Workplace Health and Quality of Life: International Surveys

TIME TO CALL IT QUITS? THE SAFETY AND HEALTH OF OLDER WORKERS

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The workforces of many countries are aging, creating pressure for older workers to retire later despite greater vulnerability to various occupational safety and health (OSH) risks. Some specific risks to older workers arise from age-related physical or psychological changes, while others reflect exposures to poor work organization or employment conditions. This article reviews evidence on the nature of the OSH risks faced by older workers, focusing on work ability, contingent work, and working hours. Work ability, the capacity to meet the physical, mental, and social demands of a job, has been linked to positive health outcomes for older workers. However, work characteristics seem to be more critical than workers' individual capacities. Contingent work is generally associated with poorer OSH outcomes, and older workers are more likely to be contingent, with special implications for their safety and health. There has been limited research on age and working hours, but risks for many physical and mental health problems are known to increase with shift work experience, and physiological and psychosocial changes associated with age may also increase injury risks. The authors discuss organizational practices and regulatory policies to protect and enhance the OSH of older workers.

Recent decades have seen substantial changes in the size and composition of the labor market in developed countries. In the United States during the period from 1950 to 1998, total labor force participation grew as more women and people of non-white origin entered the labor force (1). Conversely, the workforce participation of workers aged 45 or older declined significantly in many industrialized countries between the 1960s and 1990s (2). The U.S. Bureau of Labor

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Statistics projects that between 2006 and 2016, the number of jobs will increase by 10 percent but labor force participation will slow (3); essentially, there will be more jobs than people to fill them. If the labor force participation rate does not increase, the ratio of inactive to working persons will almost double by 2050. In Europe, this demographic change could mean that each working person financially supports one non-employed person (4), with substantial social and economic consequences. Predictably, greater attention is now being given to ways of increasing the labor force participation of older workers.[1]

The advent of a global financial crisis and severe recession in 2008 has led to significant falls in labor demand in most countries and associated increases in unemployment rates. Aside from the effects on self-funded retirement, one consequence of this recession could be to reduce policymakers' prioritization of labor market participation of older workers. This would be a mistake. Even if the recession is deep and prolonged (say, 8 to 10 years), its duration will still be shorter than the demographic trend that is predicted to produce workforce aging well into the middle of this century. The plundering of trained workers from poor countries by rich countries through migration and "guest worker" programs provides neither a sustainable and effective nor an ethical response to these changes (9). Consequently, most developed economies, and many developing ones, will still face the longer-term challenge of increasing the labor force participation of older workers. Recognition of this ongoing demographic imperative is reflected in decisions by the Australian and British governments to raise the age of eligibility for age pensions for men and women.

One strategy to address the problem presented by an aging labor force is to encourage older workers to stay in the workforce longer. The Organization for Economic Cooperation and Development (10) estimates that the removal of financial and non-financial "retirement incentives" could help raise effective retirement ages. Governments have taken action to remove mandatory retirement ages and early retirement benefits, although these steps primarily address the financial incentive to retire. There is also a pressing need to alleviate non-financial pressures to retire, particularly those arising from disability. Given that the most common reason for retirement before the age of 60 is disability (11), with low-wage earners more likely to exit the labor force through disability than voluntary retirement (12), maintaining the occupational safety and health (OSH) of older workers is a matter of economic and social, not just individual, concern.

[1] The term "older worker" is ill-defined. Some studies include workers as young as 36 in the "oldest" category (e.g., 5), while others include workers 45 and older (e.g., 6), and still others include workers 50 or 55 and older (e.g., 7, 8). The World Health Organization defines workers aged 55 and over as older workers, and this threshold is adopted here except where the available evidence is drawn from samples including younger workers, in which case the relevant age range is specified.

In parallel with the aging of the labor force there has been a marked rise in the prevalence of "nonstandard" or "contingent" work. Contingent work is defined as work that does not entail a permanent position with any one employer, consists of under 35 hours per week with any one employer, and is limited in duration (13). "Contingent" work is similar to other constructs, such as "flexible" and "precarious" work. In developed countries, such as the United States, Canada, Australia, and Spain, contingent work arrangements now account for between 30 and 40 percent of the workforce (14). Contingent workers have poorer health than non-contingent workers (15, 16), possibly because they have fewer opportunities to engage in dialogue about safety and health at work (5). They are also at greater risk for occupational injuries, but have lower sickness absence rates (17). Contingent workers are less likely than non-contingent workers to be covered by health insurance or to be eligible for employer-provided pension plans (18).

Given the relationship between employment status and OSH, contingent work represents a special problem for older workers. Many older workers prefer flexible and part-time work to a standard, 35-hour week (19), and 15 percent of contingent workers are over 55 years of age (18). Older workers are more likely than younger workers to be employed in alternative forms of employment, such as independent contracting and on-call work, and workers over 65 are more likely than any other age group to be working contingently. Thus, the trend toward contingent work and the increasing rate of older people in the labor force present specific challenges to OSH, though little is known about how these factors interrelate (11, 20, 21). Clearly, then, the relationships between age, OSH, and contingent work should be a research priority.

CURRENT KNOWLEDGE ON AGE AND OCCUPATIONAL SAFETY AND HEALTH

The relationship between age and OSH is complex. Aging is associated with a general decline in physical health, such as muscle strength, bone density, and aerobic capacity. However, the extent of the decline depends to a significant degree on individual factors such as lifestyle, body weight, fitness level, and genetics (22). For cognition, the relationship is complex, because some processes decline with age while others improve. For example, aging is associated with a reduction in the precision and speed of perceptual processes, but is also related to an increase in the control of language and the ability to process complex problems (23).

Older workers may be able to compensate for a reduced physical or mental capacity through acquired job experience and a more efficient utilization of resources, but this is only possible when job demands remain lower than overall work capacity, and when there is flexibility in job content (24). For many older workers, especially those in physically demanding jobs, this will not always

be the case. When injury at work does occur, older workers have a higher need for recovery (6), making them more susceptible to fatigue and other adverse symptoms that may exacerbate their risk of further injury.

Much of the research linking age to OSH has focused on the relatively objective and observable physical effects of work, such as injury. National labor statistics typically report physical injuries, such as bruises, burns, and amputations, rather than disease. The incidence of occupational disease is known to be higher in older workers (25), although this is partly due to the long latency of some diseases, such as pneumoconiosis and occupational cancers. For example, workers may be exposed to asbestos during their twenties or thirties, but the median age for diagnosis of malignant mesothelioma is 74 years (26).

There is also evidence that older workers are more susceptible to some occupational risks. Ritz (27) found that exposure to ionizing radiation among uranium-processing workers before the age of 40 had a marginal effect on mortality, but exposure after the age of 40 increased mortality two- to threefold for all cancers, all radiosensitive cancers, and lung cancers separately. Longitudinal studies such as Ritz's are important for determining the effect of occupational risks on health. They provide some control for the healthy worker effect, which is likely to increase among older workers.

Even less is known about long-term occupational risks for psychological health, such as anxiety and depression. However, there is some evidence that cognitive demands of the work environment experienced during the thirties can affect the onset of later-life neuropathology, such as Alzheimer's disease (28). The relationship between age and subjective well-being is also complex and somewhat counterintuitive. For example, older people generally report higher emotional well-being and have more effective cognitive strategies to regulate emotions (29), even though people tend to experience more responsibility and work overload as they mature (30). These effects may reflect age-related neurochemical changes that reduce the older person's ability to feel strong emotions (29), or they may be due to a shift in the way individuals cope as they mature. Older workers tend to use more recreational and rational coping strategies than younger workers, although the use of social support does not seem to change with age (30).

More is known about the relationship between age and injury. In comparison with younger workers, older workers experience a lower overall frequency of work-related injuries, but the injuries they do sustain tend to be more severe and are three times more likely to be fatal (31). There is contradictory evidence on the outcomes of work-related injury for older workers. Some studies report that older workers require more time off work to recover following an injury and have more disabling conditions than younger workers (31), but others find no differences between younger and older workers (32). Pransky and colleagues (7) report that older injured workers are more likely to work fewer hours after returning to work after injury, and are less likely to return to work, but they also found that older workers report fewer financial problems than younger workers

following injury. However, the relative financial resilience of older workers could be temporary, as the use of funds intended for retirement could lead to diminished quality of life in later years—a factor that cannot be measured effectively in cross-sectional surveys.

Type of occupation is the strongest predictor of occupational injury. Jobs that require heavy lifting, such as those of machine operators, mechanics, and laborers, carry greater risks of injury than professional jobs (33). However, service workers are also at greater risk of injury, which is worrying, given the projected growth of the service sector and simultaneous increase in the proportion of older workers (3). Greater numbers of older workers in industries with greater risks of injury is likely to generate substantial personal and economic costs. Falls from the same height are more prominent across all occupations for workers aged 65 and over, and are more likely to result in a fracture or fatality as people age. This means that relatively "safe" jobs for younger age groups can be more hazardous for older workers (31).

WORK ABILITY

The concept of "work ability" was developed in Finland during the 1980s and has emerged as a prominent focus for research on aging and work (see, e.g., 2, 23, 34, 35). It has been defined conceptually in terms of workers' capacity, at the time it is assessed and in the near future, to meet the physical, mental, and social demands of their jobs (2, 23). An underlying assumption is that work ability, productivity, health, and quality of life can be maintained at high levels as workers age, as long as appropriate interventions are implemented (35). Much of the research concentrates on aspects of work and health (see 34).

The key factors predicting work ability can be divided into four categories (35):

1. Work demands and the physical environment, including negative factors (associated with reduced work ability) such as poor work postures and excessive mental workload, and positive factors (associated with improved work ability) such as use of knowledge.
2. Work organization and the work community (the psychosocial work environment), including negative factors such as poor management and lack of autonomy, and a positive factor, utilization of work experience.
3. Health and functional capacity, including negative factors such as obesity, and positive factors such as physical exercise outside work.
4. Maintenance of work-related skills, including a negative factor, job retraining, and positive factors such as opportunities for development and influence at work.

Tuomi and colleagues (35) found that work ability was poorer among older workers doing physical work than those doing mental work, for both women and

men. Although the authors did not highlight gender differences, elsewhere it has been reported that women have significantly lower scores on the Work Ability Index (WAI) than men (36).

Work ability has been linked to various attitudinal, health, and organizational outcomes. Cross-sectional data have demonstrated positive associations between WAI scores and productivity, work quality, enjoyment of work, and life satisfaction. Work ability has also been associated with a lower interest in retirement (35). Examining the predictive power of WAI scores over 5 years, Tuomi and colleagues (35) reported that these scores best predicted "current work ability compared to lifetime best," "physical condition," and "perceived health." The scores predicted life satisfaction least effectively. Ilmarinen and Rantanen (2) reported that a third of 51-year-old workers with poor WAI scores developed a disability within 4 years, and 62.2 percent retired on a disability pension within 11 years.

Ilmarinen and Rantanen (2) proposed that interventions in each of the four domains noted above (work demands and the physical environment, work organization and the work community, health and functional capacity, maintenance of work-related skills) would enhance work ability. According to Tuomi and coauthors (35), however, work demands and the work environment have the strongest influence (explaining 28% of the variability in WAI scores), followed by work organization and the work community, while work-related skills and individual health and functional capacity were weaker predictors (with health and functional capacity explaining 13% of the variability in WAI scores). In the domain of work demands and physical environment, Tuomi et al. identified improvements in work postures, work tools, workplace temperature, and decision-making as the key targets for intervention. Ilmarinen and Rantanen emphasized the particular importance of decreasing physical workload. In relation to work organization and the work community, Tuomi et al. identified clarification of work roles and strategies to utilize work experience as crucial targets.

In relation to health and functional capacity, Tuomi et al. (35) recommended intervention focused on advising workers on weight control, giving guidance and support for physical activity, such as through workplace exercise programs (23), and encouraging artistic hobbies. Although regular exercise can keep physical capacity almost unchanged between the ages of 45 and 65, most older workers are not physically active during leisure time, and activity levels are lowest among blue-collar workers, who generally have the most physically demanding jobs (23). Regarding professional competence, Tuomi et al. recommended promotion of greater opportunities for development and training, both at work and during non-work time. While interventions in these two individual domains may well be beneficial, Ilmarinen and Rantanen (2) emphasized the critical importance of effective age-related interventions in the physical and psychosocial work environment if real changes in work ability are to be achieved.

Work ability is a promising construct, but it has limitations in relation to its definition, measurement, and the prediction of some outcomes. The construct has not been rigorously defined or operationalized and, consequently, the measurement qualities of the WAI have not been satisfactorily demonstrated. Clear definition would facilitate effective operationalization, which would, in turn, enable a thorough investigation of the reliability, validity, and dimensional structure of the WAI. Cultural differences in the distribution of scores and dimensionality could then be assessed. The present form of the WAI is prone to "ceiling effects," with the scores of many respondents clustering in the high range, at least in some populations. Costa and colleagues (36), for example, reported that 76.7 percent of their sample of health care workers—including shift workers, whose scores were relatively low—received WAI scores in the "excellent" or "good" range. Only 3.2 percent received poor scores. In addition, despite evidence of longitudinal relationships between work ability and important health and organizational outcomes, there is a problem of circularity in some predictive relationships. For example, the WAI contains health measures and is often used to predict health. Until these issues are resolved, no meaningful assessment is possible of how well "work ability" realizes its promise. However, it clearly warrants further investigation.

INSECURE AND CONTINGENT EMPLOYMENT

The occupational safety and health of older workers should not be examined without reference to the significant changes in business practices and work arrangements that have occurred globally over the past three decades—notably, repeated rounds of downsizing or outsourcing and the growth of temporary work and self-employment. An important consequence of these changes is that older workers are increasingly likely to hold temporary jobs or to be self-employed. The implications of these shifts have yet to be fully explored and warrant urgent attention.

One of the risk factors commonly associated with higher injury rates among younger workers is the inexperience linked to short job tenure, whereas the experience and longer tenure of older workers is seen as protective. However, these differences are likely to diminish as older workers suffer job displacement due to downsizing or take temporary jobs because of greater churning in the labor market. A Canadian study by Breslin and Smith (37) found that the injury risk associated with short job tenure was at least as high for older workers as for younger workers. This suggests that job-specific knowledge and experience rather than more general work experience is critical to OSH outcomes. Although older workers may still, on average, have longer job tenure than their younger counterparts, the shift to a more flexible labor market is likely to diminish the overall advantages that accrue from longer job tenure. Unfortunately, few studies of age differences in OSH outcomes have taken differences in job tenure into account.

The implications of labor market change are not confined to safety. Shorter average job tenure and labor market churning will also make it more difficult to identify and track occupational exposure to hazardous substances. This is almost certain to affect the recognition of occupational disease and consequent provision of workers' compensation to older workers with complex work histories—and such histories will become more common.

The growth of multiple jobholding adds further complexity. Recent evidence suggests that multiple jobholding is especially pronounced among fixed-term contract, temporary, part-time, and agency workers (38), and can have important but largely unrecognized implications for chronic injuries, exposure to hazardous substances, excessive work hours, and poor work–life balance. Recent studies have highlighted a growth of "portfolio" employment, which is strongly associated with multiple jobs, among older workers (39).

The growth of contingent work has also led to higher rates of non-reporting of injury and disease and has weakened the reliability of OSH statistics derived from workers' compensation and injury-notification systems. Reasons for this development include the growth of self-employment (where coverage is often not mandatory), ignorance and fear of reporting among temporary workers, poor reporting by small business, and manipulation of compensation premiums (15, 40). Again, this phenomenon has implications for the OSH of older workers, who increasingly occupy contingent jobs.

Job Insecurity

Given the paucity of empirical research examining the combined effects of age, OSH, and contingent work, an examination of related streams of research on job insecurity and working hours is instructive. Job insecurity is the "subjective experience of a fundamental and involuntary event" (41, p. 243), such as job loss, and is related to both safety and health outcomes. The nature of contingent work—namely, that it is not permanently associated with one employer, entails less than a 35-hour week with any one employer, and is limited in duration (13)—implies that contingent workers are likely to suffer greater job insecurity (42). Employees who perceive greater job insecurity are likely to exhibit decreased safety motivation and compliance, which in turn leads to higher levels of workplace injuries and accidents (43). The reason for this link is unclear, although it may be that employees perceiving greater job insecurity are less committed to the organization (44), and are therefore less motivated to perform safety behaviors. Alternatively, more-insecure workers may be more inclined to "cut corners" to maximize their production output, thereby increasing the risk of injury and accident. The negative effects of job insecurity, however, may to some extent be offset by age. Age is positively related to self-rated safety compliance and negatively related to both objective and self-rated frequency measures of work injuries (45). Nevertheless, the relationship between age and

safety compliance is weak ($r = 0.10$) and is unlikely to fully compensate for the effects of job insecurity for older workers.

Safety outcomes for contingent workers, particularly those on a temporary or casual contract, might entail missing out on training because it is conducted when they are not at work. Managers may believe that temporary or casual workers do not work sufficient hours, or are not expected to be employed for long enough, to "warrant" special scheduling of training to include these employees. Older employees may be at a further disadvantage by being given differential access to safety training: stereotyped beliefs persist that older workers are less ready to accept new technology, less adaptable to change, less able to learn new ideas, and less interested in training (46).

An extensive body of research now supports an association of downsizing, restructuring, and job insecurity with adverse psychological and physical health outcomes (15, 47, 48). There is evidence that the effects of job insecurity on health are even greater for older employees than for younger employees, although turnover is higher for younger employees (49). For example, a Swedish study (50) of repeated downsizing in the retailing industry found that older workers were more likely to experience adverse symptoms and long-term symptoms of distress. Other studies suggest that highly committed workers, who are more likely to be older, are more likely to report distress and negative attitudes in response to restructuring and job insecurity (51, 52).

There is a dual effect on health. On the one hand, older workers are often targeted for redundancy during downsizing, even though older workers have less job mobility and have commitments that make a move more difficult. The waves of downsizing in developed countries have contributed to a large-scale wastage of older and more experienced workers, who then vanish from the workforce or are reemployed in jobs that tend to be inferior to the ones they lost, in terms of employment (earnings, security, health, and pension entitlements), skills, and working conditions (53). Thus, as noted above, older workers may end up in "portfolio" careers of insecure temporary employment or self-employment (39). The conflict this form of employment creates with other health-related policy objectives—such as providing secure and adequate self-funded pensions and superannuation, minimizing chronic disability, prolonging work-force participation, or "healthy aging" programs—is seldom acknowledged, far less addressed (54).

On the other hand, those who "survive" restructuring may be assigned to new jobs or feel under pressure to work longer hours and not report health problems or take leave when ill. This may exacerbate the identified tendency of older workers to conserve sick leave as a cushion for serious illness (55). The consequences of these practices, however, are to increase the risk of onset of chronic illness and burnout (56). Therefore, the current climate of labor market flexibility and job insecurity poses a particular problem for the safety and health of older employees, both those who lose their jobs and those who "survive"

restructuring. There is an almost complete disconnection between attempts to develop policies that improve the work ability and the occupational health of older workers and, simultaneously, a failure to develop effective policies to address the increased work intensity and presenteeism (staying at work beyond "paid" hours and not taking sick leave) associated with downsizing. These outcomes of downsizing diminish the physical and psychological health of older workers and contribute to premature burnout among younger workers (57–59).

The available research demonstrates that job insecurity is a good predictor of occupational ill-health, although it does not comprehensively capture the concept of contingent work (60, 61). For example, some employees traditionally considered "contingent" (e.g., workers employed through a labor hiring agency) may not perceive significant job insecurity, especially if they are skilled and operating in a tight labor market. In this respect, the relationship between job insecurity and ill-health may actually be better described as a violation of the psychological contract, which leads to poorer safety and health outcomes (44). However, given that older workers are subject to stereotyped attitudes in the workplace, especially by younger workers (62), and that they are less likely than younger workers to be reemployed following displacement, the effects of job insecurity may provide a useful proxy when investigating occupational ill-health among contingently employed older workers.

Interestingly, contingent employment often has adverse effects on significant elements of the physical and psychosocial work environment components of work ability, such as autonomy, use of knowledge and experience, and job content. Another important link to contingent employment concerns aspects of work scheduling, particularly irregular hours.

Working Hours

Even though research on the health, sleep, and performance impact of working hours began more than 100 years ago, relatively little is known about how the effects vary with age. But there have been some valuable contributions to knowledge on this topic. Research on working hours, health, and safety also offers important insight into the effects of contingent work on older employees, because contingent workers are more likely to work irregular and undesirable hours (63).

There is now extensive evidence demonstrating that shift work and nonstandard hours are growing in prevalence and have adverse effects, particularly when night work is required (64–68). European data indicate that the prevalence of shift work with night work only diminishes slightly over the age of 45, and that 24 percent of men and 12 percent of women in this age group work nights. The negative impact of shift work has been recognized for some time (see, e.g., 69) and includes effects on physical health, mental health, physiological functioning, sleep, work performance, and family and social life. Night work conflicts with the circadian (daily) rhythms of most human physiological, behavioral, and

performance variables. Night shift requires work when most circadian rhythms are in an early-morning trough, between 2:00 a.m. and 6:00 a.m. It also requires daytime sleep, which is disrupted by circadian factors.

In addition to acute effects of this nature, circadian disruption may also have a longer-term impact on health. Shift work requiring night work has been linked to gastrointestinal and cardiovascular disease, psychosomatic complaints, and various forms of cancer (66, 68, 70–73). The World Health Organization International Agency for Research on Cancer Monograph Working Group (73) concluded that shift work involving circadian disruption is a group 2A carcinogen (probably carcinogenic to humans). Conversely, using data from a large, representative sample in Sweden, Akerstedt, Kecklund, and Johansson (74) found that shift work was unrelated to mortality among blue-collar workers and was associated with a significantly higher mortality rate only among female white-collar workers, for whom the prevalence of shift work was relatively low. However, the shift work category included many different work schedules, and the impact of schedules requiring night work could not be separately evaluated.

Researchers have only recently begun to examine how the effects of working hours vary with age and have yet to adequately disentangle the impact of working hours from other aspects of work, lifestyle, and aging. Aging is associated with changes in the form and synchronization of circadian rhythms and the speed of circadian adjustment to night work (68, 75). These changes seem to contribute to a curtailment of sleep after night shifts and a greater risk of sleep disorders among older shift workers (71). However, these age-related changes seem to enhance sleep before morning shifts (75).

Härmä and Ilmarinen (68) reviewed evidence on links between age and the gastrointestinal, cardiovascular, psychosomatic, and psychosocial health effects of shift work. In relation to gastrointestinal disorders, mean time between beginning shift work and the diagnosis of peptic ulcers is 5 to 6 years, but when all digestive disorders are included, the highest prevalence is among shift workers with the longest experience (23 to 40 years). Coronary heart disease is found to increase for the first 20 years of shift work exposure, after which its prevalence falls. A similar finding has been reported for depression. In relation to work and life issues, workers over 45 years of age may favor free time during weekday mornings and place less emphasis on free evenings and weekends. The extent to which the increased prevalence of disorders with age and experience reflects longer exposure or a greater susceptibility with age is unclear. Similarly, the impact of healthy worker effects and self-selection on these patterns of results is not well understood. The critical age for increasing intolerance to night work seems to be between 45 and 50 (71).

The degree of control that workers exert over work schedules can significantly affect the impact of shift work. Several studies in nursing (see 76–78) have illustrated the influence of control over the schedule, or over work tasks more generally, on work–life conflict and health. They also show that organizational

variables, such as support from supervisors and team climate, influence control. Greater work–life conflict is, in turn, associated with more physical and psychological symptoms, which predict poorer work-related attitudes. One aspect of control is the capacity to accurately predict work commitments for a reasonable period into the future. This predictability allows workers to organize their social and domestic lives more effectively. Unfortunately, the growth of contingent work has led to a marked expansion of irregular and unpredictable hours, which can be expected to have particularly negative effects on domestic and leisure activities and on work–life conflict more generally (68, 71).

Relatively little is currently known about the specific nature of the work–life conflict encountered by older workers or its effects on health. Research has demonstrated adverse effects of conflict on health, well-being, and social and domestic life (79), but has tended to focus on younger workers with dependent children. The work–life issues faced by older workers differ in potentially important ways from those confronted by their younger counterparts. One example is the tension between paid employment and simultaneous caring responsibilities for both dependent children and parents or older relatives. Primary carers have been found to have poorer physical, mental, and emotional health and substantially lower labor force participation than non-carers (80, 81). In Australia, the age groups most likely to receive carers' payments from the government are between 45 and 64 years, and carers in paid employment are significantly more likely to be dissatisfied with their level of face-to-face social contact, which is associated with poorer health status, than carers not in paid employment (81). Elsewhere, the dual role of caregiver and worker has also been found to have negative effects on mental health (82). The total time spent in employment and caring may leave very little time for social contact outside the household. The evidence suggests that older workers with caring responsibilities are disadvantaged in relation to work–life conflict and health, but more research on this issue is urgently needed.

Conversely, a recent study suggests that the interaction between work and family for older workers can be more positive than negative. Gordon, Whelan-Berry, and Hamilton (83) reported that older women made deliberate choices about their work and life responsibilities, and revised their definitions of success to incorporate more personal achievements, allowing them to balance work and family in more satisfying ways. This study did not measure health effects, however, focusing instead on work outcomes, such as job satisfaction and organizational commitment, which may be unrelated to health. Further, the participants often had well-established careers and seniority, with favorable access to paid time off work and flexible working hours. The experience of less privileged or contingently employed older workers is likely to be less positive.

Shift work and irregular working hours may have important effects on the work ability of older workers. Costa (84) reported the findings that, across a variety of work contexts, shift workers have lower work ability than day workers and that the effect is most pronounced among older workers. He attributes older

workers' reduced tolerance to shift and night work to four groups of factors: (*a*) changes in circadian rhythms; (*b*) "psycho-physical conditions," such as physical fitness and sleep efficiency; (*c*) working conditions, such as workloads; and (*d*) social conditions, such as commuting. Costa and colleagues (36) also found that the WAI scores of female shift workers in the health care sector deteriorated more markedly over time than those of their counterparts on day work. Ilmarinen and Rantanen (2) argued that the need for recovery time increases with age and the physical demands of work. Work schedules should therefore allow older workers to pause after peaks in workload to prevent cumulative fatigue. Flexible schedules that respond principally to the needs of the worker, rather than those of the employer, may be particularly important in reducing work–life conflict for older workers.

Unfortunately, evidence regarding the relationship between age and injury in shift work is very limited, and any tentative conclusions must rely on indirect evidence. Folkard recently reviewed the available evidence on this relationship and noted a "complete lack of studies that have directly examined the combined effects of age and shift work on occupational injuries and accidents" (20, p. 195). However, he concluded there is clear evidence that, irrespective of the worker's age, injury rates are higher on night shift and increase over successive night shifts more rapidly than over successive day shifts. Further, he noted evidence that, while injuries are less frequent among older workers, they tend to be more severe. Finally, he cited evidence from objective studies of physical and cognitive performance and sleepiness suggesting that older workers are less able to maintain performance, both over the course of a single night shift and over several successive night shifts. On the basis of this evidence, Folkard suggested that although it is as yet unproven, older workers might be subject to a greater risk of injuries and accidents on night shifts. He identified a "clear need" for quality epidemiological studies to examine the combined effects of aging and shift work and to separate the effects of aging alone from those arising from participation in shift work.

Costa (84) offers some specific recommendations for the management of shift workers over the age of 45: (*a*) night work should be limited or avoided; (*b*) permanent night work should be voluntary, and transfer to day work should be facilitated; (*c*) the worker should have greater scope to choose preferred shifts; (*d*) work load should be reduced; (*e*) working hours should be shortened; (*f*) rest pauses should be more frequent, and short naps should be allowed; (*g*) health checks should be more frequent (at least every 2 years); and (*h*) greater counseling and training on coping strategies should be provided. Unfortunately, while these recommendations are based in solid research on working hours, there is not a sufficient number of rigorous scientific studies to give confidence that all the recommendations would have the desired positive effect on the health of older workers or to identify the magnitude of those effects that do exist.

CONCLUSION

The aging of the workforce in developed countries has stimulated an expansion of research on the relationship between age and occupational safety and health. Although this body of research is still relatively new, it highlights several important issues that must be addressed if the workforce participation of older workers is to be managed responsibly.

As far as can be determined, current policies and practices to encourage greater labor force participation by older workers take virtually no account of the changes in the labor market, employment practices, and the nature of jobs that adversely affect the health, safety, and well-being of workers, especially older workers. More flexible work arrangements, such as "portfolio" and short-term employment, are often promoted as appropriate for older workers and may help in facilitating their continued engagement in paid work. However, to be successful, these arrangements require a related framework of regulation and policy to protect health and well-being. Unfortunately, ongoing processes of downsizing or restructuring in many organizations are likely to adversely affect the OSH of older workers to a greater degree than for their younger counterparts. Similarly, a continuing trend toward work intensification combined with longer and more irregular working hours is likely to have particularly negative effects on older workers. Yet, despite some limitations in its conceptualization and measurement, the "work ability" construct has potential to assist in finding a better accommodation between older workers and jobs. A particular strength is the focus that work ability places on physical work demands and the physical and psychosocial work environment, rather than focusing solely on the capacities of older workers to adapt to jobs.

Major challenges confronting research on older workers and OSH remain. As this article has demonstrated, more work is required to establish how aging affects OSH and how it interacts with factors such as job tenure, working hours and work intensity, and contingent employment. Caution is required when using official OSH and employment data, in view of their significant limitations such as underreporting and other reporting biases. More focused longitudinal and comparative studies are needed to systematically evaluate the relationships between aging, OSH, and relevant aspects of work organization. There is also a need to critically evaluate and refine key constructs such as work ability.

Finally, future research must also address serious disjunctions in the current policy debates surrounding workforce aging. If history is any guide, current concerns about the employment of older workers could rapidly diminish if economic instability leads to a rapid growth of unemployment. Providing a healthier workplace for older workers requires a longer-term and more critical, evidence-based perspective, rather than the knee-jerk "market-led" policies that have for some time dominated decision-making in most developed countries.

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