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WORKING ON THE HOT SEAT: URBAN BUS OPERATORS*

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Abstract—City bus operators suffer elevated health risks and striking levels of absenteeism and medical disability that may be related to occupational stress. This article provides a critical overview of findings on urban bus drivers' health status, paying particular attention to aspects of the physical and psychosocial job environment that may cause ill health. Methodological shortcomings in the research are discussed and preliminary ideas for salutagenic interventions are proposed.

Keywords—Bus drivers, Health, Occupational stress, Work environment

INTRODUCTION

City bus drivers die at a younger age from coronary heart disease, typically retire earlier with physical disabilities, and are absent from work at much higher rates for gastrointestinal, musculoskeletal, and nervous disorders than their contemporaries in numerous other occupational groups. This article describes suspected reasons for urban bus drivers' excess health risk, paying particular attention to the work environment of urban public transit operators. Preliminary ideas for salutagenic interventions and an agenda for future research are proposed.

HEALTH STATUS AMONG URBAN PUBLIC TRANSIT OPERATORS

The morbidity and mortality profile of urban bus drivers suggests a central etiological role of occupational stress in the health of urban city bus operators. Over twenty epidemiological studies of city bus drivers reveal excess rates of mortality and morbidity for heart disease and gastrointestinal and musculoskeletal disorders (Winkleby, Ragland, Fisher, and Syme 1988). Several trends within the epidemiological data suggest a causal role for occupational stress in the disease profile of urban bus drivers. First, all cause mortality is equal to or slightly less than expected in comparison to other occupational groups. However, for two of the diseases in excess, coronary heart disease and gastrointestinal disorders, stress is believed to play a significant etiological role (Henry and Stephens 1977; Krantz et al. 1988). Moreover, the increased prevalence of cardiovascular deaths does not occur until after drivers have been working for some period of time, peaking at approximately 40 years of age (Netterstrom and Laursen 1981). Similar data have recently been noted in a prospective study of coronary heart disease (Rosengren, Anderson, and Wilhelmsen 1991).

The second reason disease rates may be attributed to occupational stress is that urban city bus operators also retire early, usually with disability payments. For example, in a national study in the Netherlands, city bus drivers retired on average at age 48, a full five years earlier than other civil employees. Moreover, typical reasons for premature retirement included musculoskeletal (35% of premature retirements), psychiatric (35%), or cardiovascular disorders (7%) (Kompier et al. 1990). Of the 1,672 bus drivers who retired in the seven-year period studied, more than a third did so partially or totally disabled. Particularly striking is the fact that only 12% of drivers retired at term (i.e. at 60 years). Furthermore, bus drivers who retired with medical disability, did so at a younger age (M = 47 years) than other civil servants (M = 54 years). Most of the premature retirement among drivers is not due to voluntary attrition but rather reflects medical disability. Garbe (1980) in a study of bus drivers in Berlin found that drivers retire on average 10 years earlier than administrative civil personnel with a similar medical profile to that uncovered in the Dutch study.

Urban bus drivers also exhibit greater levels of

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psychological disturbance than comparison groups with approximately 13% of the bus operator sample scoring in the range equivalent to hospitalized psychiatric patients (Duffy and McGoldrick 1990). Of further interest, Bartone (1984) found that the degree of psychological distress exhibited within a large sample of urban bus drivers was a function of the number of typical job stressors (job hassles) they experienced at work.

The above health and death statistics by no means prove that excess morbidity and mortality among urban bus operators is induced by occupational stress. Most of the studies have poor controls and are cross-sectional in design. On the other hand, there is some reason to believe that the health data are conservative. For example, most transit districts screen out workers with a history of coronary heart disease as well as those with hypertension symptoms. Many districts also provide routine medical examinations, thus increasing the likelihood of early detection and medical treatment of elevated risk symptoms. The mortality data are particularly interesting to consider in light of the premature termination of employment among urban public transport operators. Thus, both the selection and retention of bus drivers is probably biased to underestimate the true prevalence of health risk in the profession.

Not surprisingly rates of absenteeism, workman's compensation, and disability claims are skyrocketing in the transit industry. For example, in the United States over one-fourth of the total operating costs of public transit districts are attributable to driver absenteeism, and these rates have jumped over 200% in the past decade (Long and Perry 1985). Bus drivers in the United States alone miss in excess of four million work days each year. This is more than three times the national average for blue-collar workers. In Holland, the yearly absenteeism rate for city bus drivers is more than double the rate for other pulic sector employees (Mulders et al. 1988). Similar patterns have been reported in several other Western European countries.

In studies examining the causes of absenteeism among bus drivers, a disproportionate number stem from stress-related disorders such as gastrointestinal problems and psychosomatic disorders (e.g. headaches, anxiety) (Long and Perry 1985). Furthermore, evidence that much of the absenteeism is related to illness emanates from findings comparing short duration absenteeism (fewer than 13 working days) to absences of greater duration among bus drivers. The latter but not the former are related to standardized measures of physical symptomology, current medication regimen, and reports of job stress among bus drivers (Dijkstra 1983).

There also appear to be linkages between absenteeism and early retirement with medical disabilities among urban bus drivers. Kompier and colleagues (1990) reported, for example, that Dutch city bus drivers with a greater number of absences in the preceding five year period before retirement were much more likely to retire prematurely. Furthermore, drivers requiring medical rehabilitatve services following extended periods of absence, returned to normative absenteeism levels in their respective companies. Finally, several studies have found positive associations between driver's assessments of occupational stress and absenteeism (Gardell, Aronsson, and Barklof 1983; Taylor 1980).

Although the above trends suggest a connection between occupational stress levels among city bus drivers and high levels of absenteeism, it is important to realize that certainly not all absenteeism among city bus drivers is attributable to job stress. The data are all cross-sectional and absenteeism can occur for other nonstress-related maladies. Moreover, several analyses of transit driver absenteeism indicate that a sizable portion of lost work hours are attributable to voluntary choices, often in compensation for the operator's inability to take a day off when needed (Long and Perry 1985). Nonetheless the overall patterns of absenteeism data described above, and especially Dijkstra's (1983) findings on long duration absenteeism, certainly suggest an important role of job stress in the high levels of absenteeism within the public transit industry.

Another reason to believe that urban bus operators are at excess risk for ill health stemming from high levels of occupational stress is suggested by research on possible underlying biological mechanisms. A recent, large cross-sectional study of black and white male bus drivers in San Francisco reveals elevated rates of hypertension among city bus drivers in comparison to several control groups. These comparison groups included a national sample of employed males matched on race, age, and employment status, a sample of employed males living in the same county as the drivers, and, most interestingly, a sample of data from pre-employment physical of drivers eventually hired by the public transit district (Ragland et al. 1987). The latter control group is particularly important since any self-selection factors that might be biasing health data for bus drivers are controlled. As shown in Fig. 1, age and race stratified comparisons revealed consistent evidence of elevated rates of hypertension among city bus drivers. Moveover, the extent of hypertension was directly related to years of service.

Pikus and Tarranikova (1975) also found higher rates of hypertension among bus drivers in compari-

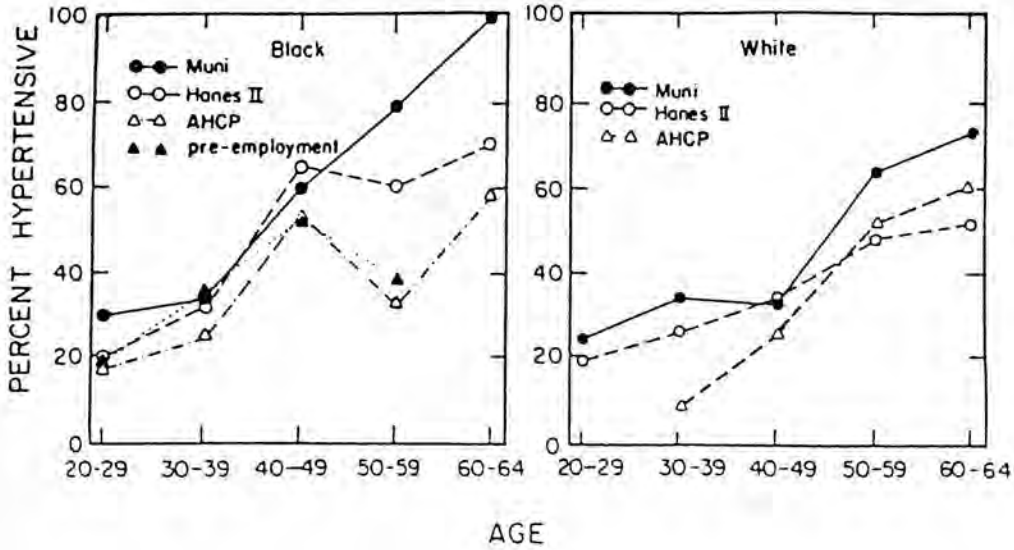

Fig. 1. Prevalence of hypertension in bus drivers. Reprinted by permission of Oxford University Press, Oxford, UK from Ragland et al. (1987). Muni—bus drivers working for the San Francisco Municipal Railway System Hanes II—sample of U.S. households conducted by the Nat'l Center for Health Statistics AHCP—Alameda County Hypertension Control Program: employed individuals living in the same geographical locale. Pre-employment—medical examinations that were conducted prior to employment as bus drivers.

son to other occupational groups. Again, the longer the driver was employed, the greater the magnitude of elevated hypertension rates among bus drivers in comparison to other occupational groups. A Norwegian study comparing male bus and truck drivers to industrial workers found similar trends (Hartvig and Midttun 1983).

While the above studies reveal evidence of elevated sympathetic activation from chronic exposure to urban bus driving, some more recent work indicates larger than expected acute elevations in both cardiovascular and neuroendocrine activity on the job among city bus drivers. Evans, Palsane, and Carrere (1987) found large elevations of systolic and diastolic blood pressure on the job among urban bus drivers both in the United States and in India. Furthermore, both Evans and his colleagues and Aarønsson and Rissler (1988) reported heightened elevations of neuroendocrine hormones (adrenaline, noradrenaline, cortisol) that are related to psychological stress.

One final link in the argument tying occupational stress to ill health among urban bus drivers is provided in a series of studies by Mulders and his colleagues (Mulders et al. 1982; Mulders et al. 1988). These investigators have examined the psychophysiological stress profile of drivers in relation to ill health. Experienced drivers (minimum of five years experience) were selected on the basis of high (≥ 5 health related absences during the preceding year) versus low (≤ 2 absences) absenteeism rates. Drivers already afflicted with long-term illnesses were excluded from the sample. High absenteeism drivers exhibited significantly greater neuroendocrine reactivity on the job (see Fig. 2). Furthermore, the trends were replicated in two additional samples, but comparing absences over a three-year period. Of additional interest, off-work, resting levels of the neuroendocrine hormones were equivalent for the low vs.

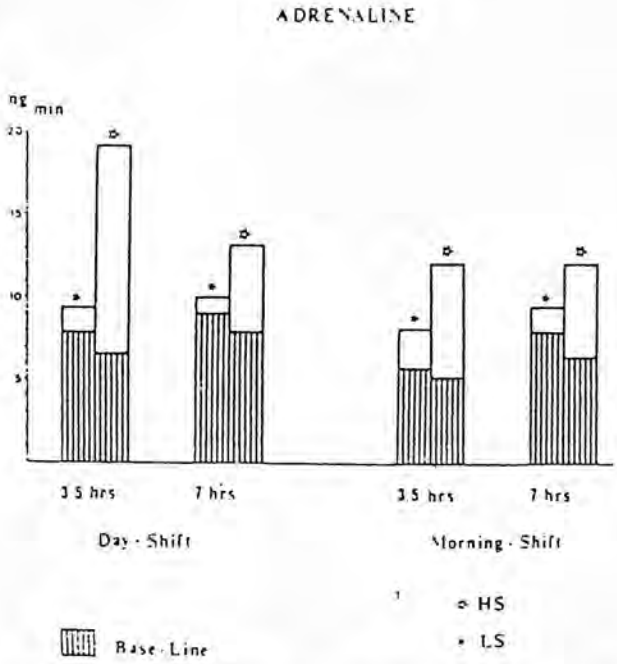

Fig. 2. Psychophysiological reactivity among city bus drivers with high vs. low levels of sickness. Reprinted by permission of Taylor & Francis, Hanks, UK from Mulders, H., et al. (1982). HS—High-sickness group, LS—Low-sickness group.

high absenteeism groups; only on-the-job elevations differed.

Summary

Urban public transport operators have excessive rates of morbidity and mortality from stress-related diseases, specifically cardiovascular and gastrointestinal disorders. Their all-cause mortality is equivalent, however, to that of other occupational groups. It is highly likely that job selection factors bias these estimates in a conservative manner given pre-employment selection and medical screening procedures operative in many urban transit districts.

City bus drivers are apt to retire prematurely, typically from stress-related illnesses or from musculoskeletal dysfunction. More than half of all urban bus drivers will retire prematurely with some medical disability. Rates of absenteeism among city bus drivers are staggering and have been increasing rapidly over the past decade. In the United States approximately one-quarter of all public transit operation costs stem directly from driver absenteeism. As in the case of premature retirement statistics, there is a disproportionately high frequency of stress-related disorders accounting for driver absenteeism from work.

Several plausible biological mechanisms are apparent for the posited occupational stress-ill health link among urban bus drivers. City bus drivers have elevated levels of hypertension, and evidence large on-the-job elevations of both cardiovascular and neuroendocrine activity. Finally, there appears to be a direct link between the extent of this elevated psychophysiological stress activity on the job and the extent of health-related absenteeism. Drivers who get sick most often also have the highest on-the-job elevations of psychophysiological stress.

THE WORK ENVIRONMENT OF URBAN PUBLIC TRANSPORT OPERATORS

Several surveys and a few observational and psychophysiological studies have attempted to uncover what elements of the city bus driver's work environment contribute to occupational stress and ill health. Surveys indicate that among the most compelling problems for city bus drivers are the threat of physical assault and crime, traffic congestion, little or no input into how work is organized or implemented, incessant time pressure, disorderly passengers, ergonomic/mechanical difficulties (temperature, seat comfort, visibility), and work schedule interference with home life and leisure activities (Bartone 1984; Blau 1981; Duffy and McGoldrick 1990; Gardell et al. 1983; Carrere et al. 1991).

Gardell and his colleagues (1983) note a particularly interesting source of stress based on their survey results of a large sample of Swedish urban bus drivers. Operators reported frequent conflict between their desire to serve the public in a professional manner and relentless time pressure to stay on schedule. Providing change, answering passenger inquiries, and assisting elderly or disabled passengers often conflicted with requirements for schedule adherence (see Fig. 3). In addition when buses are late, passengers often complain to drivers, sometimes even threatening to report them. The incessant pressure to stay on time is further amplified by the common practice of transit districts both to monitor on-time performance and to give warnings or take more punitive actions against drivers who fall behind schedule. Many drivers of city buses complain about losing some if not all of their short rest stops at the end of the line. Close to a third of drivers in one large survey reported they frequently had no time for any scheduled rest breaks except for a meal respite (Dijkstra 1983).

In addition to the tension created by the dialectic of passenger service and courtesy on one hand and punctuality on the other, demands to stay on schedule are also in opposition to the major physical stressor identified by urban bus drivers—traffic congestion. Bus drivers have three primary tasks: to drive safely, to maintain the schedule, and to serve the public in a professional and courteous manner. Two if not all three of these primary tasks are inherently contradictory and further interfered with by traffic congestion. Moreover, bus drivers typically have no say over the scheduling of routes, choice of equipment (e.g. which bus to drive), and little or no say, dependent upon seniority, about which route they will drive or which shift they will work on.

Thus the public transport operator's job at times epitomizes a combination of high workload demands and low job control. This particular profile of job characteristics has been shown to be strongly associated with cardiovascular disease in several epidemiological studies (Karasek and Theorell 1989; Schnall et al. 1990). Furthermore, high workload coupled with low control also causes increased psychophysiological stress in laboratory studies (Frankenhaeuser and Johansson 1986). The connection between this combination of high workload demands and low job control with occupational stress among bus operators has been shown directly by Carrere and her colleagues (1991). They found that drivers reporting the highest levels of job strain (workload demands minus job control) had the highest levels

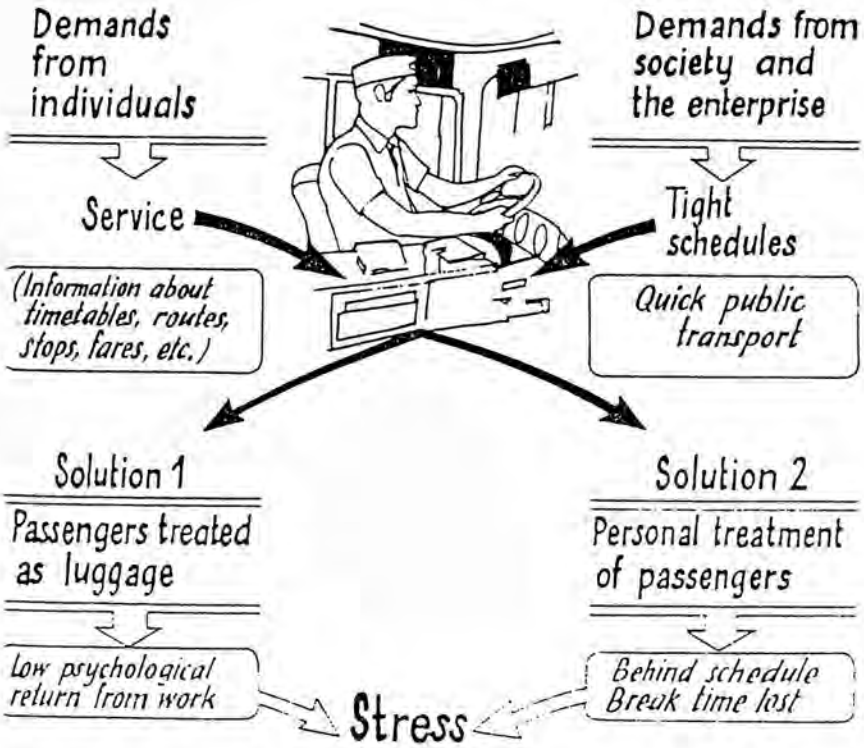

Fig. 3. Tensions between competing demands on bus operators. Reprinted by permission of The Swedish Work Environment Fund, Stockholm, Sweden from Gardell, B. et al. (1982).

of on-the-job elevations of stress hormones (Catecholamines) (see Fig. 4). These same drivers also had the highest levels of job stress as reported on a standardized instrument and evidenced more nonverbal indices of stress while driving the bus (e.g. fidgeting, repetitive object play). Gardell et al. (1983) reported that absenteeism rates among bus drivers were significantly correlated with a similar index of job strain.

The direct role of traffic congestion in the etiology of stress has been investigated among bus drivers. Evans and Carrere (1991) showed that exposure to peak levels of traffic congestion among urban bus operators was significantly correlated to on-the-job elevations of stress hormones. Moreover, the connection between traffic congestion levels and psychophysiological stress appeared to be mediated by perceived control on the job. The more exposure to

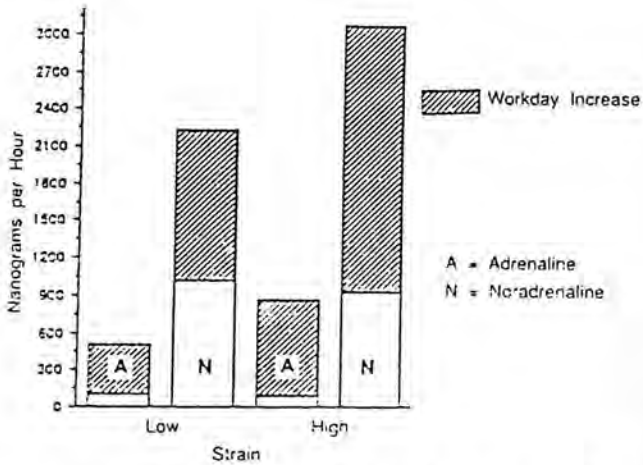

Fig. 4. Psychophysiological stress among urban bus drivers with high vs. low job strain. Reprinted by permission of the British Psychological Society, London, UK from Carrere et al. (1991).

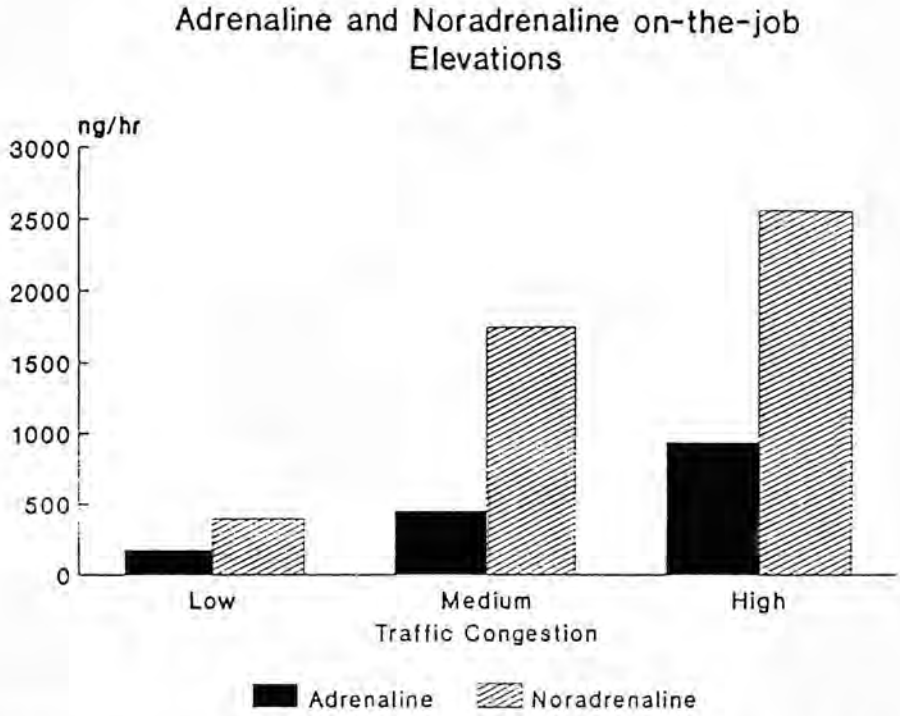

Fig. 5. Adrenaline and noradrenaline on-the-job elevations as a function of traffic congestion. Based on data presented in Evans and Carrere (1991).

peak traffic congestion levels, the lower perceptions of job control, and the higher the psychophysiological stress response (see Figs. 5, 6).*

These findings are congruent with earlier work showing that city bus drivers who felt the most time pressure at work had the highest levels of stress hormones (Gardell 1987). Interestingly, Gardell concluded that the combination of time-schedule demands and traffic congestion were the primary contributor to drivers' perceptions of time pressure. Reimann (1980) also found that drivers reporting the greatest difficulty adhering to time schedules also manifested higher levels of stress hormones. When queried as to why they had difficulty meeting schedules, traffic congestion was a major reason given.

Several studies, as noted earlier, have found that threats of physical assault and other crimes are among the most salient of city bus drivers' concerns about their work environment. Blau (1981) examined different job stressors and found that threat of crime was the best predictor of job performance (accidents, missouts, passenger complaints). The greater the perceived threat from crime, the lower the levels of job performance. Moreover, the longer the driver had been on the job, the greater the association—a pattern probably due to the greater probability that drivers with more seniority had actually encountered criminal behavior while operating a bus. Bartone (1984) factor analyzed a large sample of urban bus operator's perceptions of work stressors and found that problems with passengers were the most salient job stressor for female drivers and second on the list for male drivers. Among the specific problems noted were fare skipping, smoking on the bus, or other direct challenges to the driver's authority.

Bus operators also complain about various human factor problems associated both with vehicle operation as well as driver comfort (Bartone 1989; Dijkstra 1983; Duffy and McGoldrick 1990; Feickert and Forrester 1983; Gardell et al. 1983). Specific complaints include noise, temperature, seating and postural support, instrument panel design, vehicle maneuverability/handling capabilities, and visibility. The latter two may be exacerbated by passenger loads. Human factor problems can contribute to safety hazards directly and indirectly influence worker health. For example, Feickert and Forrester (1983) found that drivers in a major British city frequently had to reach through the steering wheel to activate the turn signal. Chicago bus drivers frequently complained about poorly maintained buses

*Hierarchical regression analyses further showed that the significant regression of psychophysiological stress onto traffic congestion was mediated by perceived job control. Traffic congestion was measured as the percentage of time the driver was exposed to service level D of congestion (greater than 90% of capacity).

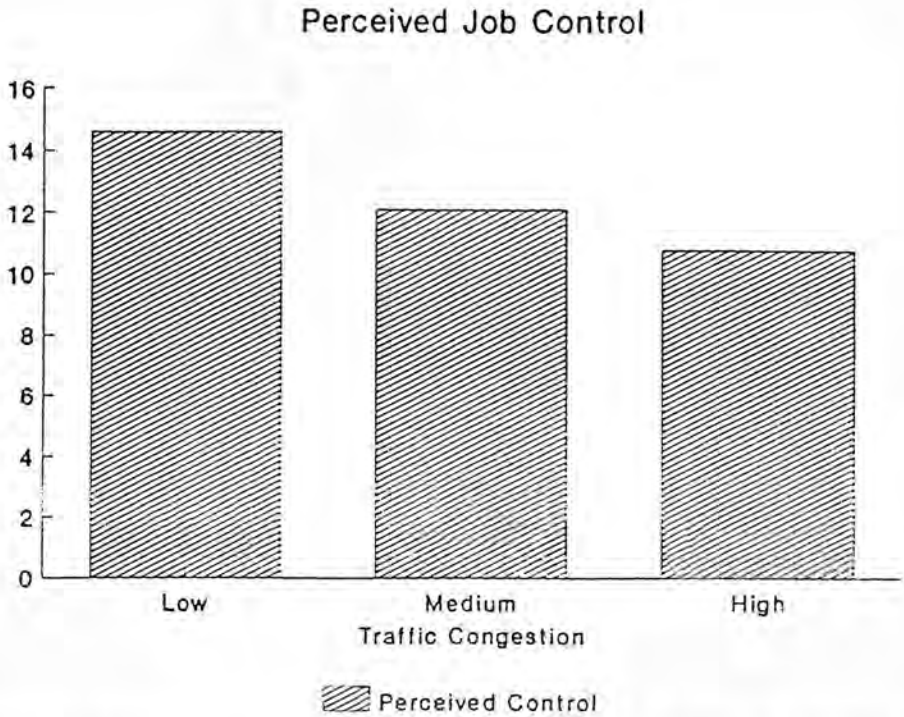

Fig. 6. Perceived job control as a function of traffic congestion. Based on data presented in Evans and Carrere (1991).

and expressed specific concerns about poorly performing brakes (Bartone 1984).

Perhaps the most detailed series of ergonomic studies of buses has been conducted by the Swedish National Road and Traffic Research Institute (VTI). VTI has conducted extensive on-the-road field studies and laboratory experiments in a bus cabin simulator (Helmers et al. 1983). The highlights of their analyses will be briefly summarized herein. It is important to keep in mind that these ergonomic investigations were conducted on buses built in Sweden to high levels of ergonomic standards that often exceed those in other countries. Temperatures from radiant heat reached maximums of 54°C in the summer and fluctuated markedly in winter with drafts from opening and closing the passenger door. Although comfort levels were judged unsatisfactory, no health or safety threats were seen from bus cabin climatic conditions. Consistent with the findings of Backman (1983) and Laursen and Netterstrom (1982), toxic fumes were slightly elevated but not at dangerous levels from a health or performance perspective. Visibility and seating comfort were judged as adequate save for the need for better, adjustable lumbar supports. Noise levels, particularly, in the low frequency range (infrasound) were substantially elevated and shown to deteriorate performance and cause discomfort in several driving simulator tests. For example, steering precision, speedholding (maintaining a specified speed), and reaction time were all negatively affected by low-frequency noise in the bus cabin. Driver self-reports of fatigue and drowsiness also correlated with low-frequency noise levels.

VTI concluded that ergonomic factors play a minor role in the health or safety of modern bus driving. However they noted that both comfort and, in the case of noise, performance levels were not satisfactory. It is also important to keep in mind that some health outcomes such as musculoskeletal problems may take prolonged periods of driving to become manifest.

Bus drivers, particularly those on split shifts or rotating shifts, often complain about disruptions of home life, particularly social activities and leisure time. Drivers also believe that these disruptions contribute to marital strain and interfere with adequate parenting (Gardell et al. 1983). For example in a survey on the social and leisure activities of bus drivers and their spouses, drivers were able to join their families for meals on average five out of a possible 21 weekly meals (Feickert and Forrester 1983). Interestingly, both male bus drivers and their spouses independently reported that social life, holiday times, hobbies, and their sexual relationship were adversely affected by driving a bus (Feickert and Forrester 1983). One spouse remarked,

After 13 years, myself and the children have learned to make a life for ourselves. We can only be a proper family

once a week, on a Sunday (if, of course, my husband's duties fit in) . . . when he comes home he eats, watches telly, then sleeps so soundly we can't wake him, so as a result he stays downstairs a lot (so you could say I even sleep alone). (Feickert and Forrester 1983, p. 14)

The disruptive effects of bus driving on family and social life appear to be a function of two primary factors. First, residual fatigue and irritability stemming from occupational stress is seen as one major cause (Dijkstra 1983; Feickert & Forrester 1983; Gardell et al. 1983). Bus drivers often report excessive fatigue and tiredness following work and, in one study, took more than 1.5 hours on average to relax and unwind upon returning home after work. These driver reports were further corroborated by independent spousal reports (Feickert and Forrester 1983). In addition, Dijkstra (1983) reported that as drivers aged the problem of tiredness after work worsened. For example, drivers over 50 years old reported being too tired to do anything after work on most days.

The second major reason why bus driving appears to be disruptive of home life is that of irregular work schedules. Split shifts and rotating shifts remain common in the transit industry and pose difficulties for the coordination of social activities with friends and families (Gardell et al. 1983; Feickert and Forrester 1983). Split shifts are often used to staff buses during peak traffic hours and, as a result, provide drivers a break in the middle of the day. See Eckenrode and Gore (1990) for thoughtful analyses of additional interactions between home and work settings.

The interference of bus driving with social relationships with family and friends outside the job is unfortunately also matched to a large degree by social isolation on the job (Syme 1991). Bus drivers report very low levels of social support from both coworkers and supervisors (Carrere et al. 1991). Low levels of social support among bus drivers are not surprising given the nature of the operator's job. He or she has very little opportunity to have face-to-face contact with fellow drivers except for an occasional moment when routes intersect or during meal breaks. Drivers are often given brief rest stops at the end of each route segment, but these typically occur in isolated terminus points. In addition, bus operators often work irregular hours that are constantly changing and typically involve several different routes. This irregular and constantly changing scheduling of work hours makes it difficult, if not impossible, for most drivers to routinely interact with the same group of fellow drivers.

Disrupted family life, difficulty with scheduling social relationships outside of work, and the generally solitary nature of bus driving may have both direct and indirect effects on drivers' health and well-being. It is well established that social isolation contributes negatively to morbidity and mortality (House, Landis, and Umberson 1988). The availability of socially supportive resources also appears to buffer the negative effects of psychosocial stressors on health (Cohen and Wills 1985).

At least three studies have examined the potential buffering effects of social support among bus drivers. Blau (1981), Bartone (1984) and Carrere et al. (1991) uncovered no evidence for the buffering effects of social support at work among bus drivers. A likely reason for these null findings is the consistently low levels of opportunity for social interaction among bus drivers. By its nature public transit operation is a solitary job, and, as noted above, few opportunities occur for building or maintaining socially supportive relationships on the job. Thus there may be insufficient variance in social support among bus drivers to adequately test its importance as a work environment factor involved in the health and well-being of bus operators.

Research on stress and health has convincingly demonstrated that people vary in their reactions to suboptimal environments (Evans and Cohen 1987; Lazarus and Folkman 1984)—not all bus drivers are likely to respond to the potentially pathogenic conditions of city bus driving in precisely the same way. Evans et al. (1987) found that Type A bus drivers perceived their jobs as more stressful, manifested more overt indices of stress while driving the bus, had more traffic accidents, and, in India, but not the United States, drove the bus more aggressively. Type A and Type B drivers did not differ, however, in their psychophysiological stress reactions to driving.

How people cope with work stressors may also influence their health and well-being. Kuhlmann (1990) found that bus and tram drivers who coped with job stressors by resignation and submission reported greater levels of job stress, experienced more psychosomatic symptoms, and felt more exhausted and took longer to unwind after the work day. Winkleby, Ragland, and Syme (1988) found a consistent inverse association between drivers' perceptions of job stress and hypertension. Thus there is some suggestion that for the subset of drivers who cope with job stressors by more passive cognitive strategies, more negative outcomes may ensue.

Bartone (1989) has taken the analysis of individual differences in reactions to job stress an important step further by examining individual factors that moderate the linkage between job stress and health outcomes. He compared drivers with high job stress

who did or did not have high levels of physical illness. Three individual factors emerged as significant, independent predictors: regressive (avoidance and denial) coping style, familial risk factors, and a personality factor called hardiness. Hardiness measures individual's appraisals of stressor encounters in terms of commitment, challenge, and control. Bus drivers low in hardiness, with family histories of chronic illness, or who employed regressive coping strategies, were most at risk for illness when exposed to high levels of job stress.

SUMMARY

Several characteristics of the work environment of urban public transport operators may contribute to the high levels of occupational stress and elevated health risks associated with city bus operation. City bus drivers report relentless time pressure and frustration over interference in the timely and safe operation of their vehicles because of traffic congestion. In addition to traffic congestion, drivers work in noisy and uncomfortable climatic settings and must sit for prolonged periods of time. The risks of physical assault and problems with unruly passengers are ever present for bus operators in many cities around the globe. Drivers also report conflicts created by their desires to serve the public in a safe and courteous manner on the one hand and pressures to remain on schedule on the other.

Drivers typically have little or no say over how work schedules are formulated or how timetables are designed. Thus urban public transit operators, particularly in major urban settings, function under a high degree of job strain—high workload demands coupled with low job control. As noted above, several negative aspects of the bus driver's work environment have been linked to cardiovascular risk factors (e.g. elevated blood pressure, elevated neuroendocrine stress hormones) as well as to absenteeism.

Another negative component of the work environment of bus operators is interference with home life and leisure activities. This interference stems from irregular work schedules and spill-over of fatigue from the demands of the job. Finally, bus driving may be fairly characterized as a socially isolated occupation. Drivers have little opportunity for regular, predictable social interactions with coworkers, supervisors or passengers. Occupational epidemiological research indicates that workers facing the constellation of job characteristics epitomized by urban bus driving—high workload demands, low control, high social isolation (ie, high isostrain)—are at substantially greater risk for coronary heart disease (Johnson and Hall 1988).

A wide range of studies in the stress and health field suggest that there are important individual differences in responsitivity to stress. Some preliminary analyses suggest that bus drivers who are Type A, low in personality hardiness, or who cope in more regressive ways (e.g. denial), may be at greater risk for negative health outcomes. Figure 7 summarizes work environment stressors and resources that may contribute to excess health risk among urban bus drivers.

METHODOLOGICAL ISSUES

Epidemiological studies comparing the incidence of morbidity and mortality in one occupation versus another necessarily confound work setting characteristics with occupational variation. Thus plausible rival explanations arise suggesting that something else associated with a particular job sector rather than its contents setting are producing spurious associations between job content and health. This problem is probably not operative for associations uncovered between urban bus driving and ill health. First, personnel selection factors probably lead to an underestimation of risk since only drivers who pass initial and, in some transit districts, periodic medical screenings are permitted to continue working. Furthermore, as noted earlier, most drivers who retire prematurely do so very early in their careers for medical reasons. When taken together, these two selection factors yield a labor force of considerable resilience in the bus driving industry.

On the other hand, perhaps individuals with certain personality types are attracted to the bus-driving profession. For example, individuals who are Type A and/or those who enjoy solitude on the job may find the prospects of being in charge of a group of people while working alone attractive. Hartvig and Midttun (1983) found that urban transport operators had significantly higher Type A scores than industrial workers. Evans et al. (1987), however, did not find this.

Short of random assignment to the work setting, the possibility of self-selection always looms as a possible confounding factor in bus driver and health findings. Two studies warrant mention because of their particular care in building in controls for self-selection factors. The first of these was a reanalysis of the Morris and colleagues (Morris et al. 1953) classic data set that had shown greater incidence of coronary heart disease in London bus operators in comparison to conductors. Morris had attributed

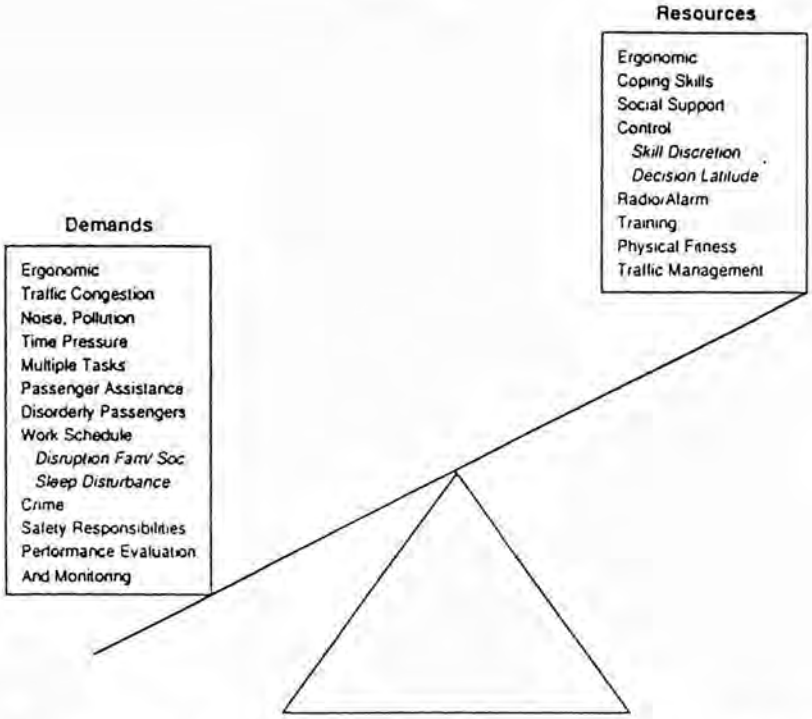

Fig. 7. Demands and resources in the occupational environment of urban bus drivers.

these differences to the exercise patterns of the two respective groups. Rosenman and Friedman (1958) suspected, instead, that the effects were due to higher levels of occupational stress experienced by drivers in comparison to conductors. In support of this interpretation, they found that drivers on London suburban routes had much lower levels of coronary heart disease than their downtown counterparts. In addition to being a good control group vis-à-vis selection factors, this reanalysis also points to the role of traffic congestion in bus driver stress.

The second study that merits mention is the San Francisco hypertension study (Ragland et al. 1987). It may be recalled that this study uncovered evidence of higher rates of hypertension among city bus drivers in comparison to several control groups. Of particular interest from a methodological viewpoint, is their use of a wait list control. One of their comparison groups consisted of individuals who had applied to become city bus drivers but who had not yet started work. This control group largely excludes any possibility that the results were due to self-selection.

One would have to argue that males who wished to drive on suburban routes differed in some fundamental way related to cardiovascular disease outcomes from their urban counterparts to explain these findings in terms of self-selection. Unfortunately, however, Rosenman and Friedman did not provide any information on seniority levels for downtown versus suburban routes. It is possible that people with more seniority opt for suburban routes.

Although field studies of individuals within the same bus driver occupation eliminate some of the major problems posed in cross-occupational comparisons, over reliance in these field studies on self-report indices of health is troublesome. If one surveys a driver's perceptions of work environment characteristics and finds correlations with self-report measures of such things as job stress, health symptoms, psychological distress and negative affect, or job satisfaction, serious questions must be raised about the validity of these findings. An association, for example, between workload demands and job stress may reflect some personal characteristic of the worker such as neuroticism or a tendency to view things negatively. A few studies of occupational stress and health among bus drivers have attempted to deal with some of the issues created by self-report data. Bartone (1989) in his study of individual factors protecting Chicago bus drivers from the ill health effects of high job stress included a statistical control for individual levels of neuroticism. Carrere et al. (1991) showed that bus driver's perceptions of the work environment (workload demands, job control) were unrelated to personal background characteristics, coping styles, or Type A behavior. In this same study she found further evidence that perceived work environment characteristics did not reflect idiosyncratic biases. An additional set of bus drivers from the same routes in the Los Angeles metropolitan area provided highly

correlated evaluations of the work environment. Thus variance among driver's reports of work conditions was primarily a function of which route and time of day they drove rather than personal characteristics.

Mono-method bias can also artificially create an apparent association between work environment factors and outcome measures, particularly when all of the measures are under the conscious control of the respondent as in the case of self-reports. This is one reason why studies showing associations between transit environment conditions and physiological outcomes are so important. Not only do these studies provide evidence of a plausible biological mechanism to explain the epidemiological findings on bus drivers and morbidity and mortality, they also reflect multimethod convergence. Conditions within the work environment of urban bus operators have been associated not only with survey measures of stress, psychological distress, and physical symptoms, but also with elevated blood pressure and neuroendocrine levels, observations of tension and nervousness, and in archival records of absenteeism, job performance, and safety.

INTERVENTION POSSIBILITIES

Several ideas for reducing occupational stress among city bus drivers follow from my analysis of job characteristic and occupational stress. One area of focus should be problems associated with time pressure and associated conflicts produced by traffic congestion and passenger service needs. Traffic congestion can be reduced via various technical interventions including bus lanes, signal prioritization, elimination of curbside cutouts (e.g. bring the passenger to the bus on an island) and through more rigorous enforcement of curbside parking rules (e.g. towing double parked cars and cars in the bus lane).

Improved passenger information systems can provide better information and reduce driver inquiries. For example electronic displays of route information, major transit transfer points, and upcoming stops are now commercially available. New information systems at the bus stop will also allow experimentation in different types of scheduling systems. For example, rather than fixed, point estimates of bus arrival, scheduling could be done on an interval basis in which buses are scheduled to arrive within certain fixed intervals that vary at different times of the day (Gardell et al. 1983). Moreover with electronic information systems, the expected time of the next arrival could be displayed at the stop. It is important to emphasize that time savings derived by these and other technical interventions should not all be absorbed by tightening the schedule of specific routes. Some of the gains afforded must be given back to the drivers in the form of longer breaks. Otherwise little or no benefit in terms of reduced time pressure and workload will be experienced.

Because of the high saliency of crime threat to drivers, more analysis of ways to enhance driver security is needed. Better alarm systems and emergency procedures via telephone are initial steps in the right direction. Rather than have rest breaks at the terminus points of routes, which typically are located in isolated areas, breaks should be scheduled in central locations where routes intersect. This would provide better security and might facilitate greater social interaction opportunities for drivers (Syme 1991). During peak hours these breaks need to be longer, recognizing that the wear and tear of sustained operation in peak traffic can be partially offset by more recovery time in a relaxing, and hopefully, sociopetal situation.

Some of the interfering effects of bus driving on home life and leisure time are undoubtedly associated with work scheduling traditions in the transit industry. Rotating and split shifts need to be examined critically by drivers and their supervisors. Fixed work schedules would allow adjustments in circadian rhythms and should provide more regular and predictable opportunities for family and social leisure activities. They might also foster more regular social contact with fellow workers. When split shifts are absolutely necessary, consideration should be given to the extent of the layover. Perhaps longer interims would provide workers better opportunities to go home for a meal or to conduct domestic errands.

Study groups/discussion committees could be formed of drivers, immediate supervisory personnel, and management. The agenda for these groups should be problem solving, not negotiation. One of the natural outgrowths of worker and management study groups may be increased trust and an enhanced sense of mutual interdependence between management and labor. The development of more socially supportive relationships among drivers could serve many useful functions. Drivers having problems coping with difficulties on the job could be taught how to handle issues better (e.g. how to deal with unruly passengers, what to do if an accident occurs). Coworkers could attempt to intercede, at least initially, between a supervisor and a worker when poor driving performance was evident or alleged. Thus the collective driver culture could become the first line of social support and of social control. Experienced, successful drivers could be

trained in peer counseling techniques and/or more formal support groups could be developed.

The temptation to select driving personnel on the basis of the limited findings to date on individual differences in bus drivers' reactions to job stress should be avoided. It is a fundamental error to translate differential responses, as indicated by at best modest correlations, to categorical selection criteria. Many false positives and false negatives would occur if one were to select, for example, only Type B or personality-hardy bus operators. Both the magnitude of the correlations in the studies cited earlier and their self-report methods add to the fragility of their predictive validity. It is also important to keep in perspective that studies comparing the net impact of job conditions and coping mechanisms on health and well-being among workers indicate that work environment factors consistently outperform coping and personality variables as predictors (Menaghan and Merves 1984; Miller 1988). Furthermore, societies ought to optimize the work environment so that most workers can enjoy productive and satisfactory experiences on their jobs rather than attempting to find the few hardy souls who can withstand the demands and pressures of poor work settings.

As a result of greater shared trust and responsibility, one might envision more radical experiments in job redesign. For example, drivers could be given greater control and responsibility to manage one or more routes in a city sector. Managerial personnel would function primarily as technical consultants and advisors and to help evaluate performance. Time schedules, staffing, and budget management for a particular route would be the responsibility of the drivers on that line. Managers and drivers together would formulate objectives and goals and evaluation criteria for such an experiment.

Transit districts need to become more open to the challenges and risks afforded by change. Labor and management must have the courage to experiment on a small scale, even radically at times, to determine if specific ideas about job changes or worker training can improve the work environment of the public transit industry. Ideally these small-scale experiments will be formulated jointly by labor-management teams (perhaps as outgrowths of study groups) and then evaluated by researchers who have the necessary methodological skills and scientific objectivity to test the efficacy of the experiments.

As noted throughout this article, research increasingly indicates that it is not high workload demands per se that lead to ill health and job dissatisfaction. Rather, it is the combination of high workload demands in concert with low job control that leads to pathology. If follows from this that if management has the courage to grant more decision latitude to workers and if labor has the wisdom to act responsibly with the provision of greater control, then the dialectic between the respective goals of economic efficiency and healthy work can dissolve within the transit industry.

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