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10 Occupational Safety

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Most workers in developed countries generally assume that their organizations will take all steps necessary to ensure that they return home safely at the end of the workday. Yet work-related injuries and fatalities continue at an alarming and unacceptable rate. In 1995 in the United States, there were 6210 fatal work injuries and approximately 3.6 million disabling injuries. These injuries resulted in an estimated 225 million production days lost for that year alone, and almost 455 million days in future years because of the debilitating, long-term consequences in many cases (United States Bureau of the Census, 1997). In the United Kingdom, approximately 1.1 million employed people were injured at work each year between 1993 and 1996 (Health and Safety Executive, 1997), with the corresponding annual financial cost to the British economy of £4–9 billion. In 1993 alone, there were 758 work-related fatalities in Canada. In the same year, 423,184 Canadian workers suffered injuries serious enough to be compensated either for wages lost due to time off work or for a permanent disability (Statistics Canada, 1994).

Taken in isolation, however, these data do not show the social meaning of occupational safety. Reasons, Ross and Paterson (1981) noted that a worker is twenty-eight times more likely to be injured or to die on the job than to suffer the same fate at the hands of a criminal. The salience of occupational safety is further apparent because the annual number of fatalities attributable to workplace injuries and illness in the USA exceeds the annual death rate due to several illnesses and other causes that attract more public attention and sympathy, such as breast, prostate or colorectal cancer, vehicular-related deaths, firearms and AIDS (Leigh, Markowitz, Fahs, Shin and Landrigan, 1997; Sauter, Hurrell, Fox, Tetrick and Barling, 1999).

Table 10.1 *Comparison of productivity losses in terms of days not worked as a function of occupational injuries (lost-time accidents) and strikes in Canada, 1993–6*

	1993	*1994*	*1995*	*1996*
Strike	1,516,640	1,606,580	1,583,061	3,345,220
Lost-time accident	15,807,748	17,639,363	16,593,260	14,470,574

While cries about the dire consequences of strikes for organizations in terms of days of work lost are frequently heard, the importance of occupational safety for productivity can be appreciated by comparing the numbers of work days lost as a function of strikes to that of occupational injuries. As can be seen from Table 10.1, the situation in Canada is clear. Over a four-year period, organizations lost approximately fifteen million work days per year to occupational injuries. During the same period, the number of workdays lost as a function of strikes never exceeded five million. Clearly, the number of people being injured or killed at work is unacceptable, and this issue is deserving of sustained research attention from psychologists.

Surprisingly, therefore, occupational or workplace safety has attracted very little research by industrial and organizational (I/O) psychologists or management scholars. In their quantitative review of the extent to which research has addressed different topics in I/O psychology, Campbell, Daft and Hulin (1982) showed that occupational safety attracted less than 1 per cent of the relevant research. To assess whether this situation has changed since that earlier study, which is possible given the occurrence of several high-profile industrial disasters (e.g., the tragedies at Bhopal and Chernobyl) we examined all articles published in several mainstream journals (the *Academy of Management Journal*, *Academy of Management Review*, *Administrative Science Quarterly*, *Journal of Organizational Behavior* and the *Journal of Occupational and Organizational Psychology*) between 1990 and 1999. Our analysis shows that the proportion of articles directly addressing occupational safety remains less than 1 per cent. While we acknowledge that occupational safety is covered in other academic journals (e.g., *Accident Analysis and Prevention*, *Human Factors*, the *Journal of Safety Research* and *Safety Science*), our central point remains: occupational safety has not attracted the attention of I/O psychologists or management scholars. This situation cannot continue; the number of workplace accidents and fatalities is unacceptable.

In this chapter we will first consider how occupational safety is conceptualized and operationalized. We will then discuss three major themes (ergonomics, leadership and human resources) through which psychological research has provided a body of knowledge that can now serve as the basis for understanding and enhancing occupational safety. Lastly, we will address several remaining challenges, notably young workers' occupational safety, new forms of work organization, and the need for intervention studies.

HOW SHOULD WE CONCEPTUALIZE AND OPERATIONALIZE OCCUPATIONAL SAFETY?

Most discussions about occupational safety, whether in the academic literature or in workplaces, typically focus on 'accidents' and/or fatalities. Thus, debate, discussions and research about occupational safety revolve around the number of accidents, the amount of time off work required following such an event (frequently taken as an indicator of severity), and the number of workers that have been killed.

Several factors limit the reliability and utility of accident and fatality measures for organizational research and practice. First, accidents and especially fatalities occur relatively infrequently and are not normally distributed, introducing challenges into the analysis of such data. Second, there are substantial definitional differences as to what constitutes an occupational injury across different jurisdictions. For example, what one state in the United States, or province in Canada, might accept as evidence of a back injury requiring time off work might be refused by other states or provinces. This renders any comparisons of injury rates across jurisdictions hazardous at best.

Psychologists have traditionally expended considerable efforts on obtaining accurate data. This leads to a third problem in assessing the number of occupational accidents, because there are realistic concerns that organizations' databases on accidents and fatalities may underestimate the actual prevalence of the problem. Recent analyses show that there is a tendency for accidents to be under-reported. In 1987, the Bureau of Labor Statistics in the United States initiated a pilot project to assess the accuracy of accident and injury data. Two hundred randomly selected

manufacturing sites, each with more than ten employees, were visited by inspectors from the Occupational Safety and Health Administration (OSHA) (Eisenberg and MacDonald, 1988). Data for each of these establishments were also obtained from OSHA-mandated employer records of injuries and illnesses, medical records, workers' compensation reports and other relevant workplace records.

Evidence of both under-reporting and over-reporting of incidents occurred (Eisenberg and MacDonald, 1988), and several of the findings are noteworthy. First, almost all cases of over-reporting were associated with incidents that required no time lost from work, whereas under-reporting involved incidents both with and without lost work time. Second, the total number of injuries and illnesses was under-reported by about 10 per cent, and the number of lost workdays was under-reported by about 25 per cent. Very few establishments were responsible for the under-reporting, indicating that this is a systematic rather than a random phenomenon. A follow-up study of 250 construction establishments some 10 years later replicated this pattern (see Conway and Svenson, 1998).

How can this inaccuracy be avoided? While psychologists and behavioural scientists decry the sole use of self-report measures of behaviour, self-reported measures of occupational events and injuries may be more accurate than compulsory reports by the organization to government agencies. As Grunberg, Moore and Greenberg (1996) note: 'We cannot think of any compelling reason or incentives for workers to deliberately misreport their accidents and injury experiences to independent researchers' (p. 226). Conway and Svenson (1998) suggest that we make use of multiple sources or records in identifying the 'real' rates of incidents and injuries. This is worth serious consideration, and is also the recommended methodology for psychological research in general.

Zohar (2000) has focused attention on micro-accidents (those incidents requiring some first aid but no time away from work) and 'near misses' (Hemingway and Smith, 1999). These may be more useful indicators, because they occur with greater frequency than accidents. Also, the difference between a 'near miss' and an actual accident may be no more than luck. Including near misses and micro-accidents is important for a more complete picture of safety-related incidents.

Focusing on near misses, micro-accidents and accidents requiring time off work, however, provides only a limited picture of issues important in occupational safety. Instead, as will become apparent throughout this chapter, other factors critical to predicting safety-related incidents must also be considered.

Waiting for the incident or injury to occur will provide little useful information for future interventions. Instead, information about factors that immediately precede safety incidents will enable researchers and practitioners to predict injuries and incidents and to construct interventions that are more likely to enhance safety. Other issues of considerable interest are safety climate, safety compliance and safety initiative, safety knowledge, and safety-related leadership, inasmuch as they provide the motivation and skills that enable employees to perform safely.

Employees' perceptions of the safety climate in the organization has been of interest for some time (see Zohar, 1980). Perceived safety climate reflects employees' shared perceptions with respect to safety in their work environment, and employee behaviours are dependent on these perceptions. Research confirms that perceived safety climate is a substantial predictor of safe performance (Hofmann and Stetzer, 1996; Zohar, 2000). For example, based on data from fifty-three different work groups, employing a total of 534 production workers, Zohar (2000) showed that perceived safety climate predicted the number of micro-accidents five months following the measurement of safety climate. The fact that Zohar (2000) obtained data on perceived safety climate and micro-accidents from separate sources (namely, individual employees and company records, respectively) and also used a longitudinal design generates considerable confidence in these results.

Safety compliance and safety initiative reflect two additional aspects of occupational safety (Griffin and Neal, 2000; Neal, Griffin and Hart, in press; Williams, Turner and Parker, 2000). When employees follow safety-related rules and work in a safe manner, they are exhibiting safety compliance (Griffin and Neal, 2000; Simard and Marchand, 1994; Thompson, Hilton and Witt, 1998; Williams *et al.*, 2000), which is expected to reduce injuries and safety incidents. In contrast, safety initiative refers to employee behaviours that go beyond simply working within established safety standards. Instead, they involve behaving proactively to help the organization improve occupational safety. For example, proactive employees engage in such behaviours as volunteering to participate in safety audits and pushing their supervisors to take action to improve safety (Griffin and Neal, 2000; Simard and Marchand, 1994; Williams

et al., 2000). Both safety compliance and safety initiative are components of safety performance, and in addition to measures of actual safety incidents provide a more thorough conceptualization of workplace safety.

Perceived safety climate, safety compliance and safety initiative all reflect aspects of the motivation to perform safely. It would avail little, however, for employees to be motivated to perform safely if they did not have the skills or knowledge to do so. Because of this, safety training is critical, and is discussed later in this chapter. Where safety training is effective, employees' knowledge of how to perform safely would be enhanced. Griffin and Neal's (2000) studies in manufacturing and mining organizations document the extent to which safety knowledge is central to occupational safety.

Lastly, we conclude this section with a comment on the use of the term 'accident'. 'Accidents happen!' is a frequent explanation offered in organizations following serious safety infractions. Why is this important? Terminologically, 'accident' implies that the event in question is random, and beyond the control of those involved. Yet subsequent examinations of most safety-related incidents reveal just the opposite: the overwhelming majority are both predictable and preventable. Were this just a terminological issue, we would dutifully relegate the term 'accident' to the status of a footnote. However, routinely using the word 'accident' presumably implies the users' agreement with this implicit meaning. In that sense, if these events were indeed random, managers might be forgiven for believing that they have less control over safety issues in the workplace than they actually do. Hence, no blame could be assigned, a comforting thought given possible legal and moral ramifications. In contrast, we argue that 'accidents don't just happen'; instead, they are predictable *and* preventable events over which all actors in the system, both management and employees, can exert control. Wherever possible, therefore, we will refrain from using the term 'accident'.

ERGONOMICS

Ergonomics or human factors engineering* is generally concerned with the design of a work system in which the work methods, layout, machines, equipment, and physical environment (e.g., lighting, noise, heat, vibration) are compatible with the physical and behavioural characteristics of the worker (Laing, 1992). One of the basic ergonomic texts reflects this orientation in its title, *Fitting the Task to the Human* (Kroemer and Grandjean, 1997). Thus, in contrast to traditional human resource practices that emphasize 'fitting' the human to the task (i.e., through selection and training), ergonomic approaches focus on the design of the work and task environment to ensure compatibility with human abilities.

There are at least three ways in which ergonomists attempt to achieve this fit, and these correspond to the principal subfields of ergonomics. First, physical ergonomics focuses on the design of the physical workplace. Drawing on fields such as physiology, biomechanics and anthropometry, the goal of physical ergonomics is to ensure that work is designed to fit the physical capabilities of the individual. In recent years, health and safety applications of physical ergonomics have focused on the prevention of musculoskeletal disorders and repetitive strain injuries.

Second, cognitive ergonomics draws on research in memory, decision-making and perceptual processes to ensure that the mental requirements of work suit human abilities. For example, cognitive ergonomists have devoted a great deal of attention to the design of process control mechanisms (e.g., gauges, switches) in order to ensure that displays are easily understood and controls easily operated. The design of computer-based technology draws increasingly on cognitive ergonomic research; see Chapter 4.

Finally, organizational ergonomics (sometimes called macro-ergonomics) considers issues of the broader socio-technical environment. Researchers interested in larger issues of system design frequently focus on the notion of 'system-risk', the suggestion that many factors (both

* The term 'human factors' is more common in North America, where 'ergonomics' refers to purely physical design. In Europe and the United Kingdom, the term 'ergonomics' is used more generally.

technical and human) operating in a complex system contribute to the riskiness of a system. Disasters such as the meltdown at Three Mile Island and the explosion in Bhopal are attributed to systems failure rather than a single cause (Kletz, 1998). Reducing risk means understanding how physical and human factors interact.

Drawing on principles of ergonomic design, LaBar (1996) identifies four key areas that may lead to safety problems in workplaces: process control, automation, maintenance, and operating procedures. Ergonomic design principles related to process control should ensure that displays and switches conform to individual expectations. For example, use of a green light to indicate danger instead of the more traditional red light would violate expectations. It is important to note that these expectations may not be universal. For North Americans, the 'up' position of a switch means 'on' or 'start', whereas for Europeans the 'down' position typically means 'on'. Gauges and displays should also be suited to their purpose. Numeric dials can be read and interpreted quickly, but digital displays are required for precision.

As the use of technology in workplaces increases, it becomes increasingly important that the design of automated systems take human limitations into account (see also Chapters 2 and 4). The principal concern here is to ensure that both humans and machines do the tasks they are best suited for. Humans are best suited for tasks that require active involvement, judgement and decision-making. Machines are best suited for repetitive motions and material handling.

Safety experts typically attribute a high percentage of workplace accidents to maintenance issues. Equipment and machines that do not allow easy access or that have hard-to-replace components discourage active maintenance. Conversely, equipment should be designed so as to allow only one method of re-assembly following routine maintenance procedures.

Finally, creating a safe working environment means establishing clear procedures on how jobs are to be completed. These procedures should detail the best method of doing the work, for example in clear guidelines for proper lifting techniques. Supplemented by clear policies and procedures on use of supplementary lifting devices, procedures to ensure that individuals lift properly can dramatically reduce the incidence of lower back injuries in the workplace.

Implementing a comprehensive ergonomics programme in the workplace requires considerable commitment from both management and employees. Typically such programmes consist of primary, secondary, and tertiary interventions (Montgomery and Kelloway, 2001). Primary interventions focus on prevention, and attempt to redesign the workplace or work procedures so as to minimize or eliminate potential hazards. Secondary interventions attempt to protect workers from hazards through, for example, the design of personal protective equipment or the formulation of policies dealing with the length of time one can be exposed to a hazard. Finally, tertiary interventions involve providing treatment for those individuals who are injured in the workplace and ensuring their safe return to work through efforts at accommodation and rehabilitation. Clearly, tertiary interventions by themselves are insufficient as they allow injuries to occur first. Secondary interventions, such as wearing personal protective equipment, have been criticized because they focus on the individual rather than the source of the problem. As Montgomery and Kelloway (2001) suggest, secondary and tertiary interventions are best viewed as complements to, rather than replacements for, primary interventions.

LEADERSHIP

It is usually held as axiomatic in organizations that 'leadership makes a difference': research findings over several decades consistently show that high quality leadership is associated with a host of positive organizational outcomes, including greater employee morale (Pillai, Schriesheim and Williams, 1999), individual sales performance (Barling, Weber and Kelloway, 1996), and branch-level financial performance (Howell and Avolio, 1993). (See also Chapter 12.) Similarly, union shop stewards' leadership is associated with rank and file members' participation in the union (Kelloway and Barling, 1993), and coaches' leadership in sports teams predicts team success (Charbonneau, Barling and Kelloway, 2001). Given these broad effects, the possible role of leadership in understanding, predicting and preventing safety infractions is intriguing, and three streams of research collectively point to its importance.

First, research has generally shown that organizations in which leaders pay attention to occupational safety enjoy higher levels of employee

motivation to work safely, as well as better organizational safety records (Cohen, 1977; Hofmann, Jacobs and Landy, 1995; Smith, Cohen, Cohen and Cleveland, 1978). Simard and Marchand (1995) investigated the effect of senior management commitment on employees' willingness to take safety initiatives. Based on responses from approximately 23,000 employees, they found that senior management commitment to occupational safety was the strongest predictor of supervisors using a participative style in the management of occupational safety. In turn, this participative style was the most significant predictor of employees' safety initiative.

While there is a growing understanding of the central role of management in organizational safety performance, little research has examined precisely what a 'strong commitment to occupational safety' means in terms of managerial action. Zohar (1980) claimed that management commitment to occupational safety can be expressed in the following different ways: safety matters receive high priority at meetings, safety officers enjoy high status positions, safety training is emphasized, open channels of communication exist between workers and employers to discuss safety issues and new ideas for enhancing safety, and there is a stable workforce. Griffiths (1985) adds to this list: a comprehensive safety policy, clear safety-related objectives, and extensive training and employee involvement.

A second stream of research has focused on leader–member exchange theory, which involves a pattern of reciprocated behaviours or social exchanges between leaders and followers (Hughes, Ginnett and Curphy, 1999). With respect to safety, it is assumed that when leaders engage in behaviours that benefit subordinates, subordinates will feel obligated to respond with behaviours that would benefit the leader. In this respect, it is assumed that occupational safety would be perceived to be important to leaders and thus a means of benefiting leaders.

Hofmann and his colleagues have conducted two studies to assess the utility of leader–member exchange to occupational safety. First, Hofmann and Morgeson (1999) studied 49 supervisor-group leader dyads in a manufacturing facility producing commercial heating and air conditioning systems, and showed that leader–member exchange was indirectly associated with the number of accidents that had occurred over a one-year period. Specifically, positive leader–member exchanges resulted in higher quality safety communication between supervisors and group leaders. In

turn, the greater the safety communication, the more group leaders were committed to occupational safety, and it was their commitment to occupational safety that directly affected the number of accidents.

In the second study, Hofmann, Morgeson and Gerras (2000) extended this notion to the military context, and studied 118 military teams required to transport heavy equipment (e.g., tanks, artillery vehicles, forklifts and cranes). Each team consisted of approximately five members and one supervisor. The supervisors' jobs included ensuring safety, which was an integral part of their performance evaluation. The results of this study replicate and extend Hofmann and Morgeson's (1999) research on leader–member exchange and occupational safety. Again, there was an indirect relationship between leader–member exchange and occupational safety. Positive leader–member exchange resulted in what Hofmann *et al.* (2000) called high safety citizenship behaviours. Safety citizenship behaviours then resulted in occupational safety. Thus, Hofmann *et al.*'s (2000) results showed that the relationship between leadership and occupational safety is indirect, and identified safety citizenship behaviour as an additional mediator of this relationship.

In the third research stream, transformational leadership (Bass, 1998) has been used as an organizing framework for understanding occupational safety for several reasons. First, transformational leadership has received extensive empirical scrutiny (Avolio, 1999; Bass, 1998; see Chapter 12), more than all other leadership theories combined since 1990 (Judge and Bono, 2000). Second, its validity is supported in a variety of contexts (e.g., Lowe, Kroeck and Sivasubramanian, 1996), including unions (Kelloway and Barling, 1993), where the availability of formal rewards by leaders is limited and the importance of personal influence is magnified accordingly. Each of the four factors comprising transformational leadership (idealized influence, inspirational motivation, intellectual stimulation and individualized consideration) lends itself to the possibility of enhancing safety performance. Leaders high in idealized influence would convey how they value employee safety through their personal behaviours. Those high in inspirational motivation would convince their followers that they could attain levels of safety not previously considered possible. The potential benefits of intellectual stimulation for enhancing safety performance are considerable. Providing intellectual stimulation for followers to confront safety issues would add knowledge about new ways of achieving high safety levels. Individualized consideration would be

evident through leaders' personal concern about their followers' physical safety at work, far beyond what would normally be required to satisfy the minimal requirements of government regulations or a collective agreement.

A further reason supporting the appropriateness of transformational leadership is that controlled-outcome research shows that transformational leadership can be taught to managers (Barling, Weber and Kelloway, 1996). While the focus of most safety training is on employees, training managers in the use of transformational leadership to enhance the occupational safety of others is just as important, and presents an innovative research challenge for scholars in the areas of both safety and leadership.

Williams *et al.* (2000) studied the role of transformational leadership in the occupational safety of a group of production technicians in a chemical processing plant. They showed that transformational leadership predicted employees' safety compliance and proactive behaviours to enhance safety. Barling, Loughlin and Kelloway (2000) examined the predictors of occupational injuries among a heterogeneous group of employees in two separate studies. They showed that transformational leadership was significantly and indirectly associated with occupational injuries. Specifically, transformational leadership predicted perceived safety climate, which significantly predicted employees' safety consciousness (their safety knowledge and safety behaviours). In turn, safety behaviours were significantly associated with safety-related events (having the potential for harm), and it was the occurrence of these safety-related events that resulted in occupational injuries. As in other studies of transformational leadership, however, it was not possible to isolate the differential role of the four components of leadership because they are so highly correlated (Bycio, Hackett and Allen, 1995).

HUMAN RESOURCES

Together with safety training, personnel selection has traditionally been one of the two most frequent techniques used to achieve occupational safety within a human resources model. To date, however, the use of selection has focused mainly on the utility of personality screening

questionnaires to differentiate between potential employees in terms of characteristics such as current or former drug addiction or alcoholism, and the extent to which they had been involved in accidents in prior jobs, which would presumably predict their susceptibility to occupational accidents. These strategies typically screen for personality characteristics, and several different questionnaires have been used (e.g., Jones, 1991; Borofsky, Bielema and Hoffman, 1993; Borofsky and Smith, 1993; Borofsky, Wagner and Turner, 1995).

To gain an appreciation of how these questionnaires are used, an examination of some of the research using this approach is useful. In one study, Borofsky and Smith (1993) compared the safety records in a mid-sized manufacturing facility of fifty-three employees *before* and another fifty-three employees *after* the introduction of pre-employment screening based on the Employee Reliability Inventory. This questionnaire assesses seven personality factors, namely freedom from disruptive alcohol and substance use, courteous job performance, emotional maturity, conscientiousness, trustworthiness, long-term job commitment and intelligent job performance. Borofsky and Smith's (1993) data show that the number of employees who had accidents after the use of pre-employment screening began was significantly lower than that within the group prior to the screening process. In a second study (Borofsky *et al.*, 1995), they focused on the safety records in a resort hotel employing approximately 3800 people, and again showed that the number of accidents and the accident rate as a percentage of the total workforce was lower after screening had been implemented.

Despite this, several methodological flaws in these studies preclude the inference that the screening procedures caused a decrease in the safety-related incidents. First, any study that lacks a control group leaves us with what Cook and Campbell (1979) refer to as 'uninterpretable results', because other plausible, alternative hypotheses could just as easily explain the increase in safety in these studies. For example, it is possible the employees in the two groups held different jobs or performed different work; perhaps data gathered before the introduction of screening were obtained from people engaged in more hazardous work? Second, because of the absence of any control group, we cannot rule out the possibility that the apparent changes were simply a part of a pre-existing trend toward increased safety, because the very factors that motivated the organization to introduce the prescreening program in the first instance

may have resulted in other changes in the organization that could also have accounted for the changes.

Even if we could accept the validity of the findings from these studies, ethical problems are raised in the extent to which this approach places primary responsibility for inappropriate behaviours on vulnerable individual employees, and then aims to exclude such individuals from the organization. Parenthetically, this approach allows management to abdicate responsibility, despite the evidence in this chapter that managers' behaviour does indeed influence occupational safety.

The second human resource approach intended to influence occupational safety is safety training. Safety training is one of the major organizational interventions used in this field. The need for its even greater emphasis is illustrated by Murray, Fitzpatrick and O'Connell's (1997) survey of fifty-five individuals involved in commercial fishing off the coast of Newfoundland. They found that fifteen of these individuals (27 per cent of their sample) could not swim!

In general, the results of well-designed studies show that employees who have undergone safety training suffer fewer work-related injuries than their untrained counterparts (Hale, 1984). In addition, some aspects of training (e.g., active learning, or behaviourally-based training) are more effective than others (Cohen and Jensen, 1984). The role of perceived safety climate is again salient, because organizations in which safety training is perceived to be offered because of management commitment, rather than because of compliance with external regulations or collective agreements, enjoy better safety records (Zohar, 1980). Of course, safety training is especially important when work is inherently more dangerous. In many 'normal' work situations, learning can occur through direct job-related experience. In the case of inherently hazardous work, however, the potential human cost of errors is far too high, making training an especially important aspect of any programme to improve occupational safety.

SOME REMAINING CHALLENGES

Several issues deserve some attention because of the challenges they will present to occupational safety. These include occupational safety for young workers, the effects of new forms of work organization on occupational safety, and the need for well-controlled intervention studies.

Young Workers

Society generally approves of young people being employed because of the opportunities offered for acquiring responsible behaviour patterns (Barling and Kelloway, 1999). Employment among teenagers and young adults (i.e., below the age of twenty-five) is thus customary. For example, approximately 50 per cent of full-time university students are employed on a part-time basis in both Canada (Krahn, 1991) and the United States (Manning, 1990). There are also indications that such employment may be on the rise, because the opportunities for part-time work have increased steadily (Barling, 1999; Barling and Gallagher, 1996), and teenagers' allowances have probably not increased sufficiently to keep pace with their discretionary purchases (Waldman and Springen, 1992).

Why is this pattern so significant? Examining non-fatal workplace accidents and injuries across the life span shows that adolescence is the age group with the highest risk. As Castillo (1999) notes, based on US data, adolescents' injuries are common, indeed more so than for adults, and the injuries they incur can exert a substantial effect on their lives. The pattern is not restricted to non-fatal injuries: approximately seventy people younger than eighteen years old, predominantly males, die each year from work-related injuries in the United States.

Given this, there is a paucity of psychological research investigating the predictors of work injuries among adolescents. Frone's (1998) study of 319 young workers, aged between sixteen and nineteen, uncovered five variables that predicted work injuries. Not surprisingly, the extent of physical hazards at work was positively associated with work injuries, as was job tenure. One explanation for the relationship between job tenure and work injuries is that adolescents with greater job experience are likely

to be placed in jobs that require more skills and that are more hazardous. There are three other predictors of greater interest in terms of the psychology of the workplace. On-the-job substance abuse rather than substance abuse in general predicted occupational injuries, which may cast doubt on the usefulness of questions about general drug use in a selection interview. Second, like others (Hofmann and Stetzer, 1996) Frone showed that work overload was associated with job injuries, as was boredom on the job. The findings relating to these latter two variables are interesting, as job design may be an appropriate intervention for occupational safety. Specifically, research should now focus on whether improvements in job design, for example increasing job-related autonomy that enhances productivity and mental health, might also influence occupational safety (Parker and Wall, 1997; see also Chapter 11).

New Forms of Work Organization

The last decade has witnessed substantial changes in the nature and pace of work and in the employment relationship (Barling, 1999; Tetrick and Barling, 1995). We now turn our attention to two of these changes which have considerable bearing on occupational safety, namely the move toward lean production, and the increase in the use of contract or contingent workers.

The goal of lean production is to increase efficiency by abolishing activities that add little or no value to the organization, thereby ensuring that the appropriate amount and quality of goods will be available when needed for the next stage of the production process. Landsbergis, Cahill and Schnall (1999) used the job demands framework of Karasek and Theorell (1990) to understand the possible effects of lean production. They speculated that, because lean production intensifies the pace and demands of work while mostly reducing the amount of decision latitude available to the individual employee, lean production methods will have a negative effect on occupational safety.

Jackson and Mullarkey's (2000) study focused on health rather than safety, but the central lesson to be learned from their findings would presumably apply to occupational safety as well. They contrasted the effects of lean production with a traditional manufacturing system for garment making, and showed that the effects of lean production were not

uniform. To the extent to which greater decision latitude was experienced as a result of lean production, health was better. In contrast, where autonomy and latitude were compromised by lean production, employee health suffered. Interestingly, these results parallel Frone's (1998) finding that boredom is associated with more injuries. Clear ramifications for work design seem to follow.

Another consequence of changes in forms of work organization has been the increased use of contingent or contract workers. The link between their use and aspects of occupational safety is important. When organizations do not make a long-term investment in their employees, they are unlikely to provide extensive training (Pfeffer, 1998), and this association extends to safety-specific training. More specifically, Rebitzer (1995) notes that host organizations rely mostly on contractors to provide safety training for their employees, despite the fact that they are less effective at doing so.

There are some initial indications that occupational safety is compromised by introducing contingent workers. First, following a workplace disaster in which twenty-three workers were killed and 232 injured, the United States Occupational Safety and Health Administration conducted a study, and the US Congress held hearings, part of which focused on occupational safety (see Kochan, Smith, Wells and Rebitzer, 1994). They concluded that contractor firms, especially non-unionized ones, provided less safety training, and that the widespread use of contract labour may well compromise safety. Second, Collinson (1999) reached a similar conclusion in his qualitative study of occupational safety in North Sea oil rigs. He showed that contingent workers are often treated less favourably than employees with fixed-term contracts, for example in terms of the quantity and quality of safety equipment available.

The Need for More Intervention Studies

To date, research has focused mostly on identifying those workplace factors and employee experiences that are associated with occupational safety. For example, Zohar (2000) shows convincingly that perceived safety climate is linked to a lower rate of micro-accidents. Similarly, Hofmann and Morgeson (1999) show that certain leader–member exchanges are associated with accidents. However, it would be premature

to assume that changing the safety climate or enhancing the quality of leader–member exchanges will necessarily result in higher levels of occupational safety. We conclude this section, therefore, by calling for well-designed intervention studies that apply existing knowledge from psychological research to enhance occupational safety.

SUMMARY

The state of occupational safety remains a major social and economic concern, yet psychologists have been remiss in not directing their energies, methodologies and talents at this issue. The literature that does exist suggests that a knowledge of traditional workplace approaches in the areas of leadership, human resources and ergonomics could be applied usefully to understand, predict and perhaps control occupational safety. In addition, special challenges in this field include the level of occupational safety experienced by young workers and contract workers. These present a research agenda in which psychologists could be involved for a long time to come.

RECOMMENDED READING

In *Normal Accidents: Living with High-Risk Technologies*, Perrow (1984) argues that, as a result of recent technological innovations, major accidents in the workplace may now be viewed as normal, and thus to be expected. Walker (1991) vividly portrays the safety hazards involved in a high-risk occupation in *Working on the Edge*, in which he tells the story of his seasonal work in the off-shore fishing industry.

An increasing number of web-sites are helpful in the area of this chapter. For example, *http://www.ccohs.ca/resources/www.html* (maintained by the Canadian Centre for Occupational Health and Safety), aims to promote occupational safety by providing information and advice, and permits an extensive internet search of occupational safety. *http://www.cdc.gov/niosh/homepage.html* (home page of the National Institute for Occupational Safety and Research in the USA) has the facility

for downloading recent articles on occupational safety and contains an extensive database for information on funding, training, special events and programmes. An extensive set of current and historical data pertaining to all aspects of occupational safety and health is available from *http://www.bls.gov* (web-site of the Bureau of Labor Statistics in the United States), which also provides access to articles from the journal *Monthly Labor Review*.

The British Health and Safety Executive can be accessed at *http://www.hse.gov.uk*. This site provides national information on legislation, training, research and practice, and describes the joint initiative on occupational safety between the European Union, United Kingdom and United States of America. *http://www.nohsc.gov.au* is the web-site of the National Occupational Health and Safety Commission in Australia. It is an excellent resource for information on research, training, legislation, practice and small business initiatives in Australia. Extensive national statistics and reports are provided.

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