

Extended Abstract

**Accidents and Injuries among Shift Workers: A Neglected Dimension of
Labor Force Inequality**

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Introduction

One of the important features of the U.S. economy is the high proportion of workers working on evenings, nights, or rotating shifts. In 1997, about one-fifth of all employed Americans worked non-standard hours. This ratio is likely to rise in the future because job growth is projected to concentrate on those occupations with a high percentage of non-day and rotating hours of employment (Presser 1999).

Nonstandard work shifts, because they are primarily required than desired, exacerbate inequality in the United States labor market. In addition to the inequality of earnings, working non-standard hours is often a non-monetary aspect of workplace disamenity (Hamermesh 1998). Biologists and neuroscientists have long discovered the significant time of day variations in task performance (the "time-of-day effects"). Usually non-day shifts are also associated with sleep deprivation and other negative effects on physiological systems. The time-of-day effects, sleep loss, and fatigue resulting from non-standard work hours could increase the chance of accident and injury both inside and out of workplace (Congress of the United States, Office of Technology Assessment 1991; Rajaratnam and Arendt 2001), an important non-monetary outcome of inequality in the labor market.

We know very little about this important safety issue, and there is virtually no empirical research at the national level linking work shifts with accidents and injuries. In this paper, we explore this relationship using data from the 1996 household component of the Medical Expenditure Panel Survey (MEPS), a nationally representative sample when applying appropriate weights. We demonstrate that non-day shift workers face a higher risk of accidents and injuries, whether on the job or not, and accidents and injuries that

specifically occur at work. Moreover, as expected, the latter relationship is more evident among those who work night and rotating shifts, which are more strongly associated with chronic sleep deprivation.

Data and Methods

Data for this research are drawn from the 1996 data of MEPS. Our sample is limited to employed individuals aged 18 and over. Excluding those with missing values on all the variables of interest, the final sample size is 8,487: 4,224 men and 4,338 women. The MEPS oversamples Hispanics and blacks. Therefore, weighting procedures are used for national estimates and for the regression analysis.

The MEPS asks the respondents about the time of their work generally began and ended most days during the reference week (the previous week of the survey) and whether the work hours changed periodically (e.g. from daytime to evening or night). Based on the midpoint of a respondent's usual working hours in a day, we group three categories of fixed work shifts—fixed day shift, fixed evening shift, and fixed night shift. If the midpoint falls between 8:00 AM and 4:00 PM, it is fixed day shift. If between 4:00 PM and midnight, it is fixed evening shift. If between midnight and 8:00 AM, it is fixed night shift. (If the midpoint falls exactly on the boundary of two shifts, the coding is for the earlier shift.) In addition to the three fixed-shift categories, for those with work hours changing periodically, we group them into the fourth category of work shift—rotating shift. In later analysis, the three non-standard work shifts—fixed evening shift, fixed night shift, and rotating shift—are combined into one category of non-day shift, opposing to the day shift.

Table 1 shows that for the sample, 77.96 percent of employed men and 78.54 percent of employed women work fixed day shifts. Accordingly, 22.04 percent of employed men and 21.46 percent of employed women have non-day shifts. These findings are consistent with earlier results based on the May 1997 Current Population Survey.

The 1996 MEPS data include rich information on each household member's medical conditions. It is further asked if any of the medical conditions are related with an injury/accident, and when the injury/accident happened. Based on the answer to the question that whether the medical conditions were results of injury or accident and when the injury or accident happened, we create a dummy variable of having injury/accident or not in 1996. The MEPS also asked whether the injury/accident occur at work, from which we derive another dummy variable of having workplace accident or not.

Table 1 shows that among employed men, 23.48 percent had injury and 10.46 percent had accident at work. Among employed women, the percentages are 17.89 and 5.49 separately. In further analysis, we explore how the medical conditions affect the respondents' overall health and create a variable on the severity of injury/accident.

Preliminary Results

Table 2 displays the cross-tabulation of having injury and workplace accident by work shift status for men and women separately. The employed men working non-day shift show marginally higher probabilities of having injuries: while 23.0 percent of those working day shift had injury in 1996, about 26.6 percent of those working evening shift, 24.1 percent of those working night shift, and 24.4 percent of those working rotating shift

had injury. The differences in the risk of having accident at work are not obvious between day shift and non-day shift male workers: evening and rotating shift workers have higher probability of having workplace accident (about 10.9 percent for evening workers, and 12.3 percent for rotating shift workers) than day workers (10.3 percent), but night workers show a lower probability (9.4 percent). Among employed women, non-day shift workers consistently display higher probabilities of having injury or workplace accident than day shift workers. 21.8 percent of women working evening shift, 22.5 percent of women working night shift, and 17.9 percent of women working rotating shift had injury, compared to 17.0 percent for women day shift workers. About 4.9 percent of women on day shift had an accident at work, and the percentages are 7.9, 9.4, and 7.0 for evening, night, and rotating shift workers separately.

Since certain occupations have a higher risk of injury and workplace accident, and certain occupations are more likely to work non-standard hours, it is necessary to see the distributions of having injury and workplace accident by occupation. As Table 3 shows, without regard to shift status, occupations in service, agriculture, precision craft and repair, and operators, fabricators, and laborers generally have relatively high proportions of workers experiencing an injury or accident at work among employed men. Table 4, which compares day and non-day male workers, shows that for certain occupations non-day workers have higher proportions experiencing an injury or accident. However, in some occupations, the numbers of men working non-day shifts are small, so the percentages should be read with caution.

Table 5 presents the distributions of injury and workplace accident by occupation for employed women. Women in certain occupations such as registered nurses, health aides,

agricultural workers, and operators, fabricators, and laborers show higher probability of having injuries and accident at work than those in other occupations. Table 6 shows the different probabilities of having an injury and accident at work by occupation between women working day shift and those working non-day shifts. As for me, we find that for certain occupations, non-day shift workers have higher probabilities of having injury. Again, one should be cautious in interpreting the results due to the small numbers of observations working non-day shifts for some occupations—but this is an important first look.

Plan of further analysis

The cross-tabulations suggest that men and women working non-day shifts face a higher risk of injury and accident at work. To further explore the relationship between work shifts and having an injury or workplace accident, we will do regressions of work shifts on having injury or workplace accident after controlling for other variables. The control variables include demographic and socioeconomic characteristics such as age, education, race, marital status, and number of children. As shown in the cross-tabulations, it is also necessary to control for occupation and other job characteristics (i.e. industry, and total work hours). Further, gender differences will be explored.

Policy Relevance

It is very important that various constituencies (e.g. unions, employers, and employees) be aware of the added risk of work injuries and accidents associated with working late

and rotating schedules. The paper will conclude with a discussion of the relevance of our findings for these constituencies.

References

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Table 1. Percent distribution of employed U.S. workers aged 18 to 59, by shift and by injury status

| Shift and injury status | Men | Women |
|-------------------------|-------|-------|
| Shift | | |
| Fixed day | 77.96 | 78.54 |
| Fixed evening | 8.03 | 8.28 |
| Fixed night | 4.81 | 3.75 |
| Rotating | 9.21 | 9.43 |
| | 100.0 | 100.0 |
| Injury status | | |
| No injury | 76.52 | 82.31 |
| Had injury | 23.48 | 17.69 |
| Accident at work | | |
| No | 89.54 | 94.51 |
| Yes | 10.46 | 5.49 |
| Number of cases (N) | 4,224 | 4,263 |

Table 2. Injury and workplace accident status by work shift

| Injury status | Shift | | | |
|-------------------------|-----------|---------------|-------------|----------|
| | Fixed day | Fixed evening | Fixed night | Rotating |
| Men | | | | |
| No injury | 76.98 | 73.45 | 75.86 | 75.58 |
| Had injury | 23.02 | 26.55 | 24.14 | 24.42 |
| Accident at work | | | | |
| No accident at work | 89.74 | 89.09 | 90.64 | 87.66 |
| Had accident at work | 10.26 | 10.91 | 9.36 | 12.34 |
| Total N | 3,293 | 339 | 203 | 389 |
| Women | | | | |
| No injury | 83.00 | 78.19 | 77.50 | 82.09 |
| Had injury | 17.00 | 21.81 | 22.50 | 17.91 |
| Accident at work | | | | |
| No accident at work | 95.13 | 92.07 | 90.63 | 93.03 |
| Had accident at work | 4.87 | 7.93 | 9.38 | 6.97 |
| Total N | 3,348 | 353 | 160 | 402 |

Table 3. Distribution of injury and workplace accident status by occupation: All employed men

| Occupation | Injury | | Accident at work | | Total N |
|--|--------|-------|------------------|-------|------------|
| | No | Yes | No | Yes | |
| Executive, administrative, and managerial | 80.64 | 19.36 | 94.80 | 5.20 | 692 |
| Professional speciality | 80.07 | 19.93 | 94.28 | 5.72 | 542 |
| Technical and related support | 76.38 | 23.62 | 93.70 | 6.30 | 127 |
| Sales | | | | | |
| Supervisors and proprietors, sales | 82.98 | 17.02 | 92.20 | 7.80 | 141 |
| Other sales | 82.06 | 17.94 | 96.18 | 3.82 | 262 |
| Administrative support | 80.00 | 20.00 | 91.70 | 8.30 | 265 |
| Service | | | | | |
| Janitors and cleaners | 77.89 | 22.11 | 85.26 | 14.74 | 95 |
| Other service | 77.26 | 22.74 | 91.28 | 8.72 | 321 |
| Agricultural | 73.83 | 26.17 | 81.88 | 18.12 | 149 |
| Precision craft and repair | | | | | |
| Carpenters | 67.16 | 32.84 | 83.58 | 16.42 | 67 |
| Other precision crafe and repair | 72.50 | 27.50 | 84.82 | 15.18 | 731 |
| Operators, fabricators, and laborers | | | | | |
| Truckdrivers | 71.90 | 28.10 | 85.62 | 14.38 | 153 |
| Laborers, except construction | 68.12 | 31.88 | 85.51 | 14.49 | 69 |
| Other operators, fabricators, and laborers | 71.31 | 28.69 | 83.44 | 16.56 | 610 |

Table 4. Distribution of having injury and workplace accident by occupation and shift status: All employed men

| Occupation | Having injury | | Having accident at work | |
|--|----------------|----------------|-------------------------|----------------|
| | Day shift | Non-day shift | Day shift | Non-day shift |
| Executive, administrative, and managerial | 18.80 (617) | 24.00 (75) | 4.70 (617) | 9.33 (75) |
| Professional speciality | 18.99 (474) | 26.47 (68) | 5.27 (474) | 8.82 (68) |
| Technical and related support | 23.53 (102) | 24.00 (25) | 4.90 (102) | 12.00 (25) |
| Sales | | | | |
| Supervisors and proprietors, sales | 19.09 (110) | 9.68 (31) | 8.18 (110) | 6.45 (31) |
| Other sales | 18.18 (187) | 17.33 (75) | 4.28 (187) | 2.67 (75) |
| Administrative support | 19.61 (204) | 21.31 (61) | 8.82 (204) | 6.56 (61) |
| Service | | | | |
| Janitors and cleaners | 18.87 (53) | 26.19 (42) | 13.21 (53) | 16.67 (42) |
| Other service | 23.13 (134) | 22.46 (187) | 9.70 (134) | 8.02 (187) |
| Agricultural | 26.09 (138) | 27.27 (11) | 18.12 (138) | 18.18 (11) |
| Precision craft and repair | | | | |
| Carpenters | 33.33 (66) | 0.00 (1) | 16.67 (66) | 0.00 (1) |
| Other precision craft and repair | 26.09 (621) | 35.45 (110) | 14.65 (621) | 18.18 (110) |
| Operators, fabricators, and laborers | | | | |
| Truckdrivers | 30.70 (114) | 20.51 (39) | 16.67 (114) | 7.69 (39) |
| Laborers, except construction | 31.37 (51) | 33.33 (18) | 13.73 (51) | 16.67 (18) |
| Other operators, fabricators, and laborers | 28.67 (422) | 28.72 (188) | 16.82 (422) | 15.96 (188) |

Note: In parentheses are numbers of observations.

Table 5. Distribution of injury and workplace accident status by occupation: All employed women

| Occupation | Injury | | Accident at work | | Total N |
|--|--------|-------|------------------|-------|---------|
| | No | Yes | No | Yes | |
| Executive, administrative, and managerial | 82.34 | 17.66 | 96.70 | 3.30 | 606 |
| Professional speciality | | | | | |
| Registered nurses | 77.87 | 22.13 | 91.80 | 8.20 | 122 |
| Other professional speciality | 83.97 | 16.03 | 97.27 | 2.73 | 549 |
| Technical and related support | 90.45 | 9.55 | 97.45 | 2.55 | 157 |
| Sales | | | | | |
| Supervisors and proprietors, sales | 83.58 | 16.42 | 94.03 | 5.97 | 134 |
| Salesworkers, retail and personal services | 84.80 | 15.20 | 95.20 | 4.80 | 125 |
| Cashiers | 83.33 | 16.67 | 94.17 | 5.83 | 120 |
| Other sales | 77.37 | 22.63 | 98.54 | 1.46 | 137 |
| Administrative support | | | | | |
| Secretaries | 83.76 | 16.24 | 98.48 | 1.52 | 197 |
| General clerks | 84.04 | 15.96 | 96.81 | 3.19 | 94 |
| Teachers' aides | 84.21 | 15.79 | 92.11 | 7.89 | 76 |
| Other administrative support | 83.95 | 16.05 | 96.56 | 3.44 | 698 |
| Service | | | | | |
| Health aides, except nurses | 69.93 | 30.07 | 84.31 | 15.69 | 153 |
| Janitors and cleaners | 88.06 | 11.94 | 92.54 | 7.46 | 67 |
| Other service | 82.28 | 17.72 | 92.46 | 7.54 | 570 |
| Agricultural | 70.27 | 29.73 | 78.38 | 21.62 | 37 |
| Precision craft and repair | 84.04 | 15.96 | 94.68 | 5.32 | 94 |
| Operators, fabricators, and laborers | 77.68 | 22.32 | 87.46 | 12.54 | 327 |

Table 6. Distribution of having injury and workplace accident by occupation and shift status: All employed women

| Occupation | Having injury | | Having accident at work | |
|--|----------------|----------------|-------------------------|----------------|
| | Day shift | Non-day shift | Day shift | Non-day shift |
| Executive, administrative, and managerial | 17.60 (551) | 18.18 (55) | 3.09 (551) | 5.45 (55) |
| Professional speciality | | | | |
| Registered nurses | 22.73 (66) | 21.43 (56) | 9.09 (66) | 7.14 (56) |
| Other professional speciality | 15.10 (490) | 23.73 (59) | 2.65 (490) | 3.39 (59) |
| Technical and related support | 11.54 (130) | 0.00 (27) | 3.08 (130) | 0.00 (27) |
| Sales | | | | |
| Supervisors and proprietors, sales | 17.78 (90) | 13.64 (44) | 7.78 (90) | 2.27 (44) |
| Salesworkers, retail and personal services | 12.73 (55) | 17.14 (70) | 1.82 (55) | 7.14 (70) |
| Cashiers | 12.96 (54) | 19.70 (66) | 1.85 (54) | 9.09 (66) |
| Other sales | 21.55 (116) | 28.57 (21) | 0.86 (116) | 4.76 (21) |
| Administrative support | | | | |
| Secretaries | 15.96 (188) | 22.22 (9) | 1.60 (188) | 0.00 (9) |
| General clerks | 17.65 (85) | 0.00 (9) | 3.53 (85) | 0.00 (9) |
| Teachers' aides | 15.79 (76) | 0.00 (0) | 7.89 (76) | 0.00 (0) |
| Other administrative support | 15.88 (592) | 16.98 (106) | 3.55 (592) | 2.83 (106) |
| Service | | | | |
| Health aides, except nurses | 27.84 (97) | 33.93 (56) | 12.37 (97) | 21.43 (56) |
| Janitors and cleaners | 10.81 (37) | 13.33 (30) | 8.11 (37) | 6.67 (30) |
| Other service | 14.92 (382) | 23.40 (188) | 6.28 (382) | 10.11 (188) |
| Agricultural | 32.35 (34) | 0.00 (3) | 23.53 (34) | 0.00 (3) |
| Precision craft and repair | 17.57 (74) | 10.00 (20) | 5.41 (74) | 5.00 (20) |
| Operators, fabricators, and laborers | 21.65 (231) | 23.96 (96) | 12.55 (231) | 12.50 (96) |

Note: In parentheses are numbers of observations.