

Laboratory and field interview methods for the study of shiftworkers

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Gordon, Tepas, Stock, and Walsh (1979) describe the manner in which shiftworkers were selected as research subjects through the cooperation of labor union organizations. In this paper, we describe the methods used to select and orient the workers to serve in a laboratory study involving measurement of the psychophysiological correlates of sleep. Procedures used for field interviews with the same subjects are also described. Some of the advantages and disadvantages of using a multimethod (laboratory and field interview) approach to the study of shiftwork effects are detailed.

Our method of interacting with labor unions and administering the Work-Sleep Survey has been reviewed by Gordon, Tepas, Stock, and Walsh (1979). The present paper concentrates on the remainder of the work-sleep study, which includes a laboratory orientation session, the laboratory sessions, and a field interview. The laboratory and interview parts of the study were designed to investigate work schedules and job activity and their relation to sleep, performance, mood, and off-the-job life. The study of these variables is not new to scientific research; however, most previous efforts to study shiftwork effects have imposed short-term sleep-wakefulness schedules on students or patients (Webb & Agnew, 1978; Weitzman, Kripke, Goldmacher, MacGregor, & Nogeire, 1970) or have examined workers with relatively brief shiftwork histories (Globus, Phoebus, & Boyd, 1972; Kripke, Cook, & Lewis, 1971). In this manner, scientists have studied some behavioral and physiological measures and their relation to acute schedules or schedule changes. Our laboratory and interview strategy was designed to investigate the effects of chronic, "real-world" shift schedules on American workers. We chose to study workers who had been employed on their current shift schedules for a substantial period of time. The laboratory study and field

interview methods are described below, followed by an evaluation of the methods based on our experiences in using them for the past 3 years.

LABORATORY METHODOLOGY

Obtaining Cooperation of Workers

Because a laboratory or university environment is often a novel and perhaps anxiety-provoking situation for many workers, we developed several strategies to promote worker comfort and trust. First, a professional yet friendly atmosphere was maintained at all times. Second, all parts of the study were fully explained and workers were continually encouraged to ask questions if procedures were unclear. Third, the comfort of workers in the research setting was enhanced by interaction with a familiar staff member. All contacts with an individual worker from the initial phone call to the end of the laboratory sessions were made by the same staff member, who was always the same sex as the worker. In addition, the work-sleep study director was usually present to greet workers at the onset of each new phase of the laboratory study. Finally, and perhaps most importantly, workers were repeatedly reassured that all information they provided was strictly confidential, that the study had neither surprises nor deception, and that they were free to terminate participation at any time. Informed consent was obtained from all participants at each level of participation.

Selection and Orientation of Workers for the Laboratory Study

Work-Sleep Survey information was used to identify potential laboratory participants. To be eligible, a worker had to indicate that he or she was interested in the study and also meet the criteria of one of the groups included in the experimental design. The major variables that defined the groups were shift, sex, and job-related physical work load. Four shift groups were studied:

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(1) steady first shift, (2) steady third shift, (3) rotating shifts, and (4) an acute change from one steady shift to a different steady shift. Within each of these shift groups, workers performing heavy physical work and others involved in more sedentary work were studied. Males and females were included in all shift and physical work-load categories. Workers who reported major health problems, unusual sleep behaviors, heavy drug use, extensive overtime or additional job hours, or excessive off-the-job physical exercise were excluded from further participation due to certain constraints of polygraphic sleep research and the commitment to study typical work-sleep relations.

The next step in the subject-selection process was an independent psychological assessment performed by a clinical psychologist. This assessment occurred in two parts: completion of the MMPI via the mail, and participation in an interview during the orientation session. The purpose of the assessment was to provide an opportunity to identify those workers who might have difficulty with the laboratory environment and to provide psychological data for all laboratory subject participants for future analysis. Workers who met our requirements for the laboratory sessions based on the Work-Sleep Survey information were telephoned by a staff member and asked to complete the MMPI at home. A total of 241 workers who agreed to complete the MMPI were sent the forms and asked to return them by mail. Additional contacts by phone and letter were made when necessary to encourage the return of the MMPI. A total of 155 MMPIs were completed and returned. These were scored and evaluated by an independent clinical psychologist, who then gave a simple "yes-no" recommendation to invite particular workers for an orientation session. Workers with elevated scores on any of the clinical scales of the MMPI were not recommended. Specific information concerning the workers' MMPI profiles was not conveyed to the work-sleep study staff at this point in the project, in order to prevent bias in experimenter-participant interaction. Based upon MMPI results, 133 workers were approved for the laboratory study and were contacted by the staff and invited to participate in the orientation session. Of the workers invited, 22 declined to participate and 17 others were ineligible due to changes in home or work conditions.

The orientation session had several functions. Additional information concerning the workers' job, sleep, health, mood, and life satisfaction was obtained via a series of questionnaires. In addition, all aspects of the laboratory sessions were explained and demonstrated to the worker, and the second part of the psychological assessment procedure was conducted.

Upon arrival at the sleep laboratory, workers were first introduced to the director of the work-sleep study, who provided a general overview of the purpose of the research and the various steps involved in the orientation

session itself. Next, workers completed the following questionnaires: the Sleep Inventory, which focused on sleep-related habits and subjective sleep perceptions; a brief health and medication survey; the Job Descriptive Index (Smith, Kendall, & Hulin, 1969); and the Profile of Mood States (McNair, Lorr, & Droppleman, 1971). After the completion of these forms, workers were given a tour of the sleep laboratory facilities and were exposed to all procedures involved in the laboratory sessions. While electrodes for electroencephalographic (EEG) recording were being attached, workers were shown copies of the forms they would be asked to complete during the laboratory sessions. A hearing test and abbreviated examples of the performance tasks were administered, and oral temperature measurement was demonstrated. After explaining polygraphic recording to the worker, a sample of the EEG and auditory evoked brain response (EBR) recordings were obtained. After the electrodes were removed, workers completed two additional questionnaires: the Worker Opinion Survey, which is a retitled version of the Perceived Quality of Life Scale (Zautra, 1975), and the Survey of Recent Events, adapted from the Social Adjustment Rating Scale (Holmes & Rahe, 1967). Workers were then introduced to the clinical psychologist who conducted an informal interview that completed the psychological assessment procedure. At the conclusion of the interview, workers were given the Cornell Medical Index to complete at home and return by mail. Workers were informed that they would be contacted at a later date if they were needed for the laboratory study. They were also told that their final decision to participate would be requested at that time.

A total of 94 workers completed orientation sessions. The information gathered during the orientation session was reviewed by the study staff in order to determine if the worker appeared to be suitable for laboratory participation. Current health and drug-use reports were evaluated, and, again, the clinical psychologist provided a simple yes-no recommendation based on the interview data. This screening process eliminated four workers from further participation, all on the recommendation of the clinical psychologist. The remaining workers were telephoned and invited to participate in the laboratory sessions.

Laboratory Sessions

A total of 90 workers were contacted by phone and invited to participate in the laboratory sessions. Of these, 11 declined to participate and 7 were no longer employed or had changed work schedules. The 72 workers who agreed to participate were scheduled to come to the laboratory on 4 consecutive days during a typical work week. In almost every case, these were the first 4 days of a given work week. Such scheduling simulated the temporal relation of regular work, sleep, and leisure time activities. Laboratory sleep times

were identical to individual workers' normal sleep times in nearly all cases. In no case did laboratory and home sleep differ in length or timing by more than 30 min.

Workers arrived at the laboratory 2 h before their desired bedtime for each session and turned in the Daily Use/Daily Log. This two-page check list was completed during the course of the day and served two major functions: It provided data about diet, drug use, and off-the-job activities throughout the day, and it reminded workers of their participation in the study and indirectly of our desire for them to lead a fairly normal life during the 4 days of the laboratory study. After preparing for bed, workers completed the Workday Report while recording electrodes were applied. This form was designed to assess the worker's subjective state of mental and physical fatigue, and to note the occurrence of any unusual or potentially stressful events of that day.

Standardized instruments and methods for the evaluation of performance, mood, and sleep were utilized during laboratory sessions. A 1-h presentation of the Wilkinson Vigilance Task (WVT) was followed by the 5-min Williams-Lubin Addition Task (WLAT). Previous studies of sleep loss and sleep pattern alterations have documented that these tasks are sensitive indicants of such changes (Taub & Berger, 1973; Wilkinson, 1968; Williams & Lubin, 1967). Workers were then asked to void completely. Upon getting into bed, mood and sleepiness were measured using our Presleep Form. This form includes the NPRU adjective check list (Johnson & Naitoh, Note 1) and the Stanford Sleepiness Scale (Hoddes, Zarcone, Smythe, Phyllips, & Dement, 1973), which have both been shown to be sensitive to sleep loss. The Presleep Form also includes additional items from Browman and Tepas (1976). Oral body temperature was recorded immediately before the sleep period. All-night polysomnographic sleep recording was performed during each of the four laboratory sessions, using the standard methods (Rechtschaffen & Kales, 1968). In addition, auditory EBRs were collected regularly throughout the night. A group of first-shift workers to which the auditory stimuli were not presented served as a control for the possible effects of the auditory stimuli upon the sleep of the workers.

Upon awakening, oral temperature was taken and the Postsleep Form, identical to the Presleep Form, was completed. After collecting and measuring a total urine volume sample, workers again performed the WLAT. Approximately 20 min after awakening, electrodes were removed, and workers completed the Postsleep Form a second time and the Personal Sleep Recorder (PSR). The PSR requests subjective estimates of sleep parameters and behaviors, as well as perceptions of sleep quality. Body temperature was recorded once again, and workers received a Daily Use/Daily Log to complete during the coming day. Workers then dressed to leave the laboratory and were provided with a light meal, if desired.

During the meal, and periodically throughout the sessions, staff members typically talked with the workers about their jobs, hobbies, families, and interests. This proved to be beneficial in that it enhanced the rapport and trust between staff and participants. Following the final laboratory session, the worker was given a form to take home, complete, and return by mail. This form allowed workers to provide the staff with feedback about the experience and make recommendations for improvement. Shortly after laboratory participation, workers received a check for \$100 and, if desired, a personal certificate of appreciation from Saint Louis University. Workers understood from the beginning that neither of these tokens of appreciation would be provided if they failed to complete all laboratory sessions.

FIELD INTERVIEW METHODOLOGY

The field interview component of the work-sleep study was designed to obtain systematic data on the jobs, health, and off-the-job lives of the laboratory study participants. We believe this to be the first study of American shiftworkers to involve both laboratory and interview data collection methods as major components. Every effort was made to maximize the rate of volunteering for field interviews and the level of openness of respondents.

The field interview had three primary purposes: (1) to obtain psychosocial data for examination in relation to work schedule, sex, and job-related physical work load; (2) to obtain information that was redundant with data collected in other parts of the work-sleep study as a measure of reliability; and (3) to explore the possible secondary effects of shiftwork on the worker's family life and family members.

Interview Procedure

The interviewer made initial contact with the laboratory participants during the meal following the final laboratory session, beginning with a personal introduction by a staff member who had conducted the laboratory sessions. The purpose, content, and style of the field interview were briefly described at that time. Workers were informed that the field interview would require up to 3 h and would be held at a time and place most convenient to the worker. It was emphasized that the interview was completely voluntary and confidential. The workers were asked to consider a request to tape-record the interview. Workers were also encouraged to invite a spouse or household partner to participate, and they were informed that this person would not be paid for the interview. To lessen the pressure to volunteer, the worker's decision concerning participation was not requested until a follow-up phone call was made.

Of the laboratory study participants, 67 (93%) volunteered for the field interview when initially invited.

Subsequently, 61 (85%) of these were interviewed. Of the six who initially agreed but were not interviewed, three failed to keep the appointment and three presented scheduling problems.

Two interviewers, one male and one female, alternately met each worker and conducted the interview. The interviewer was blind with respect to previous information gathered in the work-sleep study, with the exception of the initial Work-Sleep Survey responses.

A total of 57% of the respondents chose to have the field interview at their home. Most of the others preferred to come to the university, where we provided a comfortable room for that purpose. In 34% of the interviews, the worker's spouse was also present.

Interview Content, Format, and Climate

At the outset of the interview, a general description was again provided, the respondent signed a consent form, and the tape recording was begun, with the subject's permission. The field interview covered a basic set of content areas relevant to work and nonwork life: job and job schedule, health, sleep, mood, home life, leisure activity, social life, group participation, and demographics. Each content area was represented in two different formats that constituted the two halves of the interview session. The first half was a nonstandardized semistructured conversation, focusing mainly on the idiographic subjective level of information (i.e., the worker's attitudes, feelings, and opinions about the interview areas). The second half was a verbally administered, structured questionnaire concentrating upon descriptive information (i.e., the worker's statements on the more concrete or objective aspects of the content areas). Questionnaire responses were recorded by the interviewer on a survey form. The questionnaire contained many items similar to those used in previous studies on the psychosocial and health effects of shiftwork (Mott, Mann, McLoughlin, & Warwick, 1965; Tasto, Colligan, Skjei, & Polly, Note 2). The field interview began with a short set of demographic questions to orient the interviewer to the worker's situation and to update the Work-Sleep Survey. Further demographics were obtained at the close of the questionnaire.

The semistructured format allowed the worker to concentrate on issues that were most important to him or her, whereas the structured portion guaranteed that key items were properly quantifiable for each respondent.

There were two advantages in starting the field interviews with the semistructured portion first: It prevented biasing the worker's conversation in the direction of the content areas of the structured part, and it was easier to establish a free-flowing conversation at the outset rather than following a set of structured questions.

DISCUSSION OF METHODOLOGIES

The extensive selection and orientation process involved in the laboratory study appeared to be very effective. All workers completed the laboratory sessions except one who terminated during the last session as a result of a chronic health problem. No worker objected to any of our methods, and none refused to perform any task. The high ratio of workers who completed the laboratory study reflects the complete explanation and demonstrations during the orientation session, previous telephone contacts, and mailed literature. It is likely that, without an extensive orientation, some workers who volunteered for the laboratory sessions might have failed to complete them. Therefore, although much time and effort was expended recruiting and educating potential participants, few laboratory sessions were wasted. This point is important, in that these sessions were expensive, difficult to schedule, and extremely time consuming for the staff. In short, the few hours spent in contact with potential participants early in the course of the study probably saved many days of staff time.

Although few, if any, problems arose in connection with the laboratory sample we obtained, we did experience problems in recruiting sufficient numbers of certain types of workers. The composition of the initial pool of 1,442 workers who completed the Work-Sleep Survey did not include sufficient numbers of women on rotating shifts who were willing to volunteer for the laboratory study. In addition, workers in the "acute change" category were nearly impossible to recruit as a result of our method of selection and orientation. A criterion for inclusion in that group was for a worker to be available during the first week of a new steady shift schedule. We found that workers did not usually have sufficient advance information to identify the week of shift change far enough in advance to fit our mutual schedules.

The laboratory study and field interviews appear to have been equally successful. Although subjects were not paid for the field interview, a high percentage of the laboratory study participants volunteered to be interviewed. This suggests not only that the interviewers established effective contact during the initial meeting with the workers, but also that the workers had positive experiences during the laboratory sessions. The attrition rate of 8% between verbally agreeing to an interview and actual participation appears to be low for this type of methodology. The integration of the field interview as part of the entire work-sleep study appears to have contributed significantly to the high level of cooperation obtained in the interviews.

In the semistructured interview, workers had no difficulty providing reports of their attitudes, feelings, and opinions relative to the content areas. Typically,

respondents raised one or more topics of serious personal concern, allowing the interviewer to infer their ease during the interview.

The only respondent who refused to answer all items on the structured part of the field interview preferred not to reveal one demographic item. Although this portion called for brief responses, there was a tendency for respondents to amplify their remarks in the interest of giving more complete information. All respondents allowed the field interview to be tape-recorded, suggesting that they were convinced of the confidentiality of the study. The performance of workers in the full field interview appears to indicate that the combination and order of the semistructured and structured styles, combined with the climate of our approach, provided an effective method of data collection.

Viewing the entire work-sleep study, certain advantages to our methods have become evident. We have demonstrated that it is possible to obtain and maintain the cooperation of American workers through all parts of a time-consuming research program. Thus, we were able to examine chronic exposure to various shift schedules while workers continued to live a fairly normal life. This study also demonstrates that this information can be gathered without employer knowledge or participation. Our methods of obtaining data alleviated the problems of employer biases and recording inconsistencies often present within industrial settings. The use of standardized methods and instruments permits direct comparisons with other studies using different subject populations. Redundant data collection allows us to make a reliability check of much of the information (e.g., drug use, job and shift satisfaction, sleep-related habits, etc.) obtained from workers in different phases of the study. Finally, the multi-method approach allows us to examine the effects of shiftwork on many facets of workers' lives, rather than limit our consideration to one particular aspect.

There are, of course, drawbacks to a study of this kind. The laboratory study of workers during the regular work week resulted in a considerable time period each day during which the worker was not directly observable. As a result, we have no data concerned with on-the-job performance during the study, although workers were asked to account for their nonlaboratory time. Considerable effort was devoted to studying workers during typical work weeks, but the laboratory sessions resulted in a significant decrease in free time and some departure from normal presleep activities. Also, the workers who were studied in the laboratory and field interviews were not randomly selected, since they were required to meet the constraints of the design and polygraphic recording. In general, we suspect that our data will show these workers to be healthier than the total Work-Sleep Survey sample and the United States working population in general. Furthermore, this sample may not be represent-

ative of all American workers, since the workers were all active union members from the Saint Louis area. The degree to which these factors influence our results is unknown. Finally, an enormous amount of staff time was involved for a relatively small number of subjects. For each worker, the study required an estimated minimum of 100 h of staff member time, independent of data analysis. Perhaps more important than the sheer volume of work was the fact that experimenters often had to work unusual hours to perform the study. During the work-sleep study, it was typical for our staff to work rotating, double, night, or split shifts. Although these work hours were certainly a disadvantage, our personal experiences in conducting this study strongly suggest that work hours influence most aspects of a person's life. We hope to identify more specific relations between shift schedule and sleeping and waking behaviors following completion of our data analysis.

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