Between 1995 and 2005, the number of workers aged 55 or older will increase three times faster than employees in younger age groups. Consequently, the number of occupational injuries to older workers will grow. This article critically reviews the evidence for the relationship between the risk of occupational injuries and aging. Age-related differences in risk factors, outcomes, prevention, treatment and rehabilitation needs are discussed. Evidence is synthesized to provide recommendations for age-appropriate intervention strategies.

Keywords: **Occupational Health; Health Outcomes; Injuries; Aging; Rehabilitation**

Occupational Injuries and the Older Worker: Challenges in Research, Policy and Practice

Katy L. Benjamin, Ph.D., S.M., M.S.W.
Department of Family Medicine and Community Health
University of Massachusetts

Glenn Pransky, M.D., M.Occ. H.
Liberty Mutual Center for Disability Research

Occupational Injuries and Changing Workplace Demographics

Over the next decade and on into the 21st century, the demographics of the workforce in industrialized nations will change dramatically. In the U.S. alone, between 1995 and 2005, the proportion of workers over 55 is projected to increase almost three times as fast as the number of workers in other age groups. Estimates are that 15% of all U.S. workers will be over age 54 in the year 2005 (National Occupational Research Agenda, 1996; Riche, 1990; U.S. Department of Labor, Bureau of Labor Statistics, 1996). Moreover, these older workers can be expected to live longer, and are expected to spend more years in the workforce (Hayward, Grady, & McLaughlin, 1988), more years of healthy life (Shrey & Hursh, 1995), and face increasing restrictions on retirement benefits (U.S. Congress, 1984).

Although, in recent years, there has been a greater interest in finding methods of maintaining older workers in the workforce, little attention has been given to the issues of work injuries and illnesses in this group. Detailed information about the possible long-term health, economic, and social consequences unique to this population is lacking. The important influences on return-to-work decisions in older work-injured individuals are complex and may differ from those operating in return-to-work decisions of younger persons. Little is known about the most effective methods of prevention, rehabilitation and reinjury avoidance for this group (DeZwart, Frings-Dresen, & VanDijk, 1995). Better knowledge in this area will become increasingly necessary as the workforce ages (Ilmarinen, 1997). In this article, we review the state of knowledge in this area and present suggestions for specific interventions for older workers with occupational injuries.

Aging and Work Capacity

The effects of aging on physical and mental functioning are well established. These changes include alterations to the musculoskeletal, cardiovascular, sensory and cognitive capacities (DeZwart et al, 1995; Ilmarinen, 1997; Thomas, Browning, & Greenwood, 1994; Shephard, 1995; Wegman, 1999; Garg, 1991). However, assuming that these declines result in work capacity limitations is problematic. Much of the evidence for age-related changes in function may not apply to older workers. Many of these studies have been conducted within laboratory settings, or focus on the very old, and may have limited validity in working populations, who by and large are not elderly (Wegman, 1999). Few studies have compared older and younger individuals on parameters related to work tasks. Even less is known about the effects of aging in middle-aged populations (those

40-64) who comprise the bulk of the working "old" (Lancet, 1993). Thus, much of what is known about the aging process may not be generalizable to occupational contexts (DeZwart et al, 1995; Thomas, Browning, & Greenwood 1994; Wegman, 1999; Lancet, 1993).

Furthermore, there are a number of intervening variables in the relationship between aging and work capacity that may significantly amplify or temper the effects of growing older on the ability to perform one's job. As was pointed out by Chirikos and Nestel (1989), work incapacity and health problems are not always well correlated; many workers with physical limitations remain on the job. This may be particularly true for older individuals (Garg, 1991). Functional decline due to aging may be at least partially compensated for by the development of strategies to improve efficiency and by the advantages of both experience and expertise. For example, a study of typists found that although younger subjects typed faster, older individuals had altered their eye movements in such a way that they spent less time scanning a document to be typed. Consequently, there was no age-related difference in time to task completion (Salthouse, 1997).

Risk of Injury in Older Workers: Is it Higher?

The risk of occupational injuries decreases with age (Kotulak, 1990). One possible explanation for this is the "healthy worker effect," wherein all those who have limitations in work capacity prematurely select out of high-risk jobs or withdraw from the workforce (Holden, 1988; Mtchell, 1990). Other factors that may contribute to the observed lower rates of work injuries in older populations include experience, more senior and less physically demanding positions, better safety behavior and more available leave or sick time (Garg, 1991; Rix, 1990). The lesser rate of work injury could also be due to a reporting bias. Rather than assign an occupational etiology to their patient's complaints, providers may ascribe symptoms in older individuals to the normal aging process or to age-associated chronic conditions.

Further complicating this picture, health complaints in older individuals are not strongly related to complaints about work (Broerson, deZwart, vanDijk, Meijman, van Veldhoven, 1996). When injury does occur, there is a significantly higher risk of a work-related fatality in older workers. This increase in risk is concentrated in the upper age ranges, especially those aged 65 or older (Personick & Windau, 1995; Weeks, Levy, & Wagner, 1991; Mitchell, 1988; Kisner & Pratt, 1997; Personick & Windau, 1995).

Risk of Disability

Duration of disability after a work injury has been found to be longer for older workers, and rates of permanent disability following injury are much higher (Personick & Windau, 1995; Weeks, Levy, & Wagner, 1991; Kisner, 1991; Doering, Rhodes, & Schuster, 1983; Barkin, 1933; Kossoris, 1940). It does not appear that this longer duration of disability can be accounted for by age-related differences in occupation, industry, events or exposures resulting in injuries, or sources of injury (e.g., hard surfaces, machinery or equipment, or worker motions and positions) (Laflamme & Menckel, 1995; Landen & Hendricks, 1992). To account for this finding, Personick and Windau (1995) hypothesized that older workers were at higher risk for injuries that necessitate a longer recuperation period, such as fractures or multiple injuries. However, they did not test this theory, and a comparison of their data with data on injury type for U.S. workers overall (Weeks, Levy, & Wagner, 1991) does not reveal any clearly significant variation in injury type by age. For example, fractures for workers as a whole in 1986 accounted for 9% of all injury types, versus 11% in those aged 55 or older observed in the Personick and Windau study. Multiple body part injuries occurred in 8% of all cases versus 5% of older workers.

The most commonly cited reason for the differences in duration of disability between older and younger workers is the lesser recuperative powers of older people (Personick & Windau, 1995; Doering, Rhodes, & Schuster, 1983; Nicholson, 1995). Not only does it take longer for an injury to heal, but the healing may be incomplete, leading to more residual effects of the injury and reducing the capacity to work, either temporarily or permanently. Chirikos and Nestel (1989), for example, found that working older men who became disabled were much more likely than healthy workers to retire, or to be-

come permanently disabled if they did not retire. Hester, Decelles, and Faimon (1987) found that 99% of all permanently disabled workers sustained their condition after age 45, indicating that older workers are less able to recuperate sufficiently to return to work if they are injured.

Older workers are also more likely to suffer from co-morbidities that complicate the clinical course of recovery from their injuries. The incidence and prevalence of chronic diseases rises sharply after age 45 (Kotulak, 1990), as does disability due to these conditions (Berkowitz, 1988; Institute of Medicine, 1991). These comorbidities may affect the risk of injury and disability. Comorbidities may also complicate the diagnosis and treatment of occupational injuries in older workers, leading to an increased risk of poor recognition of work-relatedness and inappropriate treatment of such conditions in older patients.

Employer attitudes and policies may also contribute to a social environment conducive to prolonged work disability. Perceptions of older people as less able, less adaptable, more prone to illness, and possessing fewer remaining years of work life are common in both general society and in job settings (Shrey & Hursh, 1995). Once disabled, older workers are often perceived to be less amenable to successful rehabilitation (Lerman & Ribak, 1997), leading to fewer attempts to provide this service (Bornstein, 1986).

Occupationally injured employees, in general, are sometimes viewed by their employers as less stable (Bigos, Battie, Spengler, Fisher, Fordyce, Hansson, Nachemson, & Wortley, 1990). This, in combination with age biases, implies a "double jeopardy" situation for work-injured older employees.

Employers may be less willing to offer accommodations or job modifications that would return these workers to their jobs, especially if these changes are different from those routinely made for younger workers (Crown, Mutschler, Leavitt, 1987). As a result, it may be more difficult for older workers to re-enter the workforce after suffering from a work-related condition.

Given the apparent increased severity of injuries to older workers, and the lengthier, more complicated healing process, these individuals may not return to pre-injury levels of function. If older workers perceive themselves as unable to effectively perform their jobs, there is a decreased probability that they will return to the workforce after suffering an injury or illness, whether or not the condition is work-related (Ruhm, 1989). When an injury or illness is work-related, it can be hypothesized that the individual could construe the event as evidence of his or her inability to function effectively in the workplace. Thus, older workers with occupational conditions may be even less likely to attempt a return to the same job, especially if the employer does not offer appropriate accommodations (Moon & Juster, 1995).

Policies regarding retirement and disability benefits are often structured to encourage the withdrawal of older individuals from the workforce. Anti-discrimination laws may actually foster such ageism in benefits structures. A recent publication recommended that, in order to be able to access pension benefits for older employees more easily, an employer who "cares for its relatively elderly population of employees" should make "more liberal" use of the total disability for work designation. Such a strategy was recommended so that employers "would not find [themselves] with a weighty segment of nonproductive disabled workers who have to be paid despite the fact that no alternative jobs are available..." (Lerman & Ribak, 1997).

Consequences of Occupational Injuries

The consequences of withdrawing from the workforce can be harsh for older workers, especially younger "old" workers who opt to retire before full pension and other benefits can be accessed. A long-term health problem beginning at age 55 has been estimated to decrease the average age of full retirement by almost 3 years (Shapiro & Sandell, 1985; Gustman, Mitchell, & Steinmeir, 1995).

Financial status may be significantly worse for these individuals. In one study, early retirees who left the workforce involuntarily were found to be disproportionately represented among workers with low wealth (Hausman & Paquette, 1987). Poor health has been found to be more closely related to economic well being than early retirement alone (Quinn & Burkhauser, 1990). The median income ofworkers

who retired due to a partial or total work limitation has been estimated to be about 25% lower than that of people who retired in good health (Social Security Administration, 1986). For those who do not retire, but are unable to perform their former jobs, workers' compensation benefits may cease before a new job is found. In this situation, unemployment wage replacement and medical care benefits may be inadequate to meet the older individual's ongoing needs.

Involuntary unemployment at any age has been linked to increased depression and anxiety (Warr & Jackson, 1987). Older individuals who have involuntarily retired report lower levels of physical and social well-being than those persons who have voluntarily retired (Herzog, House, & Morgan, 1991). Rushlin and Morris also (1991) observed a self-reported quality of life rating 3.5 times higher for employed subjects aged $\geq$60 than unemployed persons of the same age. Thus, the increased risk of lengthy or permanent disability in older workers with an occupationally-related illness or injury implies that these individuals may have poorer quality of life or more emotional problems than younger workers or their healthy, employed contemporaries.

Where these employees can find alternative work, the salary and benefits may not be commensurate with their former job (U.S. Congress, 1986). Even without a health condition, it is known that older workers who must find new jobs after such events as plant closings or downsizing generally do not regain employment with comparable wages, benefits, or seniority levels (Shapiro & Sandell, 1985; Hutchens, 1988). Those with occupationally related health conditions are even less likely to find jobs comparable in wages and benefits to their former employment, especially when they can no longer do their former jobs. These workers may be forced to find jobs where they have less experience and therefore less seniority.

Statistics do not capture those who become discouraged and leave the workforce, yet are too young and not ill enough to qualify for retirement or disability benefits (Flaim & Sehgal, 1985). Some older workers who cannot return to their former full-time jobs may find part-time employment, also leading to injury-related adverse economic consequences (Polivka & Nardone, 1989). Studies show that few older workers in part-time positions are employed in the same occupation or industry in which they have spent the majority of their full-time careers (Golden, 1992). Thus, hourly wages may not reflect actual work experience. Part-time jobs often do not include health care and pension benefits, further reducing the financial status of these workers. This is of particular concern where injury related long-term health problems persist (Burtless, 1987). Furthermore, length of experience on a job may be protective against a work injury (Personick & Windau 1995). Where the older worker takes on a new job dissimilar to his or her former occupation, whether full- or part-time, lack of experience on the job may put them at greater risk of sustaining another occupational health problem.

Some older workers with occupationally related injuries or illnesses, particularly those who are not old enough to receive Medicare and full retirement benefits, will remain on the job due to their increased need for health care benefits available only through their employer. Thus, the onset of a health problem may actually increase the amount of time a person must remain in the workforce (Honig, 1996). The continuing health problems and residual impairment of these workers may lead to reinjury or new, more serious injuries, lower productivity, and more long-term functional limitations, both on and off the job. Younger "old" workers (aged 50-64) are most at-risk for such outcomes as they are less likely to be able to retire with full wage replacement and medical care benefits.

The consequences of occupational injuries to older women may be especially severe. As a group, women are disadvantaged because of lower earnings, less seniority, and less diversity of job skills (Herz, 1988; Nuccio, 1989), usually because of a period of absence from the workforce while rearing children. Many women reenter the workforce in part-time jobs with no health or retirement benefits (Quinn & Kozy, 1996). The lesser job experience and smaller physical capacity of most women (Nygård, Huutanen, Tuomi, & Martikainen, 1997) suggest that they may be at greater risk of suffering a work-related condition. Certain age related comorbidities more common in women, such as os-

teoporosis, could also put them at increased risk of occupational injury or disablement (Lewis, 1997). The result may be an even greater susceptibility to the adverse consequences of a work injury, including prolonged disability and poverty (Mowsesian, 1986). At the same time, many women, especially those who are single and/or have children to support, can ill-afford to stop working. Women in this situation may therefore continue to aggravate their health problem or increase their risk of incurring another occupational injury or illness.

Interventions for Prevention and Treatment of Occupational Disorders in Older Workers

Workplace interventions

A number of interventions and job modifications have been recommended in order to maintain older workers in the workforce (Abraham & Hansson, 1995; Crecy, 1987; Jessup & Greenberg, 1989; Welford, 1988). Though untested in this context, these recommendations may be applicable to workers who suffer occupational injuries. Many programs are geared towards primary prevention of health problems in older employees. Others focus on retention of these individuals in the workplace after they have experienced a health problem. Brief descriptions of these interventions follow.

Health promotion/wellness programs have generally focused on maintaining functional status through the strengthening of physical capacity or the improvement of health related behaviors. The rate of deterioration in muscular and cardiopulmonary endurance increases significantly after age 50 (World Health Organization, 1993; Chaffin, Herrin, & Keyserling, 1978). However, physically fit older individuals have been shown to maintain strength or delay significant decreases in capacity (Suurnakki, Nygård, & Ilmarinen, 1991). Thus, interventions have been designed to maintain or improve physical fitness in older workers (Ilmarinen, 1997; Shephard, 1995). For example, the FinnAge: Respect for the Aging program includes an aerobic exercise intervention that has been shown to prevent declines in central nervous system functions. This program has resulted in long-term improvements in work abilities, productivity and quality of life (Bashore, 1990; Millar, Dybing, &Hogstedt, 1995).

The benefits from these programs can also include enhanced mental acuity (Suurnakki, Nygård, & Ilmarinen, 1991) and better self-perceived health (Leino & Hänninen, 1993). Physical exercise programs have been associated with better self-perceived work ability in older individuals (Tuomi, Ilmarinen, Seitsamo, Huutnanen, Martkainen, Nygård, & Klockars, 1997). Targeting such programs towards older individuals with occupational conditions may facilitate a return to the job by increasing self-confidence in functional capacities. Further, a period of continuous inactivity in older individuals has been found to be related to increased health problems and greater risk of injury when normal activities are resumed (Chaffin & Ashton-Miller, 1991). If the worker has sustained an occupational injury resulting in restrictions on physical activity, exercise programs may decrease the risk of ongoing difficulties. However, any physical fitness programs for older workers must be accompanied by careful medical evaluation and subsequent adaptation to functional capacities when offered to injured employees (Chaffin & Ashton-Miller, 1991).

Wellness programs that focus on behavioral change such as smoking cessation or better nutrition (Pfeiffer, 1993) may also have some relevance to older workers at-risk for occupational injuries. These interventions can reduce factors commonly associated with chronic disorders that can impact upon job performance such as reduced pulmonary function, obesity or cardiovascular disease (Wegman, 1999). The Petro-Canada Heart Health program, for example, has found that cholesterol screening and early intervention results in a high return on investment for older workers (Morgan & Dyck, 1995). As in non-work related wellness programs, those most in need are often least likely to participate; this has been found to be especially true for older workers (Wegman, 1999; Alexy, 1991). It may be particularly difficult to motivate and sustain participation in older employees at high risk for work injuries, especially if they already suffer from a work limiting condition. Thus, new strategies need to be developed to ensure successful recruitment and retention of this population.

Many occupational injuries are the consequence not just of unsafe worker practices but also unsafe workplace conditions (Feyer, Williamson, & Cairns,

1997; UAW, 1999). Ergonomic modifications specific to older workers have been proposed to lessen work strain. These include improved illumination to compensate for lower visual acuity (Thomas, Browning, & Greenwood, 1994); slower and self-paced work, minimization of low-frequency vibration, decreased repetitive motion in job tasks, elimination of prolonged static postures, and seating or work stations that can be adjusted to individual anthropometry (Chaffin & Ashton-Miller, 1991). It has also been suggested that technical advances in assistive devices used in optimizing the productivity of "handicapped" workers may also help older individuals compensate for sensory or physical limitations (Robertson & Tracy, 1998). The use of these strategies for returning work injured older individuals to their jobs has not been explored.

The social aspect of the workplace environment has been shown to be especially important in the successful job retention and performance of older workers. Rodin (1986) found that, in a population of older workers, increased job autonomy and self-direction resulted in higher job satisfaction, better job performance and increased psychological well being. Job satisfaction and motivation have also been linked to better work performance in older individuals (UAW, 1999). Older workers may be particularly sensitive to the effects of repetitive, unstimulating jobs, which have been shown to result in lower productivity in this population (Czja & Sharit, 1993). Programs aimed at retaining or reintegrating older individuals through part-time or transitional employment must consider these factors; placement in low-skill, repetitive jobs may be more likely to lead to failure.

Numerous studies have suggested a relationship between stressful workplace settings and poor self-perceived work capacity in older individuals (Nygård, Huutanen, Tuomi, & Martikainen, 1997; Leino & Hanninen, 1993; Feyer, Williamson, & Cairns, 1997; Rosow, 1990). Such stress results from time pressures, unsupportive supervision, and work-related role conflicts (Nygård et al, 1997; Suurnakki, Nygård, & Ilmarinen, 1991). Recent research on the biochemical basis of stress reactions has found a relationship between the elevated cortisol levels produced in physically or mentally stressful situations and short-term memory deficits (Newcomer, Selke, Melson, Hershey, Craft, Richards, & Alderson, 1999). Thus, efforts to reduce stress in the workplace or stress reduction programs may not only improve self-perceived work capacity in older employees but also reduce memory problems usually thought to be an unavoidable part of aging.

Clearly, programs aimed at returning work-injured older employees to the job need to evaluate and address the social dimensions of the workplace as well as those related to the physical plant. Accommodations necessary to successfully return such individuals to work may well have to encompass changes in supervision, work groups and reductions in time pressures or work load. Increased flexibility in the methods or order of task performance may also be important. Where appropriate, stress reduction programs should also be considered in the rehabilitation strategy.

Informal accommodations may be particularly important for older workers with functional limitations (Lusa, Louhevarra, & Kinnunen, 1994; Daly & Bound, 1996; Ekerdt & DeViney, 1993). The injured workers and their colleagues make such accommodations themselves, without explicit directives from their employer or supervisors. Examples include ensuring that younger employees always lift heavier loads, or coworkers who voluntarily fill in for colleagues whose physical condition necessitates more frequent breaks. Such accommodations can address both the physical and social changes in the workplace necessary to successfully reintegrate older workers with occupational injuries. They may be particularly cost-effective because they do not require changes in policy or the physical plant. Employers should be encouraged to provide opportunities and sanctions for such informal ways of helping work-injured older individuals to perform their jobs.

Rehabilitation Programs

Rehabilitation efforts aimed at returning the occupationally injured older worker to the job should be carefully tailored to the specific needs of this population. There has been no study or program focused specifically on effective rehabilitation strategies for this group. However, the published literature on rehabilitating older persons with non-work related dis-

abilities or long-term unemployment describes several potentially useful strategies.

Much work has been done in the area of cardiac rehabilitation, and the relative older age of those undergoing cardiovascular procedures argues for the generalization of many of these results to senior workers with occupational injuries. Mital and Shrey (1996) have identified a number of factors in the effective work rehabilitation of these patients. The overarching feature of these programs is the emphasis on restoring work capacity, as opposed to improving general functional status. The frequent observation that improvements in functional status and symptoms did not always result in a return to work after cardiac rehabilitation led to a recommendation to specifically match rehabilitation of patient capacities specifically to job demands. Thus, treatments should be geared closely to work functions by such methods as job simulation. Mital and Shrey also advocate employer-based disability management programs where the bulk of rehabilitation activities take place in the work setting. This can reestablish the employer-employee "bond" and help the individual reestablish a "worker" identity as opposed to that of a "patient" or "disabled" person.

One common source of stress for senior workers is the lack of appropriate updated skills needed in the rapidly changing workplace (Ilmarinen, 1996; Rantanen, 1999). This implies that an important component of successful rehabilitation in older workers with occupational injuries is retraining and updating of skills needed to confidently return to work. Studies have shown that retraining programs for older workers have best results when they enhance familiarity with new skills by building upon the transferability of established competencies, thus reducing the stress of learning new information (Sterns & Doverspike, 1988).

Unlike rehabilitation programs aimed at returning younger workers to their jobs, effective services for older workers must address a wide range of social and cognitive, as well as physical, issues. Job development and skills assessment facilities are often required to find appropriate employment opportunities. Peer social support in the form of job groups or classes specifically geared toward older individuals has been found useful (Bornstein, 1986). The style and format of training to update job skills or to teach strategies to compensate for work-related deficits also must be tailored to this age group. For example, older people may require more time to master new information, necessitating a longer period of rehabilitation (Lusa, Louhevarra, & Kinnunen, 1994).

Traditional rehabilitation programs have not been geared to the needs and capacities of older individuals (Wegman, 1999; Bornstein, 1986). This may reflect not just the view that older workers are less able to be "rehabilitated," but may be a consequence of older workers' perceptions of themselves as unable to successfully regain work competency (Bornstein, 1986; Bartel & Sicherman, 1993; Cleveland & Shore, 1992). Some studies contradict these fears, demonstrating that older workers can have a sense of greater possibilities for job development than younger employees (Nygård et al, 1997). Perhaps the reason for older workers' reluctance to participate in job rehabilitation programs is not their perceived capabilities so much as pessimism that their participation will result in a good job (Brady, 1987; Brodsky & Epstein, 1996). Employers as well as employees need to be reassured that rehabilitating the older worker will have a positive payoff in that the resources spent will be recouped by significant increases in the workers' job tenure and productivity.

Medical care

Medical care of occupational conditions in older patients can be complicated by the presence of other, age-related co-morbidities. Apportionment of the cause to work factors may be more difficult due to pre-existing chronic conditions, increasing the risk of inaccurate diagnosis and inappropriate treatment in older patients who present with an occupationally related complaint. Unfortunately, most medical diagnosis and care is not focused upon improving function related to work (Engleberg, 1994) and this limitation may be even more prevalent in the treatment of older patients. This is problematic when therapies used to improve the patient's general functioning result in decreased occupational function. Also, older persons may be more at-risk for adverse reactions to medications, which may lead to an occupational injury or prevent a return to full productivity after an

injury event. Recognition of occupational etiology is not just important for proper treatment, but also for determination of benefits eligibility. Inaccurate recognition of etiology can mean ineligibility for disability or workers' compensation benefits, with attendant financial hardship. Furthermore, questionable assignment of cause can lead to an increase in adversarial actions on the part of the patient, in order to obtain these benefits (Engleberg, 1994).

The higher incidence of chronic disorders in older individuals implies that the care for older patients with work related health problems might be fragmented. They may see their primary care doctor for treatment of other conditions and a specialist or provider mandated by their employer for their occupational illness. Given this, it is particularly important for providers to communicate with each other in order to avoid inadvertent drug interactions or other conflicts in care. Ongoing provider-employer communication systems are especially important with older workers. This will ensure rapid identification of problems, monitoring of treatment effectiveness, and the appropriate management of work capacity expectations of both the employer and the worker (Weisel, Boden, & Feffer, 1994).

A good model of such an integrated system of provider-employer communication and disability management is the Minnesota Health Partnership

TABLE 1. Modifiable Factors, Interventions and Outcomes Related to Occupational Injuries in Older Workers.

FACTOR	INTERVENTION	OUTCOME
Injury Characteristics		
- Greater severity - Work-relatedness less clear - Under-reported due to work ethic or fear of employer response	- Remove from high-risk jobs - Improve differential diagnosis via provider education - Employer education to reduce ageism	- Earlier, more appropriate medical intervention - Fewer injuries - Less sever injuries - Shorter disability duration
Job Characteristics		
- High physical demands - Poor decision latitude - Role conflicts at work - Limited advancement opportunities - High stress - Ageism - Poor job/worker fit	- Ergonomic job redisign - Increased job task control - Transfer to jobs where experience counts - Flexible work schedules - Employer education	- Longer retention in workforce - Fewer work injuries - Shorter disability
Worker Characteristics		
- Decreased physical capacity - Cognitive changes - More chronic disease - Higher job satisfaction - Less likely to complain if injured - General knowledge updates needed	- Place in jobs where accuracy more important than speed - Flexible breaks, order of job tasks - Wellness programs - Job skill updates	- Fewer work injuries - Maintenance, increase in productivity - Higher work self-efficacy - Slower deterioration of physical & cognitive capacities - Prevention, earlier recognition of conditions that may lead to work disability
Treatment Characteristics		
- Disconnect of health care, occupational health care systems - Age-appropriate rehabilitation strategies lacking - Access to rehabilitation poor - Employer-provider communication weak - Benefits programs not tailored to the needs of work-injured senior employees	- System redesign to facilitate communication between providers, providers & employers - Include gerontology experts in work rehabilitation program design - Increase access to rehab. programs - Flexible benefits programs	- Better coordination of services - Treatment more successful at RTW, job retention - Decreased residual disability - Better employer under standing, expectations of worker abilities - Less financial stress associated with involuntary retirement

(State of Minnesota, 1999), wherein the employee's primary care physician provides care for both occupational and non-occupational conditions. An ongoing health assessment and treatment plan is developed by the provider in conjunction with the patient. This plan is reviewed by the employer to aid in the design of appropriate job accommodations or modifications. Although not focused on older workers, such a system addresses many of the medical management and communication issues discussed above.

In addition to providing care appropriate for returning an individual to work, medical providers may be key players in a patient's decision regarding whether or not to leave the workforce after an occupational health problem has occurred. Provider understanding of when to support retirement as well as when to encourage return to work may be important in reducing the emotional impact of this decision for the patient. It may also help in obtaining the financial benefits necessary to replace lost wages.

Table 1 summarizes the factors affecting occupational injury and work disability in older workers, potential interventions designed to address these factors, and potential outcomes affected by these interventions. It should be noted that the prevalence of the factors, the effectiveness of the suggested interventions, and the relationship of the interventions to the specified outcomes is entirely theoretical. This model should be used as a basis for exploring the association between these variables so that effective methods for maintaining older employees, with and without occupational injuries, in the workforce can be designed and implemented.

Benefits design

Finally, where a return to work is not possible after an occupational injury, appropriate benefits design is of great concern. Much has been written about the interaction of health status and economic factors in the decision to retire or to accept disability payments in lieu of retirement benefits (Baily, 1987; Burkhauser & Daly, 1996; Sandell, 1987; Burtless, 1987). The consensus is that, in situations where the retirement benefit age is raised, persons with health–related work limitations often must continue working beyond their preferential retirement age. Alternatively, they will use disability programs as sources of wage transfer. To address these concerns, it has been suggested that disability benefit programs become an explicit part of retirement programs (Baily, 1987). Another common recommendation is the creation of several different age minimums for benefits eligibility, dependent upon health status (Sandell, 1987; Burtless, 1987; Espenshade, 1987). Due to the etiology of their condition, individuals with work injuries are disproportionately affected by such changes in the benefits structure. Those with an occupationally related disability may be less likely to be able to perform their normal full-time job than are employees with non-work related conditions. These individuals may therefore need to retire before they can access their full benefits, putting them at increased risk for financial hardship.

Conclusion

Little is known about the outcomes of occupational injuries and illnesses in older workers. While employers, benefits managers and policy makers are increasingly aware of the present and future growth of this segment of the workforce, they have not yet focused upon this issue. They may be influenced by the common research finding that older workers are no more at-risk for occupational injuries than their younger colleagues, and are therefore not a problem worthy of separate consideration. However, as the minimum age for retirement benefits rises and Social Security wage replacement value falls, increasing numbers of older workers with health problems will remain in the workforce. Even if the "healthy worker" phenomenon is maintained, the greater number of older workers in the labor pool implies that there will be more occupational health problems in this age group.

The preservation of work function is particularly important in older individuals, whose lessened recuperative powers are more likely to lead to permanent loss of these abilities unless they receive treatment specific to their occupational conditions. Such treatment programs often must be tailored to the needs and capacities of older individuals (Bornstein, 1986).

Better understanding of the factors influencing the outcomes of occupational injuries is needed, along with clear standards of treatment and rehabilitation.

Policies and regulations are needed to successfully maintain the older work-injured employee in the workforce or, where this is no longer possible, to provide fair and adequate benefits. Only when the risks, outcomes and stakeholder preferences are more clearly understood can this growing segment of society enjoy the benefits of and be adequately protected from the adverse effects of prolonging work life.

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