is a limitation often cited in studies examining the relationship between shift work and health.[8,10,13,15]

And indeed, shift workers have relatively high levels of work stress (Table 2). In 1994/95, men and women working evening or rotating shifts were more likely than their counterparts with regular daytime schedules to report job strain (high psychological demands coupled with low decision-making latitude). Job insecurity was common among both men and women with a rotating or irregular schedule. Female workers on a rotating shift were more likely than those with a daytime schedule to perceive low support from their co-workers. High physical demands were reported by women on an evening, rotating or irregular shift, and by men on a rotating shift.

## Psycho-social problems

Non-standard hours can limit a worker's participation in leisure-time and family activities (see *Psycho-social factors*). The strain of shift work on family life can lead to social support problems and stress.[1,26] While data from the 1994/95 NPHS support a link between shift work and psycho-social problems, this varied with the type of shift and sex of the workers.

### Work stress

To measure *work stress*, respondents to the National Population Health Survey (NPHS) were asked to rank their responses to the following 12 statements on a five-point scale ranging from "strongly agree" (score 1) "to strongly disagree" (score 5).

a) Your job requires that you learn new things (reverse scored).
b) Your job requires a high level of skill (reverse scored).
c) Your job allows you freedom to decide how you do your job (reverse scored).
d) Your job requires that you do things over and over.
e) Your job is very hectic (reverse scored).
f) You are free from conflicting demands that others make.
g) Your job security is good.
h) Your job requires a lot of physical effort (reverse scored).
i) You have a lot to say about what happens in your job (reverse scored).
j) You are exposed to hostility or conflict from the people you work with (reverse scored).
k) Your supervisor is helpful in getting the job done.
l) The people you work with are helpful in getting the job done.

Five components of work stress were assessed:

1) *Job strain* was measured as a ratio of psychological demands (items e and f) to decision latitude. Items pertaining to decision latitude include skill discretion (a, b and d) and decision authority (c and i).[56] So that the potential contribution of each item to the scores for decision latitude and psychological demands would be equal, the summed scores of the responses to the items pertaining to each were divided by 5 and 2, respectively. The ratio for job strain was then calculated by dividing the new score for psychological demands by that for decision latitude. For values of the ratio that fell in the upper quartile of the distribution based on the 1994/95 NPHS cross-sectional file (scores equal to or greater than 1.18), the respondent was categorized as having high job strain. Cronbach's alpha was used to assess the internal consistency of the job strain scale: 0.61 for decision latitude and 0.34 for psychological demands of work.

2) *Physical demand* was measured by item h. Respondents who answered "strongly agree" or "agree" were categorized as experiencing high physical demands.

3) *Supervisor support* was measured by item k. Respondents who answered "strongly disagree" or "disagree" were categorized as receiving low support from their supervisor.

4) *Co-worker support* was measured by items j and l. Respondents who answered "strongly agree" or "agree" to item j or "strongly disagree" or "disagree" to item l were categorized as receiving low support from their co-workers.

5) *Job insecurity* was measured by item g. Respondents who answered "strongly disagree" or "disagree" were categorized as experiencing high job insecurity.

Table 2
**Prevalence of work stress, psycho-social problems and health behaviours, by sex and work schedule, workers aged 18 to 54 employed throughout 1994/95, Canada excluding territories**

| | Men | | | | Women | | | |
|---|---|---|---|---|---|---|---|---|
| | Regular daytime | Evening shift† | Rotating shift | Irregular shift | Regular daytime | Evening shift† | Rotating shift | Irregular shift |
| | % | | | | % | | | |
| **Work stress** | | | | | | | | |
| High job strain | 17 | 30*E1 | 29* | 19 | 29 | 40* | 45* | 34 |
| High physical demands | 47 | 56 | 59* | 50 | 34 | 54* | 68* | 52* |
| Low supervisor support | 19 | 31E1 | 17 | 16 | 17 | 17E2 | 17E1 | 17 |
| Low co-worker support | 32 | 37 | 36 | 29 | 34 | 37 | 52* | 34 |
| High job insecurity | 17 | 27E2 | 24* | 23* | 18 | 19E1 | 26* | 31* |
| **Psycho-social problems** | | | | | | | | |
| High personal stress | 33 | 44 | 36 | 32 | 43 | 41 | 45 | 54* |
| Married - problems with partner | 16 | 36*E2 | 22 | 19 | 21 | 29E1 | 24E1 | 25 |
| Single - difficulty finding a partner | 33 | 55* | 35 | 35 | 34 | 30E1 | 39E1 | 19*E1 |
| Low mastery | 20 | 32*E1 | 23 | 15* | 23 | 24E1 | 31* | 24 |
| **Health behaviours** | | | | | | | | |
| Daily smoker | 27 | 45* | 33 | 28 | 23 | 28 | 30 | 26 |
| Inactive | 59 | 47 | 54 | 54 | 66 | 62 | 63 | 62 |
| Heavy drinker | 21 | 27E1 | 26 | 18 | 6 | F | 5E2 | 7E1 |
| Obese | 13 | 9E2 | 15 | 10 | 11 | 10E2 | 12E1 | 12E1 |

***Data source:*** *1994/95 National Population Health Survey, cross-sectional sample, Health file*
***Notes:*** *Based on 3,583 male and 3,273 female respondents. Of the men, 2,507 worked daytime schedule, 137 evening shift, 465 rotating shift, 471 irregular shift, and 3 not stated. Sample sizes for women were 2,431 for daytime schedule, 149 for evening shift, 335 for rotating shift, 356 for irregular shift, and 2 not stated.*
*† Excludes night shift workers*
*E1 Coefficient of variation between 16.6% and 25.0%*
*E2 Coefficient of variation between 25.1% and 33.3%*
*F Coefficient of variation greater than 33.3%*
** Significantly different from regular daytime schedule ($p < 0.05$)*

## Psycho-social factors

In the National Population Health Survey, five "true/false" statements were used to measure *personal stress*:

- You are trying to take on too many things at once.
- There is too much pressure on you to be like other people.
- Too much is expected of you by others.
- Your work around the home is not appreciated.
- People are too critical of you or what you do.

A score of 1 was assigned to each "true" response. High personal stress was defined as a score of 2 or more, and accounted for 33% of the weighted distribution of the 1994/95 cross-sectional file, based on individuals aged 18 or older.

*Relationship problems* were assessed with three "true/false" statements for people who were married (married, living with a partner or in a common-law union) and one for people who were single (single, widowed, divorced or separated). The items for married respondents were:

- Your partner doesn't understand you.
- Your partner doesn't show enough affection.
- Your partner is not committed enough to your relationship.

The item for single respondents was:

- You find it very difficult to find someone compatible with you.

Married people who answered "true" to at least one of their three items and single people who answered "true" to their one item were categorized as having a relationship problem.

To measure *mastery*, respondents were asked to react to seven items, which were ranked on a five-point scale ranging from "strongly agree" (score 0) to "strongly disagree" (score 4).

- You have little control over the things that happen to you.
- There is really no way you can solve the problems you have.
- There is little you can do to change many of the important things in your life.
- You often feel helpless in dealing with the problems of life.
- Sometimes you feel you are being pushed around in life.
- What happens in the future mostly depends on you (reverse scored).
- You can do just about anything if you set your mind to it (reverse scored).

The responses to all items were summed (ranging from 0 to 28), with a higher score indicating a higher sense of mastery (Cronbach's alpha = 0.76). Respondents scoring 17 or less, who represented the lower quartile of the weighted distribution of the 1994/95 cross-sectional file, were categorized as having low mastery.

For men, the evening shift, in particular, was associated with psycho-social difficulties. Married men working an evening shift were more likely than those with regular daytime hours to report relationship problems. And single men who worked an evening shift were more likely than those with a daytime schedule to report difficulty finding someone with whom they were compatible. As well, for men, the evening shift was associated with low levels of mastery, meaning that they were more likely than daytime workers to perceive a lack of control in their lives. By contrast, men working irregular shifts had a relatively high sense of mastery, which may reflect irregular hours among the self-employed.

**Health behaviours**

The National Population Health Survey defined *daily smokers* as those who indicated that they smoked cigarettes every day.

Level of physical activity was based on total accumulated energy expenditure (EE) during leisure time. EE was calculated from the reported frequency and duration of all of a respondent's leisure-time physical activities in the three months before his or her NPHS interview and the metabolic energy demand (MET values) of each activity, which was independently established.[57,58]

$EE = 3 (N_i * D_i * METS_i/365 \text{ days})$, where

$N_i$ = number of occasions of activity i in a year,

$D_i$ = average duration in hours of activity i, and

$METS_i$ = a constant value for metabolic energy cost of activity i.

For each respondent, daily EE was the sum of energy expenditures of all leisure-time activities, expressed as total kilocalories expended per kilogram of body weight per day (KKD). An EE of 3 or more KKD was defined as high; 1.5 to 2.9 KKD, moderate; and less than 1.5 KKD, low.[57] Respondents with high or moderate EE were considered physically active; those with low EE, *inactive*.

Heavy drinking was measured by asking respondents the number of times in the past year they had had five or more alcoholic drinks on one occasion. Those who answered 12 or more times were classified as *heavy drinkers*.

Weight was defined using body mass index (BMI), which was calculated by dividing weight in kilograms by the square of height in metres (pregnant women were excluded). BMI was grouped into two categories: *obese* (BMI 30 or more) and not obese (BMI less than 30; the reference group).

For women, the evening shift was not associated with psycho-social problems, possibly because such a schedule was often a choice. However, women who worked an irregular shift were more likely than those with a daytime schedule to report high personal stress (taking on too much, feeling pressured and unappreciated). And women working a rotating schedule were more likely than regular daytime workers to have low mastery.

## Health behaviours

Individuals attempting to cope with sleep/wake disturbances, family upset, and the stress brought about by shift work may adopt unhealthy habits (see *Health behaviours*).[10,13] However, in 1994/95, the only significant difference in health behaviour between shift and daytime workers was among men working the evening shift, a high percentage of whom were daily smokers. Differences in the prevalence of inactivity during leisure time, heavy drinking, and obesity were not significant.

## Physical and emotional health

Previous research indicates a relationship between non-standard work schedules and specific chronic conditions such as cardiovascular disease, hypertension and gastrointestinal disorders (see *Health outcomes*).[8,10,11,13-19] Yet when the generally lower socio-economic status, high work stress, psycho-social problems and smoking habits of shift workers were taken into account along with their demographic and employment characteristics, the prevalence of chronic conditions in 1994/95 among shift workers did not differ significantly from that of daytime workers (Table 3).

The disruption in circadian rhythms and the social isolation brought about by shift work are believed to contribute to mental health problems.[26,35] The fact that shift workers get less sleep than regular daytime workers could exacerbate the situation (see *Shift work and sleep*).[28,29] Even so, once their demographic, socio-economic and other employment characteristics were taken into account, in 1994/95, distress levels among men and women with non-standard schedules were similar to those of workers with regular daytime schedules (Table 4).

Table 3
**Adjusted odds ratios relating selected characteristics to chronic conditions, by sex, workers aged 18 to 54 employed throughout 1994/95, Canada excluding territories**

| | Men | | Women | |
|---|---|---|---|---|
| | Adjusted odds ratio | 95% confidence interval | Adjusted odds ratio | 95% confidence interval |
| **Work schedule**† | | | | |
| Regular daytime‡ | 1.0 | … | 1.0 | … |
| Evening shift | 0.6 | 0.3, 1.1 | 1.0 | 0.6, 1.6 |
| Rotating shift | 0.7 | 0.5, 1.0 | 0.8 | 0.6, 1.2 |
| Irregular shift | 1.2 | 0.9, 1.6 | 1.2 | 0.9, 1.6 |
| **Occupation** | | | | |
| White-collar‡ | 1.0 | … | 1.0 | … |
| Clerical | 1.9* | 1.2, 3.2 | 1.1 | 0.8, 1.5 |
| Sales/Service | 0.9 | 0.6, 1.2 | 1.0 | 0.7, 1.3 |
| Blue-collar | 1.1 | 0.8, 1.4 | 0.9 | 0.6, 1.3 |
| **Weekly work hours** | | | | |
| 1-29 | 1.4 | 0.9, 2.2 | 0.9 | 0.7, 1.1 |
| 30-40‡ | 1.0 | … | 1.0 | … |
| More than 40 | 0.9 | 0.7, 1.1 | 1.0 | 0.8, 1.4 |
| **Weekend worker** | 1.3* | 1.0, 1.6 | 1.2 | 0.9, 1.6 |
| **Self-employed** | 0.9 | 0.7, 1.2 | 0.7 | 0.5, 1.1 |
| **Age group** | | | | |
| 18-24 | 1.0 | 0.6, 1.6 | 0.8 | 0.5, 1.1 |
| 25-34‡ | 1.0 | … | 1.0 | … |
| 35-44 | 1.7* | 1.3, 2.2 | 1.3* | 1.0, 1.8 |
| 45-54 | 2.6* | 1.9, 3.5 | 2.0* | 1.4, 2.7 |
| **Married** | 1.5* | 1.1, 2.0 | 0.9 | 0.8, 1.2 |
| **Child(ren) under age 12 in household** | 0.9 | 0.7, 1.2 | 1.1 | 0.9, 1.4 |
| **Postsecondary graduation** | 0.8* | 0.6, 1.0 | 1.0 | 0.8, 1.2 |
| **Lower household income** | 0.9 | 0.7, 1.1 | 0.9 | 0.7, 1.1 |
| **Work stress** | | | | |
| High job strain | 1.3 | 0.9, 1.8 | 1.0 | 0.8, 1.2 |
| High physical demands | 0.8 | 0.7, 1.1 | 1.4* | 1.1, 1.7 |
| Low supervisor support | 0.7* | 0.5, 1.0 | 1.1 | 0.8, 1.4 |
| Low co-worker support | 1.2 | 1.0, 1.6 | 1.3* | 1.1, 1.7 |
| High job insecurity | 1.2 | 0.9, 1.7 | 1.5* | 1.2, 2.0 |
| **Psycho-social factors** | | | | |
| High personal stress | 1.6* | 1.3, 2.0 | 1.4* | 1.2, 1.8 |
| Relationship problems | 1.2 | 0.9, 1.6 | 0.9 | 0.7, 1.2 |
| Low mastery | 0.9 | 0.7, 1.2 | 1.1 | 0.9, 1.4 |
| **Health behaviours** | | | | |
| Daily smoker | 1.3* | 1.0, 1.6 | 1.4* | 1.1, 1.7 |
| Inactive | 1.0 | 0.8, 1.2 | 1.0 | 0.8, 1.2 |
| Heavy drinker | 1.2 | 0.9, 1.5 | 0.7 | 0.5, 1.0 |
| Obese | 1.2 | 0.9, 1.6 | 1.1 | 0.8, 1.6 |

***Data source:*** *1994/95 National Population Health Survey, cross-sectional sample, Health file*
***Notes:*** *Analysis based on 3,246 men and 3,147 women; 1,008 men and 1,161 women were categorized as having one or more chronic conditions in 1994/95; 337 male respondents and 126 female respondents were dropped from models because of missing values. "Missing" categories for occupation, self-employed, household income, work stress, and obese variables were included in models to maximize sample size, but their odds ratios are not shown. When not noted, reference category is absence of characteristic; for example, reference category for "weekend worker" is "not weekend worker." Because of rounding, some confidence intervals with 1.0 as lower/upper limit are significant.*
*† Excludes night shift workers*
*‡ Reference category*
** $p < 0.05$*
*… Not applicable*

Table 4
**Regression coefficients relating selected characteristics to psychological distress levels, by sex, workers aged 18 to 54 employed throughout 1994/95, Canada excluding territories**

| | Men | | | Women | | |
|---|---|---|---|---|---|---|
| | B | 95% confidence interval | beta | B | 95% confidence interval | beta |
| **Work schedule**† | | | | | | |
| Regular daytime‡ | … | … | … | … | … | … |
| Evening shift | 0.31 | -0.46, 1.08 | 0.02 | -0.22 | -0.71, 0.27 | -0.02 |
| Rotating shift | 0.00 | -0.34, 0.35 | 0.00 | -0.02 | -0.48, 0.44 | 0.00 |
| Irregular shift | 0.01 | -0.31, 0.33 | 0.00 | 0.20 | -0.19, 0.60 | 0.02 |
| **Occupation** | | | | | | |
| White-collart‡ | … | … | … | … | … | … |
| Clerical | 0.18 | -0.41, 0.77 | 0.02 | -0.16 | -0.46, 0.15 | -0.02 |
| Sales/Service | -0.08 | -0.44, 0.28 | -0.01 | -0.10 | -0.45, 0.24 | -0.02 |
| Blue-collar | -0.38* | -0.65, -0.12 | -0.07* | 0.24 | -0.26, 0.74 | 0.02 |
| **Weekly work hours** | | | | | | |
| 1-29 | 0.46 | -0.05, 0.97 | 0.05 | 0.06 | -0.25, 0.36 | 0.01 |
| 30-40‡ | … | … | … | … | … | … |
| More than 40 | -0.21 | -0.43, 0.02 | -0.04 | -0.13 | -0.41, 0.15 | -0.02 |
| **Weekend worker** | 0.11 | -0.11, 0.32 | 0.02 | -0.18 | -0.47, 0.11 | -0.03 |
| **Self-employed** | 0.18 | -0.10, 0.46 | 0.03 | 0.02 | -0.40, 0.43 | 0.00 |
| **Age** | -0.04* | -0.05, -0.02 | -0.13* | -0.03* | -0.05, -0.02 | -0.10* |
| **Married** | -0.15 | -0.44, 0.15 | -0.03 | -0.27 | -0.54, 0.01 | -0.04 |
| **Child(ren) under age 12 in household** | -0.12 | -0.37, 0.13 | -0.02 | -0.29* | -0.54, -0.04 | -0.05* |
| **Postsecondary graduation** | 0.12 | -0.11, 0.35 | 0.02 | 0.08 | -0.17, 0.33 | 0.01 |
| **Lower household income** | -0.11 | -0.35, 0.13 | -0.02 | 0.18 | -0.10, 0.46 | 0.03 |
| **Work stress** | | | | | | |
| Job strain§ | 0.71* | 0.30, 1.12 | 0.09* | 0.27 | -0.11, 0.65 | 0.04 |
| Physical demands§ | 0.01 | -0.08, 0.11 | 0.01 | 0.00 | -0.11, 0.11 | 0.00 |
| Supervisor support†† | -0.06 | -0.17, 0.04 | -0.03 | -0.08 | -0.19, 0.03 | -0.03 |
| Co-worker support†† | 0.06 | -0.02, 0.14 | 0.03 | 0.12* | 0.04, 0.20 | 0.07* |
| Job insecurity§ | 0.05 | -0.06, 0.15 | 0.02 | 0.04 | -0.07, 0.14 | 0.02 |
| **Psycho-social factors** | | | | | | |
| Personal stress§ | 0.55* | 0.44, 0.65 | 0.25* | 0.50* | 0.40, 0.61 | 0.23* |
| Relationship problems§ | 0.22 | -0.07, 0.51 | 0.04 | 0.39* | 0.09, 0.69 | 0.06* |
| Mastery§ | -0.17* | -0.20, -0.14 | -0.26* | -0.19* | -0.22, -0.16 | -0.28* |
| **Health behaviours** | | | | | | |
| Daily smoker | 0.16 | -0.09, 0.42 | 0.03 | 0.42* | 0.14, 0.69 | 0.06* |
| Inactive | 0.09 | -0.12, 0.29 | 0.02 | 0.02 | -0.22, 0.26 | 0.00 |
| Heavy drinker | 0.33* | 0.11, 0.56 | 0.05* | 0.55* | 0.08, 1.02 | 0.05* |
| Obese | -0.18 | -0.47, 0.11 | -0.02 | -0.16 | -0.48, 0.16 | -0.02 |
| **Intercept** | 6.12 | 4.93, 7.31 | | 6.85 | 5.77, 7.93 | |

***Data source:*** *1994/95 National Population Health Survey, cross-sectional sample, Health file*
***Notes:*** *Based on 3,111 men and 3,006 women; 472 male respondents and 267 female respondents were dropped from models because of missing values. "Missing" categories for occupation, self-employment, household income, and obese variables were included in models to maximize sample size, but their respective B and beta coefficients are not shown. When not noted, reference category is absence of characteristic; for example, reference category for "weekend worker" is "not weekend worker."*
*† Excludes night shift workers*
*‡ Reference category*
*§ Coded from low to high*
*†† Coded from high to low*
** $p < 0.05$*
*$R^2$=.26; Adj. $R^2$=.25; df=31 3,079 for men*
*$R^2$=.26; Adj. $R^2$=.25; df=31 2,974 for women*
*… Not applicable*

## Health outcomes

Two health outcomes were considered for the analysis in this article: chronic conditions and psychological distress.

To determine the presence of *chronic conditions*, respondents to the National Population Health Survey were asked if they had "any long-term health conditions that have lasted or are expected to last six months or more that have been diagnosed by a health professional." A checklist of conditions was read to them. Conditions considered in this analysis were: asthma, arthritis or rheumatism, back problems (excluding arthritis), high blood pressure, migraine, chronic bronchitis or emphysema, diabetes, epilepsy, heart disease, cancer, and stomach or intestinal ulcers. Respondents were classified as having "none" or "one or more" of these conditions in 1994/95. For analyses based on the longitudinal file, respondents were classified as having a new chronic condition if they reported at least one condition from the checklist in 1998/99 that they had not reported in 1994/95.

*Distress* in 1994/95 was based on responses to the following questions:

- During the past month, about how often did you feel so sad that nothing could cheer you up?
- During the past month, how often did you feel
  - ... nervous?
  - ... restless or fidgety?
  - ... hopeless?
  - ... worthless?
- During the past month, how often did you feel that everything was an effort?

Each question was answered on a five-point scale: "all of the time" (score 4), "most of the time" (3), "some of the time" (2), "a little of the time" (1) or "none of the time" (0). Responses to all items were scored and summed; the possible range of scores was 0 to 24, with a higher score indicating more distress. The average score was 3.5, with a standard deviation of 3.4. To deal with outlying values that resulted in skewness in the distribution, scores more than two standard deviations over the mean were capped (that is, scores greater than 10 were capped at 10). Values were capped for less than 5% of records. For analyses based on the longitudinal file, changes in distress scores were examined. For each record on the longitudinal file, the difference in distress scores between 1996/97 and 1994/95 was calculated as the score in 1996/97 minus the score in 1994/95. Likewise the difference between 1998/99 and 1994/95 was set to the 1998/99 value minus the 1994/95 value. Again, changes greater than two standard deviations above or below the mean change were capped (around 6% of records).

That is, shift workers were no more or less likely to report feeling sad, nervous, restless, hopeless, worthless, or that everything was an effort.

The lack of a cross-sectional relationship between shift work and chronic conditions or distress may be because many workers have trouble adjusting to shift work right from the start and transfer to a regular daytime schedule after a short period.[47] For these workers, symptoms of illness such as sleep disturbance, gastrointestinal complaints and mood disturbance are apparent from the outset.[34] The terms "shift work intolerance" or "shift maladaptation syndrome" have been used to describe this phenomenon.[34,59] Because such people

## Shift work and sleep

Although the night shift is believed to be the most disruptive to sleep,[1] data from the 2000/01 Canadian Community Health Survey reveal that other types of shift work are associated with sleep problems. Compared with regular daytime workers, men and women who worked an evening, rotating or irregular shift tended to have problems such as trouble falling or staying asleep, getting less than six hours of sleep in a 24-hour period, and not finding sleep refreshing. While several studies have attributed shift workers' sleep problems to noise, disturbances in circadian rhythms may exert a stronger influence.[4,20]

**Prevalence of sleep problems, by work schedule† and sex, workers aged 18 to 54 employed throughout 2000/01, Canada excluding territories**

| | Regular daytime | Evening shift | Rotating shift | Irregular shift |
|---|---|---|---|---|
| | | | % | |
| **Men** | | | | |
| Trouble falling/staying asleep most of time/sometimes | 38 | 45* | 44* | 41* |
| Less than 6 hours sleep | 10 | 13 | 15* | 16* |
| Sleep not always refreshing | 30 | 40* | 36* | 33 |
| **Women** | | | | |
| Trouble falling/staying asleep most of time/sometimes | 48 | 49 | 51* | 54* |
| Less than 6 hours sleep | 9 | 13* | 13* | 11* |
| Sleep not always refreshing | 36 | 45* | 43* | 41* |

***Data source:*** *2000/01 Canadian Community Health Survey, Cycle 1.1*
*† Excludes night shift workers*
** Significantly different from regular daytime ($p < 0.05$)*

tend to stop working shift in a relatively short time, their physical and psychological problems may not be apparent in a cross-sectional analysis.

### In the long run

While there was no cross-sectional relationship between shift work and chronic conditions or psychological distress, analysis of NPHS longitudinal data indicates that those who worked shift in 1994/95 were at some increased risk over the long run.

For men, a non-standard schedule in 1994/95 was predictive of developing chronic conditions in the next four years (Table 5). Compared with men who had a regular daytime schedule, those working an evening, rotating or irregular shift in 1994/95 all had increased odds of having been diagnosed with at least one new chronic condition by 1998/99.

For women, a non-standard schedule in 1994/95 was not associated with a new diagnosis of chronic conditions. This may be because, more than men, women worked shift to accommodate other needs such as caring for family or going to school. It has been suggested that commitment to shift work may be the most important individual factor related to the ability to tolerate it.[47] Another possibility is that certain chronic conditions among women were associated with working shift, but limited sample sizes meant that the analysis could not be carried out at a level of detail that would reveal these relationships.

For both sexes, working the evening shift in 1994/95 was associated with an increase in psychological distress between 1994/95 and 1996/97 (Table 6). By 1998/99, however, the average predicted distress level of people who had worked the evening shift in 1994/95 did not differ from that of regular daytime workers (Table 7).

The lack of a cross-sectional relationship between shift work and distress and the reduction of distress over four years among people who worked the evening shift in 1994/95 suggest that they either ceased working shift or learned to cope with a non-standard schedule.

### Limitations

In this analysis, it was not possible to control for the length of time that people had been working shift, and therefore, associations between shift work and health outcomes may be obscured.

The variable for shift work was derived based on information about the respondent's main job (see *Work factors*). Some respondents had more than one job, and schedules may have differed from the main one.

Small sample sizes prevented a full analysis of some issues. For example, it was not possible to carry out a detailed analysis of transitions into and out of shift work over time (between National Population Health Survey cycles). Also, night shift workers had to be excluded from most analyses based on NPHS data. In the NPHS longitudinal file, 29 men and 49 women worked the night shift in 1994/95. Some consideration was given to grouping them with evening or rotating shift workers. However, this might distort the analyses and make it difficult to interpret the results.

Sample sizes were also relatively small for the evening shift (98 men and 103 women), which, in some cases, may have resulted in findings that are not statistically significant.

It was necessary to group chronic conditions. Possibly, some individual conditions were significantly associated with working shift, while others were not. Furthermore, the four-year follow-up, 1994/95 to 1998/99, may be too brief for the full effect of associations between shift work and chronic conditions to emerge. For the NPHS, a chronic condition is defined as one that has lasted or is expected to last six months or longer, and that has been diagnosed by a health professional. It is not possible to know if the conditions reported satisfied all the criteria. As well, proxy reporting was permitted for questions about chronic conditions, which may affect the reported prevalence and incidence.[60] Diagnoses were not verified by an independent source, so inaccuracies may exist for both proxy and self-reported data.

Most interviews in the first NPHS cycle (1994/95) were conducted in person; in subsequent cycles (1996/97 and 1998/99), most were conducted by telephone. To some extent, changes in psychological distress levels between cycles may reflect this change in collection methodology. Some studies suggest that collecting information about psychiatric symptoms by telephone results in fewer problems being reported, compared with face-to-face interviews;[61] other studies have found no significant differences.[62,63]

Table 5
**Adjusted odds ratios relating selected characteristics in 1994/95 to incidence of one or more chronic conditions between 1994/95 and 1998/99, by sex, workers aged 18 to 54 employed throughout 1994/95, Canada excluding territories**

| | Men | | Women | |
|---|---|---|---|---|
| | Adjusted odds ratio | 95% confidence interval | Adjusted odds ratio | 95% confidence interval |
| **Work schedule**† | | | | |
| Regular daytime‡ | 1.0 | … | 1.0 | … |
| Evening shift | 2.0* | 1.0, 4.1 | 1.0 | 0.5, 2.0 |
| Rotating shift | 1.7* | 1.1, 2.5 | 1.2 | 0.7, 1.9 |
| Irregular shift | 1.7* | 1.1, 2.7 | 1.0 | 0.7, 1.5 |
| **Occupation** | | | | |
| White-collar‡ | 1.0 | … | 1.0 | … |
| Clerical | 1.5 | 0.7, 2.9 | 1.0 | 0.7, 1.3 |
| Sales/Service | 1.1 | 0.7, 1.8 | 1.2 | 0.8, 1.7 |
| Blue-collar | 1.1 | 0.8, 1.6 | 1.2 | 0.7, 2.1 |
| **Weekly work hours** | | | | |
| 1-29 | 0.9 | 0.5, 1.8 | 0.8 | 0.6, 1.1 |
| 30-40‡ | 1.0 | … | 1.0 | … |
| More than 40 | 0.9 | 0.6, 1.1 | 0.8 | 0.6, 1.1 |
| **Weekend worker** | 0.7* | 0.5, 1.0 | 1.0 | 0.8, 1.4 |
| **Self-employed** | 1.2 | 0.8, 1.7 | 0.9 | 0.6, 1.4 |
| **Age group** | | | | |
| 18-24 | 0.9 | 0.4, 1.8 | 0.9 | 0.5, 1.6 |
| 25-34‡ | 1.0 | … | 1.0 | … |
| 35-44 | 1.5* | 1.1, 2.1 | 1.4* | 1.0, 1.9 |
| 45-54 | 1.7* | 1.2, 2.5 | 1.9* | 1.3, 2.7 |
| **Married** | 1.4 | 1.0, 2.1 | 0.9 | 0.7, 1.2 |
| **Child(ren) under age 12 in household** | 0.6* | 0.4, 0.9 | 1.0 | 0.8, 1.4 |
| **Postsecondary graduation** | 1.0 | 0.8, 1.4 | 0.9 | 0.7, 1.2 |
| **Lower household income** | 1.1 | 0.8, 1.5 | 1.1 | 0.8, 1.5 |
| **Work stress** | | | | |
| High job strain | 1.0 | 0.7, 1.5 | 1.3 | 1.0, 1.7 |
| High physical demands | 1.2 | 0.8, 1.6 | 0.9 | 0.7, 1.2 |
| Low supervisor support | 1.1 | 0.7, 1.5 | 1.2 | 0.8, 1.6 |
| Low co-worker support | 1.0 | 0.7, 1.3 | 1.1 | 0.8, 1.4 |
| High job insecurity | 1.1 | 0.7, 1.5 | 0.9 | 0.6, 1.2 |
| **Psycho-social factors** | | | | |
| High personal stress | 1.2 | 0.9, 1.6 | 1.0 | 0.8, 1.3 |
| Relationship problems | 1.0 | 0.7, 1.4 | 1.2 | 0.9, 1.7 |
| Low mastery | 1.0 | 0.7, 1.5 | 1.3 | 1.0, 1.7 |
| **Health behaviours** | | | | |
| Daily smoker | 1.4* | 1.1, 1.9 | 1.1 | 0.8, 1.5 |
| Inactive | 1.0 | 0.7, 1.2 | 0.9 | 0.7, 1.1 |
| Heavy drinker | 0.8 | 0.6, 1.1 | 1.3 | 0.8, 2.1 |
| Obese | 2.0* | 1.4, 2.8 | 1.7* | 1.2, 2.4 |
| **One or more chronic conditions in 1994/95** | 1.0 | 0.7, 1.3 | 1.2 | 0.9, 1.6 |

***Data source:*** *1994/95, 1996/97, 1998/99 National Population Health Survey, longitudinal sample, Health file*
***Notes:*** *Based on 2,284 men and 2,273 women; 497 men and 594 women were categorized as being diagnosed with a new chronic condition between 1994/95 and 1998/99; 236 male respondents and 84 female respondents were dropped from models because of missing values. "Missing" categories for occupation, self-employed, household income, work stress, and obese variables were included in models to maximize sample size, but their odds ratios are not shown. When not noted, reference category is absence of characteristic; for example, reference category for "weekend worker" is "not weekend worker." Because of rounding, some confidence intervals with 1.0 as lower/upper limit are significant.*
*† Excludes night shift workers*
*‡ Reference category*
** $p < 0.05$*
*··· Not applicable*

Table 6
**Regression coefficients relating selected characteristics in 1994/95 to changes in psychological distress levels between 1994/95 and 1996/97, by sex, workers aged 18 to 54 employed throughout 1994/95, Canada excluding territories**

| | Men | | | Women | | |
|---|---|---|---|---|---|---|
| | B | 95% confidence interval | beta | B | 95% confidence interval | beta |
| **Work schedule**† | | | | | | |
| Regular daytime‡ | … | … | … | … | … | … |
| Evening shift | 0.86* | 0.14, 1.57 | 0.07* | 0.62* | 0.01, 1.22 | 0.04* |
| Rotating shift | 0.06 | -0.34, 0.45 | 0.01 | 0.20 | -0.37, 0.76 | 0.02 |
| Irregular shift | 0.23 | -0.10, 0.57 | 0.03 | 0.32 | -0.25, 0.88 | 0.03 |
| **Occupation** | | | | | | |
| White-collar‡ | … | … | … | … | … | … |
| Clerical | 0.31 | -0.33, 0.95 | 0.03 | 0.03 | -0.29, 0.36 | 0.01 |
| Sales/Service | -0.03 | -0.40, 0.35 | 0.00 | 0.03 | -0.37, 0.42 | 0.00 |
| Blue-collar | 0.09 | -0.24, 0.42 | 0.02 | -0.23 | -0.86, 0.41 | -0.02 |
| **Weekly work hours** | | | | | | |
| 1-29 | -0.17 | -0.66, 0.32 | -0.02 | -0.08 | -0.41, 0.25 | -0.01 |
| 30-40‡ | … | … | … | … | … | … |
| More than 40 | -0.13 | -0.39, 0.13 | -0.02 | 0.01 | -0.33, 0.34 | 0.00 |
| **Weekend worker** | -0.09 | -0.32, 0.15 | -0.02 | 0.05 | -0.26, 0.35 | 0.01 |
| **Self-employed** | -0.10 | -0.41, 0.21 | -0.01 | -0.22 | -0.67, 0.24 | -0.02 |
| **Age** | -0.01 | -0.02, 0.01 | -0.02 | 0.01 | -0.01, 0.02 | 0.02 |
| **Married** | 0.03 | -0.33, 0.39 | 0.00 | 0.03 | -0.26, 0.33 | 0.01 |
| **Child(en) under age 12 in household** | -0.01 | -0.30, 0.27 | 0.00 | -0.16 | -0.45, 0.14 | -0.03 |
| **Postsecondary graduation** | 0.10 | -0.16, 0.36 | 0.02 | 0.18 | -0.11, 0.48 | 0.03 |
| **Lower household income** | -0.29* | -0.57, -0.02 | -0.05* | 0.30 | -0.03, 0.62 | 0.05 |
| **Work stress** | | | | | | |
| Job strain§ | -0.03 | -0.47, 0.41 | 0.00 | 0.15 | -0.28, 0.58 | 0.02 |
| Physical demands§ | 0.05 | -0.05, 0.15 | 0.03 | 0.06 | -0.05, 0.17 | 0.03 |
| Supervisor support†† | 0.01 | -0.11, 0.12 | 0.00 | 0.05 | -0.07, 0.17 | 0.02 |
| Co-worker support†† | 0.13* | 0.04, 0.21 | 0.07* | 0.01 | -0.08, 0.09 | 0.00 |
| Job insecurity§ | 0.06 | -0.07, 0.18 | 0.02 | 0.01 | -0.10, 0.13 | 0.01 |
| **Psycho-social factors** | | | | | | |
| Personal stress§ | 0.15* | 0.02, 0.28 | 0.07 | 0.14* | 0.02, 0.26 | 0.06* |
| Relationship problems§ | -0.16 | -0.45, 0.12 | -0.03 | 0.16 | -0.14, 0.45 | 0.02 |
| Mastery§ | 0.01 | -0.03, 0.04 | 0.01 | -0.05* | -0.09, -0.02 | -0.08* |
| **Health behaviours** | | | | | | |
| Daily smoker | 0.25* | 0.01, 0.50 | 0.04* | 0.19 | -0.15, 0.52 | 0.03 |
| Inactive | 0.18 | -0.04, 0.41 | 0.03 | 0.02 | -0.24, 0.28 | 0.00 |
| Heavy drinker | -0.15 | -0.42, 0.12 | -0.02 | 0.18 | -0.41, 0.78 | 0.01 |
| Obese | -0.10 | -0.42, 0.22 | -0.01 | -0.19 | -0.56, 0.18 | -0.02 |
| **Distress level in 1994/95** | -0.60* | -0.66, -0.54 | -0.63* | -0.60* | -0.65, -0.55 | -0.66* |
| **Intercept** | -0.03 | -1.37, 1.31 | | 1.18 | -0.20, 2.56 | |

***Data source:*** *1994/95, 1996/97, 1998/99 National Population Health Survey, longitudinal sample, Health file*
***Notes:*** *Based on 2,151 men and 2,150 women; 369 male respondents and 207 female respondents were dropped from models because of missing values. "Missing" categories for occupation, self-employed, household income, and obese variables were included in models to maximize sample size, but their B and beta coefficients are not shown. When not noted, reference category is absence of characteristic; for example, reference category for "weekend worker" is "not weekend worker."*
*† Excludes night shift workers*
*‡ Reference category*
*§ Coded from low to high*
*†† Coded from high to low*
** $p < 0.05$*
*$R^2$=.37; Adj. $R^2$=.36; df=32 2,118 for men*
*$R^2$=.37; Adj. $R^2$=.36; df=32 2,117 for women*
*… Not applicable*

Table 7
**Regression coefficients relating selected characteristics in 1994/95 to changes in psychological distress levels between 1994/95 and 1998/99, by sex, workers aged 18 to 54 employed throughout 1994/95, Canada excluding territories**

| | Men | | | Women | | |
|---|---|---|---|---|---|---|
| | B | 95% confidence interval | beta | B | 95% confidence interval | beta |
| **Work schedule**† | | | | | | |
| Regular daytime‡ | … | … | … | … | … | … |
| Evening shift | 0.44 | -0.34, 1.21 | 0.03 | 0.46 | -0.27, 1.19 | 0.03 |
| Rotating shift | -0.31 | -0.67, 0.05 | -0.04 | 0.40 | -0.33, 1.13 | 0.04 |
| Irregular shift | -0.04 | -0.47, 0.39 | 0.00 | -0.08 | -0.65, 0.49 | -0.01 |
| **Occupation** | | | | | | |
| White-collar‡ | … | … | … | … | … | … |
| Clerical | 0.17 | -0.54, 0.88 | 0.01 | -0.07 | -0.43, 0.30 | -0.01 |
| Sales/Service | 0.43* | -0.01, 0.88 | 0.06* | -0.17 | -0.61, 0.27 | -0.02 |
| Blue-collar | 0.06 | -0.28, 0.39 | 0.01 | -0.20 | -0.70, 0.31 | -0.02 |
| **Weekly work hours** | | | | | | |
| 1-29 | 0.15 | -0.45, 0.75 | 0.01 | 0.17 | -0.18, 0.52 | 0.02 |
| 30-40‡ | … | … | … | … | … | … |
| More than 40 | -0.11 | -0.41, 0.19 | -0.02 | -0.17 | -0.54, 0.20 | -0.02 |
| **Weekend worker** | -0.15 | -0.43, 0.13 | -0.03 | -0.28 | -0.60, 0.04 | -0.04 |
| **Self-employed** | -0.11 | -0.46, 0.25 | -0.01 | -0.13 | -0.69, 0.43 | -0.01 |
| **Age** | 0.01 | -0.01, 0.03 | 0.03 | -0.01 | -0.02, 0.01 | -0.02 |
| **Married** | -0.22 | -0.59, 0.14 | -0.04 | -0.02 | -0.36, 0.32 | 0.00 |
| **Child(ren) under age 12 in household** | 0.29 | -0.01, 0.58 | 0.05 | -0.25 | -0.59, 0.09 | -0.04 |
| **Postsecondary graduation** | -0.04 | -0.33, 0.24 | -0.01 | 0.13 | -0.21, 0.46 | 0.02 |
| **Lower household income** | -0.33* | -0.62, -0.04 | -0.05* | 0.26 | -0.10, 0.61 | 0.04 |
| **Work stress** | | | | | | |
| Job strain§ | -0.17 | -0.59, 0.25 | -0.02 | 0.12 | -0.31, 0.55 | 0.01 |
| Physical demands§ | 0.02 | -0.09, 0.13 | 0.01 | 0.02 | -0.12, 0.15 | 0.01 |
| Supervisor support†† | 0.00 | -0.13, 0.13 | 0.00 | 0.10 | -0.03, 0.24 | 0.04 |
| Co-worker support†† | 0.12* | 0.04, 0.21 | 0.07* | -0.02 | -0.11, 0.07 | -0.01 |
| Job insecurity§ | 0.20* | 0.06, 0.33 | 0.08* | -0.17* | -0.32, -0.02 | -0.07* |
| **Psycho-social factors** | | | | | | |
| Personal stress§ | 0.09 | -0.02, 0.20 | 0.04 | 0.04 | -0.07, 0.15 | 0.02 |
| Relationship problems§ | -0.16 | -0.49, 0.18 | -0.02 | 0.29 | -0.04, 0.62 | 0.04 |
| Mastery§ | 0.00 | -0.03, 0.04 | 0.00 | -0.06* | -0.10, -0.02 | -0.08* |
| **Health behaviours** | | | | | | |
| Daily smoker | 0.08 | -0.19, 0.35 | 0.01 | 0.30 | -0.06, 0.66 | 0.04 |
| Physically inactive | 0.15 | -0.10, 0.39 | 0.03 | -0.16 | -0.44, 0.12 | -0.03 |
| Heavy drinker | 0.09 | -0.20, 0.38 | 0.01 | -0.13 | -0.77, 0.51 | -0.01 |
| Obese | -0.10 | -0.43, 0.24 | -0.01 | 0.04 | -0.36, 0.44 | 0.00 |
| **Distress level in 1994/95** | -0.63* | -0.69, -0.57 | -0.62* | -0.59* | -0.65, -0.53 | -0.62* |
| **Intercept** | -0.14 | -1.56, 1.27 | | 3.01* | 1.38, 4.64 | |

***Data source:*** *1994/95, 1996/97, 1998/99 National Population Health Survey, longitudinal sample, Health file*
***Notes:*** *Based on 2,150 men and 2,148 women; 370 male respondents and 209 female respondents were dropped from models because of missing values. "Missing" categories for occupation, self-employed, household income, and obese variables were included in models to maximize sample size, but, their B and beta coefficients are not shown. When not noted, reference category is absence of characteristic; for example, reference category for "weekend worker" is "not weekend worker."*
*† Excludes night shift workers*
*‡ Reference category*
*§ Coded from low to high*
*†† Coded from high to low*
** $p < 0.05$*
*$R^2$=.38; Adj. $R^2$=.37; df=32 2,117 for men*
*$R^2$=.35; Adj. $R^2$=.34; df=32 2,115 for women*
*… Not applicable*

## A "shifting" workforce

Although the overall proportion of employed Canadians working shift has changed little over the past decade, transitions out of shift work are the rule, not the exception (see *Trends in working shift*). In the majority of cases, the transition is to a regular daytime schedule rather than to a different type of shift, or it involves leaving the labour force entirely (data not shown).

Of those who worked an evening, rotating or irregular shift in 1994/95, less than one in five maintained this schedule in both 1996/97 and 1998/99 (Table 8). In fact, the proportions who had an irregular shift in 1994/95 and continued with this schedule in 1996/97 and 1998/99 were just 12% for men and 11% for women. By contrast, about 75% of the men and women who worked regular daytime hours in 1994/95 did so as well in 1996/97 and 1998/99.

Table 8
**Work schedule in 1994/95, 1996/97 and 1998/99, by sex, workers aged 18 to 54 employed throughout 1994/95, Canada excluding territories**

| Work schedule† 1994/95 | Full-year workers 1994/95 | Same schedule 1996/97 | Same schedule 1996/97 and 1998/99 |
|---|---|---|---|
| | '000 | % | % |
| **Men** | | | |
| Regular daytime | 3,847 | 85 | 74 |
| Evening shift | 259 | 30*E1 | F* |
| Rotating shift | 604 | 49* | 32* |
| Irregular shift | 722 | 27* | 12*E1 |
| **Women** | | | |
| Regular daytime | 3,252 | 85 | 76 |
| Evening shift | 168 | 37* | 19*E2 |
| Rotating shift | 358 | 50* | 27* |
| Irregular shift | 483 | 30* | 11*E1 |

***Data source:*** *1994/95, 1996/97, 1998/99 National Population Health Survey, longitudinal sample, Health file*
***Notes:*** *Based on 2,520 male and 2,357 female longitudinal respondents. Of the men, 1,786 worked daytime schedule, 98 evening shift , 301 rotating shift, and 335 irregular shift in 1994/95. For women, sample sizes were 1,772 for daytime schedule, 103 for evening shift, 241 for rotating shift, and 241 for irregular shift.*
*† Excludes night shift workers*
*E1 Coefficient of variation between 16.6% and 25.0%*
*E2 Coefficient of variation between 25.15 and 33.3%*
*F Coefficient of variation greater than 33.3%*
** Significantly different from regular daytime ($p < 0.05$)*

### Trends in working shift

Over the past decade, the percentage of Canadian workers with non-standard hours changed very little. According to the Survey of Work Arrangements (November 1991 and November 1995), the first three cycles of the National Population Health Survey (1994/95, 1996/97 and 1998/99), and the Canadian Community Health Survey (2000/01), the proportion of employed people reporting shift work remained relatively stable at approximately 30%.

Before 1990, little information was available about the percentage of workers with non-standard hours, and there are comparability problems with the limited data that do exist.[64] However, some historical evidence points to a rise in the prevalence of shift work in both Canada and the United States throughout the 1970s and 1980s because of growth of the service sector and dramatic increases in the proportion of students working during the school year.[48,64]

**Percentage of workers with non-standard hours, by sex, workers aged 18 to 54, Canada excluding territories, selected years 1991 to 2000/01**

| | Men | Women |
|---|---|---|
| | % | |
| 1991 Survey of Work Arrangements (November) | 28 | 29 |
| 1994/95 National Population Health Survey | 31 | 27 |
| 1995 Survey of Work Arrangements (November) | 33 | 30 |
| 1996/97 National Population Health Survey | 30 | 28 |
| 1998/99 National Population Health Survey | 31 | 28 |
| 2000/01 Canadian Community Health Survey | 31 | 28 |

***Notes:*** *No significant differences in percentages for women across years; for men, rate for 1995 Survey of Work Arrangements exceeds rate for 1991 Survey of Work Arrangements ($p < 0.05$ adjusted for multiple comparisons).*

## Concluding remarks

About 3 out of 10 Canadian workers are putting in non-standard hours. Most work shifts because their jobs require it, not because they choose to do so. With a few notable exceptions, shift work tends to be performed by younger, unmarried, less-educated and less affluent individuals.

According to the National Population Health Survey, shift workers face a number of potential psycho-social problems. In 1994/95, work stress was relatively common among shift workers: job strain for those who worked an evening or rotating shift; job insecurity for those who worked a rotating or irregular shift. Men who worked an evening shift in 1994/95 were more likely than those with a regular daytime schedule to report a low sense of mastery, and to have relationship problems. They were also

more likely to be daily smokers. For women, an irregular shift was related to high personal stress, and a rotating shift, to a low sense of mastery.

Even when work stress, personal stress, health behaviour, socio-economic status and other work-related factors were taken into account, men working an evening, rotating or irregular shift all had higher odds of reporting a diagnosis of a chronic condition sometime in the four years from 1994/95 to 1998/99 than did men with regular daytime schedules. For both sexes, working the evening shift in 1994/95 was associated with an increase in psychological distress by 1996/97. Thus, consistent with other research, analysis of NPHS data suggests a link between mental health and shift work.[25,27-30] The association, however, was significant longitudinally but not cross-sectionally.

The evening shift is especially problematic for men. Women's apparently greater ability to cope may be because they are more likely than men to work these schedules to care for family. In such cases, an evening shift may even help accommodate other priorities.

Given the problems experienced by shift workers, it is not surprising that most do not maintain non-standard hours for prolonged periods. Within two years, most shift workers either changed their hours or left the workforce. This supports earlier studies suggesting a "healthy survivor effect," meaning that the people who continue are a more robust group who are willing and able to tolerate the stress of working shift.[12,17,25,47]

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## Appendix

Table A
**Distribution of chronic condition prevalence and incidence, by sex, workers aged 18 to 54 employed throughout 1994/95, Canada excluding territories**

| | Men | | | Women | | |
|---|---|---|---|---|---|---|
| | Sample size | Estimated population | | Sample size | Estimated population | |
| | | '000 | % | | '000 | % |
| **Total - 1994/95 cross-sectional file** | 3,583 | 5,524 | 100.0 | 3,273 | 4,369 | 100.0 |
| **Chronic condition(s) in 1994/95** | | | | | | |
| None | 2,480 | 3,867 | 70.0 | 2,069 | 2,880 | 65.9 |
| One or more | 1,099 | 1,651 | 29.9 | 1,201 | 1,487 | 34.0 |
| Missing | 4 | F | F | 3 | F | F |
| **Total - longitudinal file** | 2,520 | 5,448 | 100.0 | 2,357 | 4,269 | 100.0 |
| **Chronic condition(s) diagnosed between 1994/95 and 1998/99** | | | | | | |
| None | 1,970 | 4,249 | 78.0 | 1,724 | 3,163 | 74.1 |
| One or more | 543 | 1,184 | 21.7 | 626 | 1,089 | 25.5 |
| Missing | 7 | F | F | 7 | F | F |

***Data source:*** *1994/95 National Population Health Survey, cross-sectional sample, Health file; 1994/95, 1996/97 and 1998/99 National Population Health Survey, longitudinal sample, Health file*
***Note:*** *Because of rounding, detail may not add to totals.*
*F Coefficient of variation greater than 33.3%*

Table B
**Average psychological distress scores, by sex, workers aged 18 to 54 employed throughout 1994/95, Canada excluding territories**

| | Sample responding | Missing | Weighted average |
|---|---|---|---|
| **Men** | | | |
| **Distress score 1994/95** | 3,350 | 233 | 2.9 |
| **Difference in scores** | | | |
| Between 1994/95 and 1998/99 | 2,324 | 196 | -0.6 |
| Between 1994/95 and 1996/97 | 2,325 | 195 | -0.6 |
| **Women** | | | |
| **Distress score 1994/95** | 3,214 | 59 | 3.4 |
| **Difference in scores** | | | |
| Between 1994/95 and 1998/99 | 2,312 | 45 | -0.7 |
| Between 1994/95 and 1996/97 | 2,308 | 49 | -0.7 |

***Data source:*** *1994/95 National Population Health Survey, cross-sectional sample, Health file; 1994/95, 1996/97 and 1998/99 National Population Health Survey, longitudinal sample, Health file*

Table C
**Distribution of selected characteristics, by sex, workers aged 18 to 54 employed throughout 1994/95, Canada excluding territories, National Population Health Survey, cross-sectional sample, Health file, 1994/95**

| | Men | | | Women | | |
|---|---|---|---|---|---|---|
| | Sample size | Estimated population | | Sample size | Estimated population | |
| | | '000 | % | | '000 | % |
| **Total** | **3,583** | **5,524** | **100.0** | **3,273** | **4,369** | **100.0** |
| **Work schedule**† | | | | | | |
| Regular daytime | 2,507 | 3,933 | 71.2 | 2,431 | 3,298 | 75.5 |
| Evening shift | 137 | 261 | 4.7 | 149 | 187 | 4.3 |
| Rotating shift | 465 | 618 | 11.2 | 335 | 372 | 8.5 |
| Irregular shift | 471 | 711 | 12.9 | 356 | 509 | 11.7 |
| Missing | 3 | F | F | 2 | F | F |
| **Occupation** | | | | | | |
| White-collar | 1,086 | 1,732 | 31.4 | 1,286 | 1,676 | 38.4 |
| Clerical | 173 | 334 | 6.0 | 825 | 1,118 | 25.6 |
| Sales/Service | 561 | 895 | 16.2 | 725 | 941 | 21.5 |
| Blue-collar | 1,587 | 2,276 | 41.2 | 242 | 370 | 8.5 |
| Missing | 176 | 286 | 5.2 | 195 | 263 | 6.0 |
| **Weekly work hours** | | | | | | |
| 1-29 | 217 | 401 | 7.3 | 708 | 1,005 | 23.0 |
| 30-40 | 1,681 | 2,629 | 47.6 | 1,908 | 2,529 | 57.9 |
| More than 40 | 1,669 | 2,470 | 44.7 | 653 | 831 | 19.0 |
| Missing | 16 | F | F | 4 | F | F |
| **Weekend worker** | | | | | | |
| Yes | 1,561 | 2,321 | 42.0 | 1,206 | 1,476 | 33.8 |
| No | 2,019 | 3,201 | 58.0 | 2,065 | 2,890 | 66.2 |
| Missing | 3 | F | F | 2 | F | F |
| **Self-employed** | | | | | | |
| Yes | 607 | 961 | 17.4 | 296 | 422 | 9.7 |
| No | 2,897 | 4,455 | 80.6 | 2,873 | 3,811 | 87.2 |
| Missing | 79 | 109 | 2.0 | 104 | 136 | 3.1 |
| **Age group** | | | | | | |
| 18-24 | 362 | 519 | 9.4 | 374 | 479 | 11.0 |
| 25-34 | 1,120 | 1,684 | 30.5 | 1,058 | 1,375 | 31.5 |
| 35-44 | 1,183 | 1,887 | 34.2 | 1,062 | 1,499 | 34.3 |
| 45-54 | 918 | 1,435 | 26.0 | 779 | 1,015 | 23.2 |
| **Married** | | | | | | |
| Yes | 2,434 | 4,054 | 73.4 | 2,108 | 3,045 | 69.7 |
| No | 1,149 | 1,470 | 26.6 | 1,164 | 1,321 | 30.2 |
| Missing | 0 | 0 | 0 | 1 | F | F |
| **Child(ren) under age 12 in household** | | | | | | |
| Yes | 1,193 | 2,147 | 38.9 | 1,102 | 1,614 | 37.0 |
| No | 2,390 | 3,377 | 61.1 | 2,171 | 2,755 | 63.0 |
| **Education** | | | | | | |
| Less than postsecondary graduation | 2,172 | 3,231 | 58.5 | 1,881 | 2,482 | 56.8 |
| Postsecondary graduation | 1,406 | 2,285 | 41.4 | 1,389 | 1,884 | 43.1 |
| Missing | 5 | F | F | 3 | F | F |
| **Household income** | | | | | | |
| Lower | 1,086 | 1,596 | 28.9 | 1,118 | 1,354 | 31.0 |
| Higher | 2,361 | 3,668 | 66.4 | 2,053 | 2,865 | 65.6 |
| Missing | 136 | 260 | 4.7 | 102 | 151 | 3.4 |
| **High job strain** | | | | | | |
| Yes | 620 | 910 | 16.5 | 973 | 1,255 | 28.7 |
| No | 2,604 | 3,845 | 69.6 | 2,101 | 2,758 | 63.1 |
| Missing | 359 | 769 | 13.9 | 199 | 356 | 8.1 |
| **High physical demands** | | | | | | |
| Yes | 1,632 | 2,317 | 41.9 | 1,274 | 1,603 | 36.7 |
| No | 1,592 | 2,439 | 44.1 | 1,800 | 2,411 | 55.2 |
| Missing | 359 | 769 | 13.9 | 199 | 356 | 8.1 |
| **Low supervisor support** | | | | | | |
| Yes | 577 | 906 | 16.4 | 495 | 681 | 15.6 |
| No | 2,647 | 3,850 | 69.7 | 2,579 | 3,332 | 76.3 |
| Missing | 359 | 769 | 13.9 | 199 | 356 | 8.1 |
| **Low co-worker support** | | | | | | |
| Yes | 1,012 | 1,518 | 27.5 | 1,071 | 1,445 | 33.1 |
| No | 2,212 | 3,237 | 58.6 | 2,003 | 2,568 | 58.8 |
| Missing | 359 | 769 | 13.9 | 199 | 356 | 8.1 |
| **High job insecurity** | | | | | | |
| Yes | 569 | 901 | 16.3 | 631 | 807 | 18.5 |
| No | 2,655 | 3,855 | 69.8 | 2,443 | 3,206 | 73.4 |
| Missing | 359 | 769 | 13.9 | 199 | 356 | 8.1 |
| **High personal stress** | | | | | | |
| Yes | 1,104 | 1,714 | 31.0 | 1,367 | 1,889 | 43.2 |
| No | 2,245 | 3,387 | 61.3 | 1,843 | 2,393 | 54.8 |
| Missing | 234 | 423 | 7.7 | 63 | 87 | 2.0 |
| **Relationship problems** | | | | | | |
| Yes | 801 | 1,166 | 21.1 | 823 | 1,081 | 24.7 |
| No | 2,557 | 3,960 | 71.7 | 2,396 | 3,215 | 73.6 |
| Missing | 225 | 398 | 7.2 | 54 | 73 | 1.7 |
| **Low mastery** | | | | | | |
| Yes | 684 | 1,030 | 18.6 | 764 | 1,019 | 23.3 |
| No | 2,666 | 4,092 | 74.1 | 2,445 | 3,253 | 74.4 |
| Missing | 233 | 403 | 7.3 | 64 | 98 | 2.2 |
| **Daily smoker** | | | | | | |
| Yes | 1,067 | 1,587 | 28.7 | 832 | 1,067 | 24.4 |
| No | 2,515 | 3,933 | 71.2 | 2,441 | 3,302 | 75.6 |
| Missing | 1 | F | F | 0 | 0 | 0 |
| **Inactive** | | | | | | |
| Yes | 1,928 | 2,935 | 53.1 | 2,007 | 2,800 | 64.1 |
| No | 1,445 | 2,221 | 40.2 | 1,218 | 1,505 | 34.4 |
| Missing | 210 | 368 | 6.7 | 48 | 65[E1] | 1.5[E1] |
| **Heavy drinker** | | | | | | |
| Yes | 898 | 1,154 | 20.9 | 222 | 254 | 5.8 |
| No | 2,610 | 4,266 | 77.2 | 3,011 | 4,057 | 92.9 |
| Missing | 75 | 104 | 1.9 | 40 | 57[E1] | 1.3[E1] |
| **Obese** | | | | | | |
| Yes | 499 | 665 | 12.0 | 377 | 454 | 10.4 |
| No | 2,992 | 4,667 | 84.5 | 2,680 | 3,611 | 82.7 |
| Missing/Not applicable | 92 | 192 | 3.5 | 216 | 304 | 7.0 |

***Notes:*** *Because of rounding, detail may not add to totals. Questions on job strain, physical demands, supervisor and co-worker support, job insecurity, personal stress, relationship problems, mastery, and physical activity were not asked of proxy respondents; therefore, percentage of missing values for these variables is higher. A problem with computer-assisted interview in third quarter 1994/95 data collection resulted in French-language respondents being bypassed for questions on work stress, which further increased missing values for these variables.*

*† Excludes night shift workers*

*E1 Coefficient of variation between 16.6% and 25.0%*

*F Coefficient of variation greater than 33.3%*

Table D

**Distribution of selected characteristics, by sex, workers aged 18 to 54 employed throughout 1994/95, Canada excluding territories, 1994/95, 1996/97, 1998/99 National Population Health Survey, longitudinal sample, Health file**

| | Men | | | Women | | |
|---|---|---|---|---|---|---|
| | Sample size | Estimated population | | Sample size | Estimated population | |
| | | '000 | % | | '000 | % |
| **Total** | **2,520** | **5,448** | **100.0** | **2,357** | **4,269** | **100.0** |
| **Work schedule**† | | | | | | |
| Regular daytime | 1,786 | 3,863 | 70.9 | 1,772 | 3,258 | 76.3 |
| Evening shift | 98 | 259 | 4.8 | 103 | 168 | 3.9 |
| Rotating shift | 301 | 604 | 11.1 | 241 | 359 | 8.4 |
| Irregular shfit | 335 | 722 | 13.2 | 241 | 484 | 11.3 |
| **Occupation** | | | | | | |
| White-collar | 771 | 1,675 | 30.7 | 944 | 1,682 | 39.4 |
| Clerical | 133 | 323 | 5.9 | 613 | 1,083 | 25.4 |
| Sales/Service | 393 | 918 | 16.8 | 507 | 917 | 21.5 |
| Blue-collar | 1,106 | 2,270 | 41.7 | 171 | 365 | 8.6 |
| Missing | 117 | 263 | 4.8 | 122 | 222 | 5.2 |
| **Weekly work hours** | | | | | | |
| 1-29 | 145 | 379 | 7.0 | 511 | 1,004 | 23.5 |
| 30-40 | 1,198 | 2,642 | 48.5 | 1,383 | 2,455 | 57.5 |
| More than 40 | 1,167 | 2,401 | 44.1 | 460 | 805 | 18.9 |
| Missing | 10 | F | F | 3 | F | F |
| **Weekend worker** | | | | | | |
| Yes | 1,069 | 2,267 | 41.6 | 833 | 1,408 | 33.0 |
| No | 1,451 | 3,181 | 58.4 | 1,524 | 2,861 | 67.0 |
| **Self-employed** | | | | | | |
| Yes | 433 | 926 | 17.0 | 203 | 395 | 9.3 |
| No | 2,035 | 4,412 | 81.0 | 2,087 | 3,758 | 88.0 |
| Missing | 52 | 111[E1] | 2.0[E1] | 67 | 116[E1] | 2.7[E1] |
| **Age group** | | | | | | |
| 18-24 | 262 | 547 | 10.0 | 257 | 449 | 10.5 |
| 25-34 | 770 | 1,636 | 30.0 | 745 | 1,317 | 30.9 |
| 35-44 | 830 | 1,892 | 34.7 | 786 | 1,533 | 35.9 |
| 45-54 | 658 | 1,373 | 25.2 | 569 | 969 | 22.7 |
| **Married** | | | | | | |
| Yes | 1,721 | 4,003 | 73.5 | 1,525 | 3,040 | 71.2 |
| No | 799 | 1,445 | 26.5 | 832 | 1,229 | 28.8 |
| **Child(ren) under age 12 in household** | | | | | | |
| Yes | 849 | 2,186 | 40.1 | 821 | 1,657 | 38.8 |
| No | 1,671 | 3,262 | 59.9 | 1,536 | 2,612 | 61.2 |
| **Education** | | | | | | |
| Less than postsecondary graduation | 1,512 | 3,209 | 58.9 | 1,323 | 2,410 | 56.4 |
| Postsecondary graduation | 1,004 | 2,230 | 40.9 | 1,031 | 1,854 | 43.4 |
| Missing | 4 | F | F | 3 | F | F |
| **Household income** | | | | | | |
| Lower | 759 | 1,543 | 28.3 | 805 | 1,332 | 31.2 |
| Higher | 1,659 | 3,648 | 67.0 | 1,480 | 2,790 | 65.4 |
| Missing | 102 | 257 | 4.7 | 72 | 147 | 3.4 |
| **High job strain** | | | | | | |
| Yes | 427 | 914 | 16.8 | 692 | 1,210 | 28.4 |
| No | 1,820 | 3,800 | 69.8 | 1,518 | 2,719 | 63.7 |
| Missing | 273 | 733 | 13.5 | 147 | 340 | 8.0 |
| **High physical demands** | | | | | | |
| Yes | 1,137 | 2,315 | 42.5 | 890 | 1,543 | 36.2 |
| No | 1,110 | 2,399 | 44.0 | 1,320 | 2,386 | 55.9 |
| Missing | 273 | 733 | 13.5 | 147 | 340 | 8.0 |
| **Low supervisor support** | | | | | | |
| Yes | 398 | 870 | 16.0 | 362 | 672 | 15.7 |
| No | 1,849 | 3,845 | 70.6 | 1,848 | 3,258 | 76.3 |
| Missing | 273 | 733 | 13.5 | 147 | 340 | 8.0 |
| **Low co-worker support** | | | | | | |
| Yes | 698 | 1,540 | 28.3 | 770 | 1,425 | 33.4 |
| No | 1,549 | 3,175 | 58.3 | 1,440 | 2,505 | 58.7 |
| Missing | 273 | 733 | 13.5 | 147 | 340 | 8.0 |
| **High job insecurity** | | | | | | |
| Yes | 386 | 860 | 15.8 | 458 | 802 | 18.8 |
| No | 1,861 | 3,854 | 70.7 | 1,752 | 3,128 | 73.3 |
| Missing | 273 | 733 | 13.5 | 147 | 340 | 8.0 |
| **High personal stress** | | | | | | |
| Yes | 735 | 1,657 | 30.4 | 978 | 1,858 | 43.5 |
| No | 1,615 | 3,389 | 62.2 | 1,341 | 2,342 | 54.9 |
| Missing | 170 | 402 | 7.4 | 38 | 69[E1] | 1.6[E1] |
| **Relationship problems** | | | | | | |
| Yes | 552 | 1,169 | 21.4 | 590 | 1,068 | 25.0 |
| No | 1,806 | 3,891 | 71.4 | 1,735 | 3,147 | 73.7 |
| Missing | 162 | 388 | 7.1 | 32 | 54[E1] | 1.3[E1] |
| **Low mastery** | | | | | | |
| Yes | 462 | 999 | 18.3 | 562 | 1,006 | 23.6 |
| No | 1,893 | 4,061 | 74.5 | 1,760 | 3,187 | 74.6 |
| Missing | 165 | 388 | 7.1 | 35 | 77[E1] | 1.8[E1] |
| **Daily smoker** | | | | | | |
| Yes | 735 | 1,490 | 27.3 | 589 | 1,045 | 24.5 |
| No | 1,784 | 3,953 | 72.6 | 1,768 | 3,224 | 75.5 |
| Missing | 1 | F | F | 0 | 0 | 0 |
| **Inactive** | | | | | | |
| Yes | 1,358 | 2,914 | 53.5 | 1,480 | 2,794 | 65.5 |
| No | 1,008 | 2,172 | 39.9 | 850 | 1,429 | 33.5 |
| Missing | 154 | 362 | 6.6 | 27 | 46[E1] | 1.1[E1] |
| **Heavy drinker** | | | | | | |
| Yes | 611 | 1,120 | 20.6 | 146 | 232 | 5.4 |
| No | 1,858 | 4,232 | 77.7 | 2,184 | 3,984 | 93.3 |
| Missing | 51 | 96[E1] | 1.8[E1] | 27 | 52[E1] | 1.2[E1] |
| **Obese** | | | | | | |
| Yes | 335 | 674 | 12.4 | 283 | 448 | 10.5 |
| No | 2,117 | 4,558 | 83.7 | 1,928 | 3,552 | 83.2 |
| Missing/Not applicable | 68 | 216[E1] | 4.0 | 146 | 270 | 6.3 |

***Notes:*** *Because of rounding, detail may not add to totals. Questions on job strain, physical demands, supervisor and co-worker support, job insecurity, personal stress, relationship problems, mastery, and physical activity were not asked of proxy respondents; therefore, percentage of missing values for these variables is higher. A problem with computer-assisted interview in third quarter 1994/95 data collection resulted in French-language respondents being bypassed for questions on work stress, which further increased missing values for these variables.*

*† Excludes night shift workers*

*E1 Coefficient of variation between 16.6% and 25.0%*

*F Coefficient of variation greater than 33.3%*