

Chapter 4

The Prevalence and Use of Shift Work

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The Prevalence and Use of Shift Work

Some **20** million Americans—approximately one in five employed persons—can be broadly defined as shift workers, that is, they do not work a standard daytime schedule (15). Instead, they work evenings, nights, a split or extended shift, or rotating shifts. These shift schedules, some of which conflict with biological rhythms and social time order, are used in many occupations and industries, ranging from the health care professions to the manufacturing and transportation industries to clerical positions. Various factors, including demand for services, the amount of time required to perform a procedure or task, technological advances, and expense, have led to the spread of shift work. Clearly, shift work is required in any modern, industrially developed country.

This chapter discusses and evaluates the prevalence of shift work in the United States. It describes national sources of data on shift work, the prevalence of shift work and its use in different employment sectors, and the demographic characteristics of shift workers. A final section outlines available data on specific work schedules. Although economic and technological factors significantly influence the use of shift work and specific schedules, they are beyond the scope of this chapter.

THE DEMOGRAPHICS OF SHIFT WORK

A basic demographic issue in any consideration of shift work is its overall prevalence. Since estimates of shift work vary with the definition used, it is important to consider how shift work is measured in national surveys. Who is a shift worker? In general, a shift worker is defined as someone who does not regularly work a standard daytime schedule. But what is standard? Not only is this an arbitrary determination, so is the definition of an evening, night, or split shift and of what constitutes shift rotation. There is considerable variation in the work hours of nonstandard schedules, depending on the nature and place of employment.

Defining a Shift Worker

National demographic surveys generally ask about shift work in one of two ways:

- by having respondents classify their shift, with minimal, if any, instruction provided; and
- by asking respondents about the specific hours they work (each day or most days of the week) and then determining their shift status according to precise guidelines.

Each approach has limitations.

Self-classification provides responses that are difficult to interpret. For example, some respondents may call themselves “day workers” when they work between 1 p.m. and 9 p.m.; others with the same hours of employment may regard themselves as “evening workers.” The advantage of self-classification is that it requires only one question on the questionnaire, minimizing respondent time and cost.

In contrast, a series of questions is required to obtain people’s actual work hours. This series might include some or all of the following: the time work begins, the time work ends, and whether the shift rotates. These questions may be asked with regard to most days during a reference week prior to the survey or for all days of the week. Although more time-consuming and costly, this procedure allows for precise definition of shifts. These definitions, although explicit, vary by researcher, depending in part on whether the investigator is considering starting time only or both starting and ending time, and whether shift rotation is taken into account. For example, a person who works during the day within the reference period of the survey may actually work a rotating shift, but this will not be clear unless a question about shift rotation is asked.

Sources of National Data on Shift Work

The most comprehensive data on the prevalence of shift work in the United States are based on supplements to the Current Population Survey (CPS) (table 4-1). The CPS is a household sample survey conducted monthly by the Bureau of the Census (within the U.S. Department of Commerce) for the Bureau of Labor Statistics (BLS)

Table 4-I—Sources of National Data on Shift Work

Survey	Conducted by	Years administered	Size
Current Population Survey (CPS) May supplement	Bureau of Labor Statistics	1972 to 1980; 1985,1991	55,000 to 60,000 households
June supplement	Bureau of Labor Statistics ¹	1982	55,000 to 60,000 households
Quality of Employment Survey	Institute for Social Research, University of Michigan	1977	1,515 persons
National Survey of Families and Households	Center for Demography and Ecology, University of Wisconsin	1987 to 1988	13,017 persons and spouses or cohabitants
National Longitudinal Survey, Youth Cohort	Center for Human Resource Research, Ohio State University	1979 to present	12,686 persons and spouses

a sponsored by the National Institute of Child Health and Human Development.

SOURCE: Office of Technology Assessment, 1991.

(within the U.S. Department of Labor). A portion of the labor force in the United States is regularly asked a fixed list of questions regarding employment. The number of households surveyed each month generally ranges from about 55,000 to 60,000. Data are collected for all members of the household age 16 and over, and beginning in 1980 some basic demographic questions on children in the household were also asked. In May of each year between 1973 and 1980, a supplement was added to the CPS with questions on the specific hours of employment (beginning and ending time) for the principal job held the previous week and questions on whether more than one job was held (but none on the hours employed in nonprincipal jobs). In May 1980, data were collected for the first time on whether or not the principal job was a rotating shift. All questions on specific work hours were asked only of wage and salary earners (self-employed persons were excluded).

Between 1980 and 1985 there were no supplements to the May CPS on work schedules. However, in May 1985 there was a supplement which went beyond the earlier ones to include questions on which days and hours people worked and, for persons with more than one job, the hours work began and ended on the second job. Whereas the work hours continued to be asked with regard to the reference week, shift rotation was defined differently in 1985, affecting the precision with which one

can compare the 1985 results with those from earlier years. In May 1985, employed persons were also asked to categorize their usual work shift; interviewers were given rough guidelines to help if there was difficulty.¹ Unlike the previous May CPS supplements, in 1985 the shift work questions were asked of all employed persons. A supplement with shift work questions was added to the May 1991 CPS, which will provide the most recent estimates of national shift work prevalence since 1985.²

In addition to the May CPS supplements, the June 1982 CPS supplement contained some data on shift work. This supplement (sponsored by the National Institute of Child Health and Human Development) focused on fertility and child care and included questions on the time work began and ended (but not shift rotation) for employed women with children under the age of 5. The supplement provided the first opportunity to consider at a national level shift work in relation to child care use, although it is limited to women with pre-school age children.

Until recently, the only other national data on shift work were from the 1977 Quality of Employment Survey (QES). This survey was a national probability sample³ of 1,515 persons age 16 and over who were working for pay for 20 or more hours per week. Although the survey was conducted in earlier years, only in 1977 were questions asked on the specific

¹The CPS obtains information on all household members from one adult member. Accordingly, the work schedules of all employed persons are reported by one person and thus are more subject to error than if truly self-reported.

²Appropriations for the BLS have been reduced by nearly \$14.5 million over the last 3 years, undoubtedly limiting data collection (9).

³A national probability sample is selected on the basis of statistical procedures that, with appropriate weighting, yield a sample that represents the total U.S. population and can be generalized accordingly.

working hours of respondents and their employed spouses, if married. Moreover, because of the sample design and the definition of shift work, the data are problematic in assessing the prevalence of shift work in the United States in 1977.⁴

A recent and comprehensive source of data on shift work at the national level is the 1987-88 National Survey of Families and Households, conducted by the Center for Demography and Ecology at the University of Wisconsin. This survey is a national probability sample of 13,017 respondents and, for those married or cohabiting, their spouses and partners. It asks the most detailed questions about work schedules of any national survey to date, including the hours work began and ended for each day of the week and shift rotation. It also includes detailed data on family attitudes and behavior. Although no analyses of the effects of shift work have been completed using these data, preliminary results on prevalence are consistent with the 1985 May CPS findings (17).

Although specific to a particular age group, another key source of data for the study of shift work in the United States is the National Longitudinal Survey, Youth Cohort, conducted for the BLS by the Center for Human Resource Research at Ohio State University. This survey is a national probability sample of 12,686 persons age 14 to 21 as of January 1, 1979, the year of the first interview, with annual interviews thereafter. A self-defined shift status was asked of employed persons almost every year of the study. Beginning in 1983, employed persons with children were also asked the specific hours their work began and ended, as well as the work hours of employed spouses, if married. Questions about shift rotation were asked in some years but not others. In 1988 through 1990, specific hours worked and shift rotation questions were asked of all employed persons, not just those with children, and all employed spouses, if married. These data, however, have not yet been analyzed.

The above sources are all based on household surveys, and information is collected from one or more household members. The BLS has collected data on shift work and scheduled weekly hours from employers, in the Area and Industry Wage Surveys,

for various years since the end of World War II. Although the findings of these surveys are reported only for specific industries and selected metropolitan areas, they are important because they provide data on pay differentials by shift status.

Estimates of Shift Work Prevalence

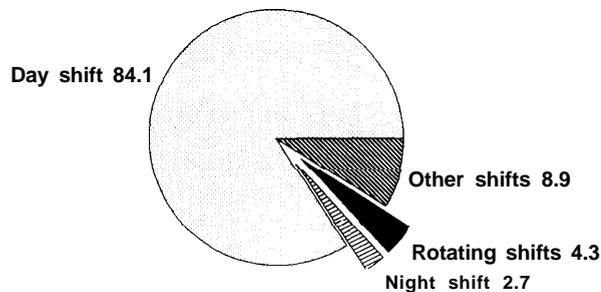
The most widely used estimates of the prevalence of shift work in the United States are from the May CPS supplements, starting with 1973. Between 1973 and 1980, BLS published tabulations of full-time nonfarm workers (employed 35 or more hours per week), and the determination of the work schedule was based on beginning and ending times of shifts. A day shift was defined as half or more hours of employment between 8 a.m. and 4 p.m., an evening shift as most hours between 4 p.m. and midnight, a night shift as most hours between midnight and 8 a.m., and a miscellaneous shift as fewer than 6 or more than 12 hours a day (including split shifts).

Based on these criteria, the prevalence of shift work changed little between 1973 and 1980, at least for full-time nonagricultural workers (data on part-time workers are not available): about one out of six full-time workers was employed in shift work (24). This proportion, however, is an underestimate, since persons on rotating shifts were not identified prior to 1980. Accordingly, everyone on a rotating shift who worked a day schedule in the reference week of the survey was classified as a day rather than a nonday worker. Adjusting for this misclassification in the 1980 data, it has been estimated (11) that one out of five full-time nonagricultural wage and salary workers in the United States was a shift worker. Again, these figures relate to the principal job only (6.2 percent of the employed population in 1989 held multiple jobs) (19).

The 1985 CPS data on work shifts are not strictly comparable to those for 1973 to 1980 because of definitional differences, as noted above. Crude comparisons suggest little change in the overall prevalence of shift work between 1980 and 1985. From tabulations of the May 1985 CPS, it can be estimated that one in five nonagricultural workers (both wage and salary workers and the self-employed, part-time and full-time combined) was

⁴Both part-time and full-time workers were grouped together, with no minimum hours required for the employment of spouses of respondents but a 20-hour minimum for respondents themselves. Shift workers were defined as persons who did not begin work between 3:30 a.m. and 11:59 a.m. and thus include spouses who work a few hours in the afternoon.

Figure 4-1—Percentage of Shift Workers Among Full-Time Employees in the United States



SOURCE: E.F. Mellor, "Shift Work and Flexitime: How Prevalent Are They?" *Monthly Labor Review* 109: 14-21, 1986.

employed in shift work (figure 4-1).⁵ This estimate is based on specific work hours (as in earlier years), but it closely approximates figures based on the respondent's categorization of his or her shift status and is limited to wage and salary workers only, part-time and full-time combined (8).⁶ According to the BLS figures, persons working part-time (fewer than 35 hours per week) were much more likely to be working a shift (47.5 percent) than those working full-time (15.9 percent) (8).

In the 1985 CPS supplement, 2.7 percent of full-time workers and 5.0 percent of part-time workers were classified as night workers. Therefore, approximately 2.0 million individuals work at night. Another 4.3 percent of full-time workers, approximately 3.1 million people in the population, reported working rotating shifts. While some, if not most, of these individuals occasionally work at night, the survey does not differentiate rotation schedules that include night work from those that do not.

Shift Workers in Various Employment Sectors

Many occupations and industries involve shift work. The factors that lead to shift work, however, vary considerably. Specific reasons for adopting shift work schedules include:

- an extended period of time required to complete a particular job or process,
- a constant need or extended demand for services,
- economic factors (e.g., the expense of capital investment, the need for maximum competitiveness), and
- technological advances.

In the following section, the prevalence of shift work in various employment sectors is discussed (table 4-2).

In manufacturing, the use of shift work and night operations may reflect several considerations. A high ratio of capital investment to labor costs is an important incentive for maximizing the use of plants and equipment and therefore operating at night (5). Continuous-process industries, like basic steel, may operate around the clock to avoid high startup and shutdown costs. Some industries are characterized by processes that require extended periods of time (more than 12 hours) for completion. This is the case for many chemical manufacturing processes. Other factors, such as increased demand for a product and favorable utility rates at night, also favor the establishment of 24-hour operations.

The importance of capital investment for the prevalence of shift work and night operations is borne out by data collected by the BLS from industries in large metropolitan areas (5). For the period 1979 to 1984, capital-intensive industries and continuous-process operations had as many as 50 percent of employees working evening or night shifts.⁷ In contrast, less than 3 percent of workers in labor-intensive industries are scheduled for an evening or night shift.

Shift work is prevalent in transportation occupations and industries, including trucking, airlines, railroads, and shipping (table 4-2).⁸ Among those employed by public utilities and transportation industries, 20.6 percent are shift workers. Of full-time motor vehicle operators, 25.5 percent are shift workers, approximately half of them working night or rotating shifts (8). While many transportation sectors are governed by hours of service regulations, these regulations do not preclude night work, shifts

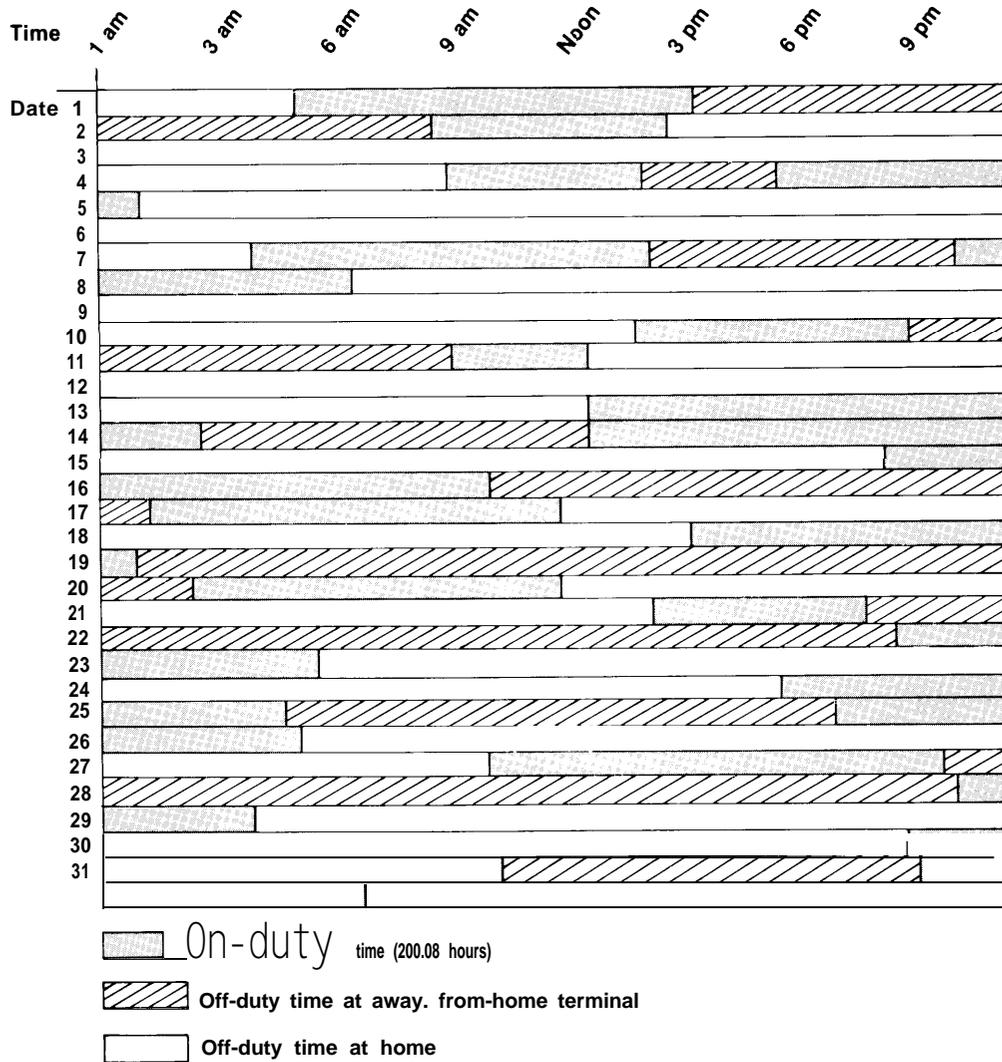
⁵Table 4-2 lists a lower estimate than one in five, based on self-definition rather than actual hours, and is limited to full-time workers only.

⁶All published tabulations on shift work by the BLS for 1985 are based on self-categorization and are limited to wage and salary workers.

⁷These surveys have been repeated since 1984.

⁸Shift schedules and hours of service regulations for the transportation industry are discussed in detail in ch. 6.

Figure 4-2—A Month in the Life of a Locomotive Engineer



Actual work history of a locomotive engineer on a pool freight run of 182 miles, from October 1 to 31, 1990.

SOURCE: C.E. Anderson, Brotherhood of Locomotive Engineers, 1991.

exceeding 8 hours, or erratic scheduling (figures 4-2 and 4-3).

Around-the-clock operations are also demanded by various service industries, which are a significant and growing sector of the U.S. economy. Certain services may be in demand during nonstandard hours because of the nature of the service itself or the needs of customers employed during standard hours.

For example, continuous service is required from police and firefighters, hospital staff, nightguards, and military personnel. Persons employed in the retail and entertainment industries are also involved in shift work.

The 1985 CPS data illustrate the disproportionately high percentage of shift workers in service

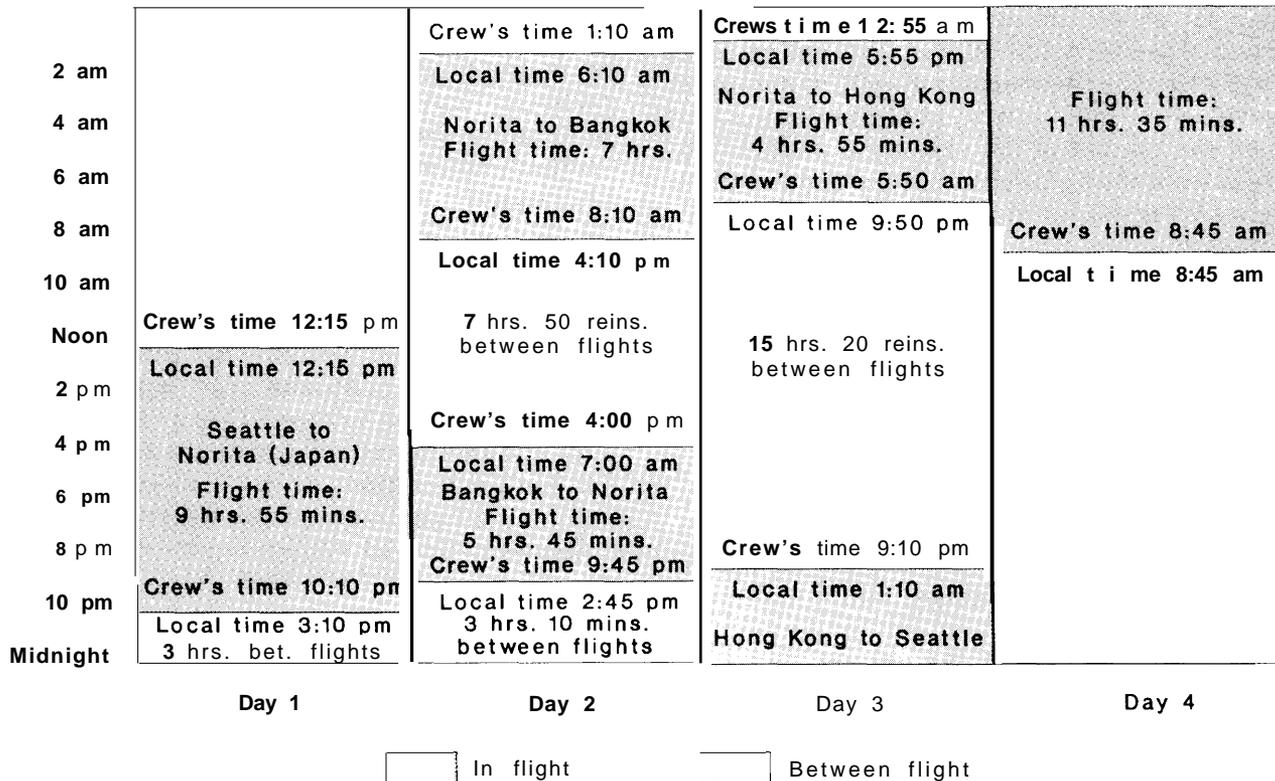
Table 4-2-Shift Work in Various Employment Sectors

Occupation or industry	Total workers employed (thousands)	Standard work schedule (percent)	Shift work (percent)			
			Evening shift	Night shift	Rotating shift	Total
<i>Occupation</i>						
Managerial and professional specialty	18,944	91.4	2.0	1.2	2.7	8.6
Executive, administrative, and managerial	9,079	92.6	1.8	0.8	2.6	7.4
Professional specialty.	9,866	90.3	2.3	1.5	2.8	9.7
Health-diagnosing occupations	212	77.6	1.7	—	13.6	22.4
Health assessment and treating occupations.	1,257	68.7	8.3	8.3	12.1	31.3
Technical, sales, and administrative support	21,961	88.3	4.2	2.1	3.5	11.7
Technicians and related support	2,548	84.5	6.5	3.3	4.6	15.5
Health technologists and technicians	761	70.1	12.5	9.0	7.6	29.9
Sales occupations	6,730	82.8	4.1	2.2	6.9	17.2
Supervisors	1,957	84.0	2.8	2.1	7.4	16.0
Salesworkers, retail and personal services	2,400	72.3	8.3	3.6	11.5	27.7
Administrative support, including clerical	12,684	92.0	3.7	1.7	1.6	8.0
Computer equipment operators.	673	81.2	11.0	2.7	4.1	18.8
Mail and message distributing	613	76.2	12.7	9.1	0.4	23.8
Service occupations	7,268	61.6	16.9	6.1	8.7	38.4
Private household	275	83.0	7.3	1.9	—	17.0
Protective service	1,286	39.2	19.8	7.2	23.8	60.8
Service, except private household and protective.	5,707	65.6	16.7	6.1	5.7	34.4
Food service	2,194	56.9	21.2	5.3	8.2	43.1
Health service	1,076	63.9	14.8	10.3	6.8	36.1
Cleaning and building service	1,719	74.4	16.1	5.4	1.7	25.6
Personal service	718	73.9	7.5	3.7	6.2	26.1
Precision production, craft, and repair	10,477	87.0	6.3	2.2	3.7	13.0
Mechanics and repairers	3,582	87.3	6.0	2.3	3.6	12.7
Construction trades	3,282	94.1	3.4	1.0	1.2	5.9
Other precision production, craft, and repair	3,614	80.3	9.3	3.2	6.1	19.7
Operators, fabricators, and laborers	13,326	76.3	10.5	4.6	6.2	23.7
Machine operators, assemblers, and inspectors	6,748	76.3	13.2	3.7	6.2	23.7
Transportation and material-moving occupations	3,448	73.8	5.8	6.0	7.4	26.2
Motor vehicle operators	2,392	74.5	4.3	6.9	5.9	25.5
Handlers, equipment cleaners, helpers, and laborers	3,130	78.9	9.9	5.2	4.9	21.1
Farming, forestry, and fishing.	1,418	89.9	1.5	1.4	0.7	10.1
<i>Industry</i>						
Private sector.	60,127	83.5	6.6	2.9	4.4	16.5
Goods-producing industries	24,626	85.0	7.4	2.6	3.9	15.0
Agriculture	1,154	89.4	0.9	2.2	0.2	10.6
Mining	885	78.1	6.0	1.6	12.1	21.9
Construction	4,279	97.5	1.3	0.4	0.4	2.5
Manufacturing.	18,309	82.1	9.3	3.2	4.5	17.9
Durable goods	11,277	84.0	10.0	2.5	2.8	16.0
Nondurable goods	7,033	79.1	8.2	4.4	7.2	20.9
Service-producing industries	35,501	82.4	6.1	3.0	4.8	17.6

Occupation or industry	Total workers employed (thousands)	Standard work schedule (percent)	Shift work (percent)			
			Evening shift	Night shift	Rotating shift	Total
Transportation and public utilities	4,958	79.4	6.1	3.5	6.4	20.6
Wholesale trade	3,222	91.9	2.9	2.1	0.9	8.1
Retail trade	9,111	73.7	9.1	3.7	8.6	26.3
Eating and drinking places	2,242	52.4	21.0	5.3	12.5	47.6
Finance, insurance, and real estate	5,003	93.9	1.9	1.0	1.1	6.1
Services	13,207	82.9	6.4	3.3	3.9	17.1
Private household	345	80.8	7.3	1.5	0.7	19.2
Business and repair	3,242	87.4	5.8	2.4	3.1	12.6
Personal, except private household	1,379	74.0	10.1	3.8	6.6	26.0
Entertainment and recreation	529	66.6	13.8	2.2	7.3	33.4
Professional services	7,682	83.8	5.4	3.7	3.6	16.2
Hospitals	2,303	73.0	10.5	6.6	8.5	27.0
Public sector	13,268	87.2	4.6	2.0	3.7	12.8
Federal Government	2,901	86.2	6.1	3.4	2.8	13.8
State government	3,320	88.2	4.3	2.3	3.0	11.8
Local government	7,047	87.1	4.2	1.3	4.5	12.9

SOURCE: E.F.Mellor, "Shift Work and Flexitime: How Prevalent Are They?" *Monthly Labor Review* 109:14-21, 1986.

Figure 4-3-Four Days With an International Flight Crew



International trip schedule for a single flight crew.
 SOURCE: Courtesy B. Edmunds, Airline Pilots Association, 1991.

occupations (8).⁹ More than 38 percent of those employed full-time in service occupations are shift workers, compared to the average of 15.9 percent for all full-time employed persons. This prevalence of **shift** work in service occupations holds true among some professional groups; while only 9.7 percent of full-time professionals overall are shift workers, 22.4 percent of full-time professionals in health-diagnosing occupations (e.g., doctors and dentists) are shift workers, as are 31.3 percent of professionals in the health assessment and treatment occupations (e.g., registered nurses and therapists) (table 4-2).¹⁰ Some subgroups among the service sector exhibit an extremely high prevalence of shift work. For example, 60.8 percent of full-time protective service workers (e.g., police and firefighters) are employed during nonstandard hours. Among persons employed in service-producing industries, those employed in eating and drinking places (47.6 percent) and in entertainment and recreation (33.4 percent) are especially likely to be shift workers.

Technological advances and the increased importance of global communication and interaction have become powerful incentives for the addition of a second and third shift. BLS reported that between 1978 and 1985, the number of clerical personnel working at night increased three times faster than the number of all other night workers (4). Night work among technical and professional office personnel increased 36 percent during this period. Competitive pressures, either to accelerate information processing and the services provided by these industries or to conduct business in different time zones, are important factors in the increased hours of work in the office environment. The high cost of office automation equipment and large computer centers may lead to an increase in the hours of operation in order to make the best use of the investment. Night hours may also be established to take advantage of less expensive and more readily available computer time from computer programming and data analysis services (10).

Who Are Shift Workers?

Shift work may have different health and social **effects** on men as compared to women, single as compared to married persons, and parents as compared to nonparents. In fact, some of the advantages

and problems associated with shift work have been attributed to marital and child-care responsibilities. This section presents demographic data on the prevalence of shift work among men, women, married persons, and persons with child-rearing responsibilities.

Analysis of data from the CPS supplements and other sources noted above yields an assessment of the personal characteristics of shift workers in relation to regular daytime workers (comparisons based on self-reporting of full-time wage and salary earners in 1985) (8) (table 4-3). Among full-time employed men, 27.4 percent between the ages of 16 and 19, compared to 14.6 percent age 45 and over, do not work a regular daytime schedule (8). Thus, younger men are more likely to work nonstandard schedules than older men. Also, single men are more likely to be shift workers than married men. Among full-time employed single and married men, 21.1 and 16.5 percent, respectively, work nonstandard hours. Black men are more likely to work nonstandard hours: approximately 22.6 percent of full-time employed black men are shift workers, compared to 17.3 percent of white men. There is little difference in frequency of shift work between whites and persons of Hispanic origin. Although young, single, and black men are more likely to be shift workers, older, married, and white men, being the majority of full-time workers, form the majority of shift workers.

Gender differences in shift work prevalence depend on whether full-time or part-time work is considered. Considering only full-time wage and salary earners age 16 and over (based on self-reporting), the BLS reports that 17.8 percent of men and 13.0 percent of women are shift workers (8) (table 4-3). Since women are more likely than men to work part-time, gender differences are not substantial when all employed persons, part-time and full-time, are considered. As of May 1985 (based on actual work hours), 20.3 percent of men and 17.1 percent of women age 18 and over in nonagricultural occupations were shift workers (15). Men are more likely than women to work night, miscellaneous, and rotating shifts, whereas women are more likely than men to work the evening shift (14).

⁹Note that the BLS reports this only for full-time wage and salary earners, and it is based on the respondent's designation of the shift worked.

¹⁰Shift work prevalence and patterns in the health professions are considered in detail in ch. 8.

Table 4-3--Demographic Profile of Shift Workers

Characteristic	Total workers employed (thousands)	Standard work schedule (percent)	Shift work (percent)			Total
			Evening shift	Night shift	Rotating shift	
Age						
Men, 16 years and over	43,779	82.2	6.8	3.0	4.9	17.8
16 to 19	1,139	72.6	11.8	4.7	7.0	27.4
20 to 24	5,567	80.0	8.5	3.5	5.0	20.0
25 to 34	14,281	80.0	7.8	3.3	5.6	20.0
35 to 44	10,630	83.6	5.7	2.7	5.0	16.4
45 to 54	7,094	85.4	5.3	2.7	3.9	14.6
55 to 64	4,594	85.5	5.6	2.1	3.8	14.5
65 And over....	474	85.4	2.8	2.5	4.0	14.6
Women, 16 years and over	29,616	87.0	5.5	2.3	3.3	13.0
16 to 19	777	71.1	12.8	4.0	9.4	28.9
20 to 24	4,346	84.0	6.7	2.0	5.1	16.0
25 to 34	9,510	87.5	5.3	2.2	3.3	12.5
35 to 44	7,080	88.9	4.8	2.3	2.2	11.1
45 to 54	4,753	88.4	4.6	2.2	2.8	11.6
55 to 64	2,838	87.3	5.3	2.6	3.2	12.7
65 And over....	311	85.8	7.3	3.8	—	14.2
Total, 16 years and over	73,395	84.1	6.3	2.7	4.3	15.9
Race and Hispanic origin						
White	63,523	84.7	5.8	2.6	4.3	15.3
Men	38,588	82.7	6.3	2.9	5.0	17.3
Women	24,935	87.8	5.0	2.1	3.3	12.3
Black	7,847	80.1	9.8	3.5	4.3	19.9
Men	4,054	77.4	10.6	3.7	5.3	22.6
Women	3,793	83.0	8.9	3.2	3.2	17.0
Hispanic origin	4,911	84.6	7.1	2.5	3.3	15.4
Men	3,184	82.3	7.7	2.8	4.0	17.7
Women	1,727	88.8	5.8	1.9	2.0	11.2
Marital status						
Men						
Single, never married	9,703	78.9	9.3	3.6	5.0	21.1
Married, spouse present	29,666	83.5	5.7	2.7	5.1	16.5
Widowed, divorced, or separated	4,410	80.4	8.5	3.6	4.0	19.6
Women						
Single, never married	7,109	83.6	6.8	2.3	5.2	16.4
Married, spouse present	15,679	89.9	4.3	1.9	2.3	10.1
Widowed, divorced, or separated	6,828	83.7	7.0	3.3	3.6	16.3

SOURCE: E.F. Mellor, "Shift Work and flexitime: How Prevalent Are They?" *Monthly Labor Review* 109:14-21, 1986.

A detailed analysis of the job characteristics of female shift workers, based on the May 1985 CPS, included women age 18 and over employed in various occupations and industries, both full- and part-time (15). It therefore focused on the seven occupations with the highest percentage of women working freed nights, namely (in rank order), registered nurses, nurses' aides, practical nurses, food preparation and service workers, textile operators, janitors, and cashiers. Over half (58.9 percent) the women who worked fixed nights were employed in these seven occupations, and close to half of them worked evenings (49.1 percent) or a rotating shift (42.1 percent). In contrast, only 14.8 percent of those

who worked freed days and 19.4 percent of those who worked a miscellaneous shift (more than 12 hours a day, including split shifts) were in these occupations. As for industry, 48.3 percent of all women who worked freed nights in 1985 were in medical services, compared to 18.0 percent who worked freed evenings, 20.5 percent who worked rotating shifts, 9.0 percent who worked miscellaneous shifts, and 11.2 percent who worked freed days. Among all employed women, 12.9 percent were in medical services, compared to 3.2 percent of all employed men.

Since the CPS collects similar data on all household members, it is possible to consider the work

schedules of husbands and wives jointly when both are employed (dual-earner couples). From the perspective of a couple, the prevalence of shift work is high. Based on the May 1980 CPS data, one-fourth of all dual-earner couples without children and one-third of all dual-earner couples with children included at least one spouse who did shift work (12). An analysis of the May 1985 data for dual-earner couples with children showed a similar proportion (one-third) (16).

A study of full-time dual-earner couples, based on the May 1980 CPS, showed that although employed wives are more likely than employed husbands to be service workers, service work produces a higher likelihood of shift work among husbands (50.7 percent) than wives (30.3 percent) (12). Within service occupations, the highest prevalence of shift work for husbands was among protective service workers (66.0 percent); the highest prevalence for wives was in health service (36.7 percent).

Given that couples who are young and couples who have children are more likely to work nonstandard hours, it is not surprising to find a remarkably high prevalence of shift work among young dual-earner parents with children under age 5. It is estimated that about 50 percent of all young couples with children under the age of 5 in the United States include at least one spouse who works nonstandard hours (13). This estimate is based on an analysis of the parents in the National Longitudinal Study, Youth Cohort, as of 1984, when they were age 19 to 26. Among those employed full-time, mothers were about as likely as fathers to work nonstandard shifts (29.0 and 30.2 percent, respectively), but there were differences in the type of shift: fathers were more likely than mothers to work freed nondays (19.1 percent and 14.8 percent, respectively), and mothers were more likely than fathers to work a rotating schedule (14.2 percent and 11.1 percent, respectively). Over one-fourth of all part-time employed mothers in this sample (26.9 percent) were on rotating schedules, and an additional 14.7 percent were freed nonday workers; accordingly, about two-fifths of part-time employed mothers were nonday workers.

An analysis of shift work among women age 18 to 44 with pre-school age children, based on the June 1982 CPS, showed that the prevalence of shift work was considerably higher among unmarried than married mothers (11). Thus, among persons with

children, it is both young dual-earner parents and unmarried employed mothers who are especially likely to be working nonday hours. Whether these particular subgroups are increasing is unknown.

WHY DO EMPLOYEES PERFORM SHIFT WORK?

The previous discussion provides evidence that shift work has a broad demographic sweep, including people of differing age, gender, marital status, and type of employment. The diversity of individuals working nonstandard schedules suggests that the motivation, concerns, and needs of these workers are not uniform. In the following section, the reasons individuals give for working nonstandard schedules are discussed.

Why do employees perform shift work? Some workers prefer nonday work. A survey of workers from four plants found that most of the permanent night shift workers prefer to work that shift (22). Data from the May 1985 CPS, however, suggest that many individuals do not prefer shift work. Respondents were asked their main reason for working a nonday shift. Answers were coded into subsets of voluntary and involuntary reasons. Voluntary reasons included better child-care arrangements, better pay, better arrangements for care of other family members, and more time to attend school. Involuntary reasons included inability to get any other job and requirement of the job. The BLS reported that only 28 percent of persons not working a regular daytime schedule gave a voluntary reason (e.g., to accommodate child care); 72 percent gave involuntary reasons, and 90 percent of these said the schedule was a job requirement (8).

An analysis of full-time, dual-earner couples in the May 1980 CPS also indicates that the type of employment is exceedingly important in determining an individual's schedule (12). In this study, occupational and industrial differences in shift work were more pronounced than personal characteristics such as age, race, union membership, or multiple jobs.

A separate analysis of dual-earner couples with children considered the reasons why parents were working nonday schedules (16). It was found that fathers and mothers differ considerably in their main reasons for doing so. For only a small minority of

fathers the primary reason for working nondays is child care (5.6 percent) or other family caregiving (2.5 percent), compared to close to a majority of mothers (34.3 percent for child care and 12.3 percent for other family caregiving). Better pay is not a common reason for either gender, although it is more relevant for fathers than mothers.

Among these dual-earner couples, the main reason for working nonstandard hours varies by type of shift as well as gender. Clearly, it is difficult to provide care to family members on a regular basis when one works a rotating shift. Thus, persons who work fixed nondays are more likely than persons on a rotating shift to do so primarily in order to care for children or other family members, including the elderly. As might be expected, the age of the youngest child is important: child care is most likely to be the reason for working nonday hours when employed wives have children under the age of 6 (41.9 percent) (16).

SHIFT WORK SCHEDULES

While the traditional work schedule is typified by 40 hours of work during the daylight hours, an increasing variety of work schedules is in place in the United States (3,6,18). Shift work schedules involve working hours outside the standard workday (8 a.m. to 4 p.m.) (21). The Federal Government does not collect data characterizing specific shift work schedules employed by occupations and industries in the United States. Although the samples used in the national studies that ask scheduling questions are large, the actual number of shift workers in the samples is not sufficiently large to analyze the different types of schedules. Furthermore, private industry and labor representatives do not formally collect data concerning shift work and schedules (20). The dearth of information concerning shift work schedules has led researchers to conclude that:

... neither trade organizations nor labor unions maintain quantitative data on the type and distribution of shift work practices in their industries. Even where information on shift schedules was available, it was cumbersome and complex. . . . More comprehensive data were maintained by the Bureau of Labor Statistics (BLS) . . . although this information . . . is woefully inadequate for characterizing industries by types and distribution of shift systems (1).

Available information suggests that several hundred shift routines are in place in the United States (3,18). Several factors contribute to this variation. Schedules vary significantly among industries and occupations and according to the type of work performed. Since shift schedules are generally determined at individual work sites, diverse schedules are found even within a single industry, reflecting geographic and regional differences (table 4-4). Work schedules are also influenced by certain laws and regulations (see ch. 6). The Fair Labor Standards Act of 1938 established the standard 40-hour workweek that now covers nearly 60 percent of all wage and salary workers and is part of the social norm (18). Another standard has been derived from many Federal and State statutes, as well as union contracts: the 8-hour day. These legal standards bear particularly on schedules involving a compressed workweek (box 4-A), extended duty hours, and overtime (box 4-B). Tradition in a particular occupation or industry, labor costs, and availability of skilled labor also influence the type of shift system in place at a work site.

Research suggests that the most common shift schedule in the United States, especially in the manufacturing sector, involves working 5 days on a single shift, followed by 2 days off (2,7). Such a schedule can involve 8-or 12-hour shifts and 3 (day, evening, and night) or 2 (day and evening or day and night) shifts per day, which may be fixed, rotating, or a combination of the two (partially fixed). Shift work systems are also employed to cover 7 days a week of continuous operation, such as in the service sector or in continuous-process manufacturing. Again, the length of the scheduled workday may range from 8 to 12 hours. Shifts maybe fixed, partially fixed, or rotating. Shift rotation may be rapid (3 days) or long (4 weeks); it may proceed forward (day, evening, night) or backward (day, night, evening). Other types of shift scheduling exist, and these may be increasing in popularity. For example, the compressed workweek, in which employees work approximately 40 hours in fewer than 5 days, is common in certain employment sectors, and its use may be expanding (see box 4-A). Irregular scheduling, in which shifts are variable and erratic, is used in some employment sectors, including the transportation and manufacturing industries (figures 4-2 and 4-3). While data have not been collected to document this work practice, labor representatives have

Table 4-4-Three Mills and Their Schedules

5-week rotational 8-hour shift schedule: Cosmopolis, WA--pulp/paper mill (week 5 is a repeat of week 1)				
Shift	Time			
Day	7:30 a.m. to 3:30 p.m.			
Evening	3:30 p.m. to 11 :30 p.m.			
Night	11 :30 p.m. to 7:30 a.m.			
	Letters A through D represent groups of workers.			
	Week 1	Week 2	Week 3	Week 4
	M T W T F S S	M T W T F S S	M T W T F S S	M T W T T S S
Day	D D D D D A A	A A A A A B B	B B B B B C C	C C C C C D D
Evening	B B C C C C C	C C D D D D D	D D A A A A A	A A B B B B B
Night	A A A A B B B	B B B B C C C	C C C C D D D	D D D D A A A
Off	C C B B A D D	D D C C B A A	A A D D C B B	B B A A D C C
Fixed-shift 8-hour schedule: operate 7days/week: Adel, GA—panel mill (employees do not rotate-week 5 is a repeat of week 1)				
Shift	Time			
D = Day	7 a.m. to 3 p.m.			
E = Evening	3 p.m. to 11 p.m.			
N = Night	11 p.m. to 7 a.m.			
R = Relief worker				
O = Off				
	Week 1	Week 2	Week 3	Week 4
	M T W T F S S	M T W T F S S	M T W T F S S	M T W T T S S
Day	D O O D D D D	D D D O O D D	D D D D D O O	O D D D D D D
Evening	O E E E E E E	E O O E E E E	E E E O O E E	E E E E E O O
Night	N N N N N O O	O N N N N N O	N O O N N N N	N N N O O N N
Relief	R R R O O R R	R R R R R O O	O R R R R R R	R O O R R R R
5-week rotational 12-hour shift schedule: Valliant, OK—pulp/paper mill (week 5 is a repeat of week 1)				
Shift	Time			
Day	7 a.m. to 7 p.m.			
Night	7 p.m. to 7 a.m.			
	Letters A through D represent groups of workers.			
	Week 1	Week 2	Week 3	Week 4
	M T W T F S S	M T W T F S S	M T W T F S S	M T W T T S S
Day	D D D D B B B	A A A A C C C	B B B B D D D	C C C C A A A
Night	B A A A C C C	C B B B D D D	D C C C A A A	A D D D B B B
Off	C C C C D D D	D D D D A A A	A A A B B B	B B B C C C
Off	A B B B A A A	B C C C B B B	C D D D C C C	D A A A D D D

SOURCE: M. Waters, Weyerhaeuser Co., Tacoma, WA, 1990.

indicated to the Office of Technology Assessment (OTA) their concern about its increasing use (23).

How specific shift work schedules are selected at individual work sites in the United States has not been carefully documented. Schedules may be dictated by management or, more commonly, derived from discussion between management and unionized or nonunionized employees. Clearly, the absence of information concerning specific shift work systems and how they are derived handicaps the study of the health, performance, and social effects of shift work, as well as the derivation of sound shift work policies.

SUMMARY AND CONCLUSIONS

Shift work, a required dimension of work in any industrially developed country, encompasses a wide range of nonstandard work schedules, including evening work, night work, split or extended shifts, and rotating shifts. While national data indicate that shift work is prevalent, there are large gaps in these data. OTA finds that the Federal Government's collection of data pertaining to the prevalence and use of shift work has not been consistent.

The most recent and comprehensive data, collected by the BLS in 1985, indicate that one out of

Box 4-A—The Compressed Workweek

The compressed workweek (CWW) refers to a schedule in which employees work approximately 40 hours in fewer than 5 days. A variety of schedules, with a variety of rationales, can be said to constitute a CWW. Typically, work is performed 10 or 12 hours per day, 3 or 4 days per week, and 3 or 4 days per week are free. Other possibilities include along break schedule; for example, a schedule of 12-hour shifts may employ a sequence of 4 days on duty, 7 days off duty, 4 days on, 3 days off, 3 days on, 1 day off, 3 days on, and 3 days off. As with all types of shift work, national data on the prevalence of specific CWW schedules are not available.

The CWW with 12-hour shifts appears to be common in the chemical industry (including petrochemical), the petroleum industry, offshore oil rigs, and ministeel industries. Other types of employment that could adopt the CWW include the paper industry, other manufacturing processes, utility industries (including nuclear powerplants), nursing and other health fields, clerical work, administrative work, technical maintenance, and computer operations.

Information derived from management and employee comments, limited psychological testing, and performance and safety records has highlighted some of the advantages and disadvantages of the CWW (table 4-5). In general, the CWW appears to increase worker satisfaction because it allows more days and weekends off. For example, in one plant, conversion to a CWW schedule with 12-hour shifts reduced the number of days on the job each year from 273 to 182. Also, when the CWW has 12-hour rotating shifts, fewer consecutive days are spent on the night shift and there is more time to recuperate than with 8-hour shifts 5 days a week. This may lessen the fatigue associated with rotating shifts and night work (see ch. 5). While more days off may improve employee satisfaction, concerns about increased moonlighting have been voiced and have been documented in one case. In general, however, studies have failed to document an increase in moonlighting.

Data have suggested that not all employees endorse the CWW. Family responsibilities and previous work experience appear to influence preference for the CWW (see figure 4-4). One study estimated that 28 percent of work sites adopting a CWW will revert to the standard 8-hour day, 5-day week schedule. A few studies have indicated that women, especially those with young children, and older employees may be less satisfied with a CWW,

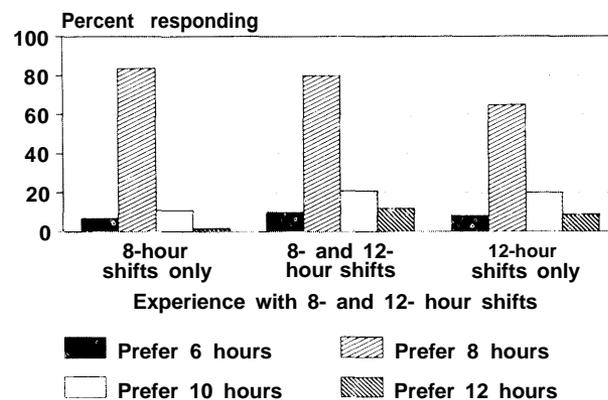
The use of the CWW; especially with two 12-hour shifts replacing three 8-hour shifts, may be more cost-effective for employers, since the number of shift changes is decreased (shift changes are the least productive time in an operation). Absenteeism also appears to be diminished when the CWW is adopted. Replacement of absent employees, however, may be more difficult with this schedule, since one common way of replacing an absent employee is holding over another from a previous shift, which is ill-advised for shifts of 12 hours.

Concerns over performance and safety have been voiced in relation to the CWW, although few studies have analyzed this issue (see ch. 5). It has been suggested that fewer errors and accidents occur and productivity improves on CWW schedules. Other studies suggest that a 12-hour day, 4-day week produces more fatigue and poorer sleep and psychomotor performance than an 8-hour day, 5-day week.

Administrative problems may arise from the use of the 12-hour shift and the CWW. Since laws and regulations regarding hours of work are generally based on the 8-hour day and 40-hour workweek, computation of hourly wage and vacation time must be adjusted. Similarly, since exposure limits to noise, chemicals, and heat are generally based on the 8-hour day, they may need to be recalculated.

SOURCE: Office of Technology Assessment 1991.

Figure 4-4--Shift Work History and Preference



Data drawn from a study of 2,115 hourly and salary workers employed at four industrial sites.

SOURCE: D. Tepas, "Condensed Working Hours: Questions and Issues," *Studies in Industrial and Organizational Psychology. Shiftwork: Health, Sleep and Performance*, vol. 9, G. Costa, G. Cesana, K. Kogi, et al. (eds.) (Frankfurt am Main: Verlag, Peter Lang, 1989).

Table 4-5-Potential Advantages and Disadvantages of 12-Hour Schedules

Factor	Advantage	Disadvantage
Most workers like it, which could result in:		
. Increased job satisfaction; less difficulty in recruiting new personnel	x	
. Improved employee morale	x	
. Decreased absenteeism due to proportionate loss of pay	x	
● Sleep time more easily adjusted to two shifts instead of three shifts	x	
● Decreased attrition (decreased training cost, more experienced operators)	x	
More days off and more consecutive days off		
● Workers like days off and weekends off (75 to 85 more days off)	x	
. There is more time with family, leisure time, time to conduct personal business	x	
. Workers take less personal time off	x	
. Workers lose touch with operations		x
● Workers might be tempted to moonlight, travel great distances, or engage in exhausting recreation on consecutive days off and return to work fatigued		x
Shift turnovers reduced from 3 per day to 2 per day		
● Reduced number of communication errors during shift turnover	x	
● Improved continuity of operations	x	
● More chance that the crew that begins a maintenance job or begins an evolution will be the same crew that ends it. This contributes to quality work and job satisfaction.	x	
● Reduction in commute time and commute cost by about one-third.	x	
Within any 1 day, 12 hours of work is more fatiguing than 8 hours of work		
● Alertness and safety might decline		x
● Because the day is longer, workers might work at a slower pace		x
● Workers need more breaks		x
. 8-hour night shifts are difficult; 12-hour night shifts are more difficult		x
● 12-hour shifts might be more difficult for older workers		x
Over several consecutive days, 12 hours of work per day is more fatiguing than 8 hours of work per day		
. Less time for rest exists between consecutive workdays; fatigue might accumulate		x
● Fewer consecutive workdays and more rest days will dissipate fatigue	x	

SOURCE: Adapted from U.S. Nuclear Regulatory Commission, *NUREG/CR-4248 Recommendations for NRC Policy on Shift Scheduling and Overtime at Nuclear Power Plants* (Richland, WA: Pacific Northwest Laboratory, 1985).

five full-time workers—approximately 20 million Americans—is a shift worker. Approximately 2.0 million individuals are night workers, and 3.1 million people work rotating shifts, which may involve night work. These individuals are most likely to be employed in capital-intensive manufacturing industries, transportation, and service industries.

Shift work is done by 17.8 percent of men and 13.0 percent of women employed full-time. Data indicate that young, single, and black men are more likely to be shift workers; however, older, married, and white men, being the majority of full-time workers form the majority of shift workers. While men are more likely than women to be shift workers, shift work is highly prevalent among women in some employment sectors, including nursing and health services. Data suggest that shift work affects many families, especially those with young children. It is estimated that 50 percent of all young, dual-earner couples with children under the age of 5

include at least one spouse who works nonstandard hours.

There are hundreds of different shift work schedules in place. However, data concerning the specific properties of shift work schedules, such as the involvement of night work, shift length, the number of consecutive days worked, and the use of rotating shifts, have not been collected by the Federal Government, labor representatives, or industry. The absence of such data severely handicaps the study of the health, performance, and social effects of shift work, as well as changes in trends concerning the use of shift work.

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Box 4-1340 *Hours Plus: Overtime and Moonlighting*

Overtime and moonlighting have always played a significant role in American industry. As is the case with shift work, working extended hours at one or more jobs may raise performance and safety questions (see ch. 5).

The supplement to the May 1985 Current Population Survey (CPS) provides information on the prevalence and demography of overtime work. From these data, the BLS estimated that 21.4 million persons work more than 40 hours per week at one job. It was further estimated that 10.5 million Americans receive premium pay for overtime work usually at the rate of one-and-a-half times their normal pay. With few exceptions, individuals receiving premium pay for overtime worked more than 40 hours a week; further, they averaged 9.6 hours of overtime. Nearly two-thirds of these employees reported working 1 to 8 hours beyond 40 hours; 16 percent reported 16 hours or more beyond 40 hours.

Overtime compensation was more common in certain occupations, including precision production, craft and repair, and operators, fabricators, and laborers. These groups account for more than half of all workers receiving premium pay for overtime. Within industry groups, mining, manufacturing, transportation, public utilities, and construction most commonly receive premium overtime pay. Of the approximately 60 percent of employees not being compensated for work beyond 40 hours per week most were in managerial, professional, technical, sales, and administrative support jobs, which are outside the provisions of the Fair Labor Standards Act (see ch. 6).

Overtime may be used by employers to meet unexpected or excessive short-term demand, to fill in for absent workers, or, when used regularly, as a cost-saving device (i.e., it costs less to pay overtime premiums than to hire new workers, with their pensions, sick leave, and health insurance benefits). Data indicating the extent to which overtime work is voluntary or mandatory for employees are lacking.

A supplement to the May 1989 CPS survey addressed the issue of holding more than one job, or moonlighting. In this survey the CPS defined a moonlighter as an employed person who 1) had a wage- or salary-paying job with two employers or more, 2) was self-employed and also held a job paying a wage or salary, or 3) worked as an unpaid family worker on the primary job (the one at which the greatest number of hours are worked) and had a secondary job paying a wage or salary.

It was estimated that 7.2 million persons hold two or more jobs, which is a 52 percent increase from 1980. Among men, 4.1 million, most of them married, moonlight. Of men with more than one job, 82+8 percent hold one full-time job and one part-time job; 11.3 percent hold two part-time jobs; and 5.8 percent work two full-time jobs. On average, men holding two jobs work a total of 55.8 hours per week.

This survey indicated a sharp increase in the number of women working multiple jobs. Some 3.1 million women hold more than one job, averaging 47.1 hours of work per week. Women makeup 43 percent of all persons holding multiple jobs, in contrast to an estimated 15 percent in 1970. Among women who moonlight, 64 percent hold one full-time job and one part-time job; 33 percent hold two part-time jobs; and 2.9 percent hold two full-time jobs. Most women with more than one job were widowed, divorced, or separated.

Individuals work more than one job for various reasons. Among the reasons were the following: to meet regular expenses (35.5 percent); to pay off debts (8.9 percent); to save for the future (16.2 percent); and to gain experience in a different occupation (14.7 percent). The highest rates of moonlighting were found in public administration (8.8 percent), service industries (7.8 percent), educational services (11.1 percent), and male protective service workers (11.8 percent).

SOURCES: D.E. Carr, "Overtime Work: An Expanded View," *Monthly Labor Review* 109:36-39, 1986; J.F. Stinson, Jr., "Multiple Job Holding Up Sharply in the 1980s," *Monthly Labor Review* 113:3-10, 1990.

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