Chapter 24

Occupational Health and Safety Risks for the Aging Worker

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24.1 Introduction

The US population is aging, and so is the US workforce. This is being driven by factors beyond demographics; faced with longer life expectancy, economic uncertainty, and the uncertain future of retirement funding mechanisms such as Social Security and employer pension plans, many people want to work longer. Challenged by shortages of qualified workers, many employers also want to keep experienced workers on the job longer. Thus, it is in

Disclaimer: The findings and conclusions presented in this chapter are those of the authors and do not necessarily reflect the views of the National Institute for Occupational Safety and Health.

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the interest of workers, employers, and the nation to optimize the chance that workers remain healthy, safe, and productive as they age. It is increasingly accepted that the best way to achieve this goal is through a multigenerational, multifaceted approach that protects workers from occupational hazards causing illness and injury, promotes behaviors that improve health and well-being, and facilitates better quality of life and continued productivity through adoption of "age friendly" workplace programs and policies. Thus, anticipating and addressing the challenges of an aging workforce is an important current need.

24.2 Trends in Workforce Demographics

A recent review of projected trends through 2020 documents that there will be a decreasing proportion of younger workers and an increasing proportion of older workers in the US workforce [1] (Fig. 24.1). A factor in the decline of the youth labor force, aged 16 to 24 years, is increasing school attendance, perhaps related to current economic difficulties, which is leading to increased competition from other age groups for the entry level jobs where younger workers are commonly employed. Numbers were 22.5 million (17.9% of the workforce) in 1990; 22.5 million (15.8%) in 2000; 20.9 million (13.6%) in 2010; and projected to fall to 18.3 million (11.2%) in 2020. Prime-age workers, 25 to 54 years, were 88.3 million (70.2% of the workforce) in 1990; 101.4 million (71.1%) in 2000; 102.9 million (66.9%) in 2010; and are projected to be 104.6 million (63.7%) in 2020. In contrast, the 55-year-and-older age group is projected to grow far more substantially in numbers and in proportion than other workforce age groups. The aging of the baby-boom generation, born 1946–1964, is an important factor. In 2020, the youngest of this generation will be 56. Numbers in the 55-year-and-older workforce age group were 15.0 million (11.9% of the workforce) in 1990; 18.7 million (13.1%) in 2000; 30.0 million (19.5%) in 2010; and are projected to be 41.4 million (25.2%) in 2020. The median age of the workforce will trend greater across many demographic groups, including men, women, whites, blacks, Asians, Hispanics, and non-Hispanics (Fig. 24.2).

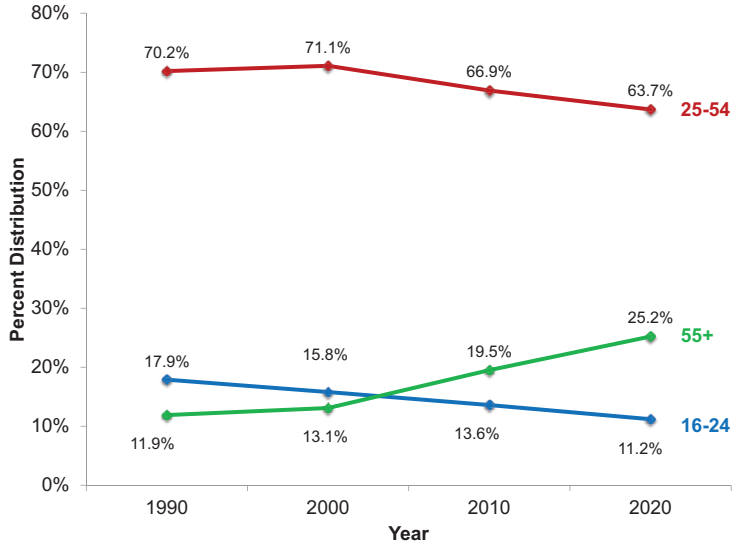

Figure 24.1 Past, current, and projected percent distribution of US civilian labor force by age group (16–24 years, 25–54 years, and 55 years and older) [1].

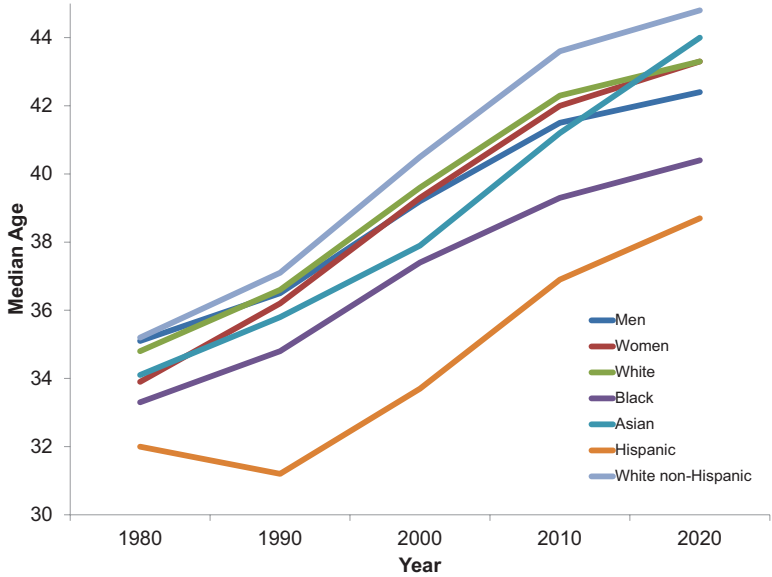

Figure 24.2 Past, current, and projected median age of the US civilian labor force by gender, race, and ethnicity [1].

In addition to the aging of the baby-boom generation, other factors also underlie aging of the US workforce [2]. The global population is aging; life expectancy has increased; and fertility rates have decreased. Furthermore, the economic downturn and changing policies related to retirement and benefits are causing older workers to stay in the workforce longer.

24.3 Health and Safety Risks of Older Workers Exposed to Occupational Stressors

Age-related changes in behavior and physiological and cognitive function are important factors in characterizing the risks posed to older individuals in occupational settings. While the majority of these age-related changes may most appropriately be described as declines in function, the aging population is a highly heterogeneous group, demonstrating significant variability in functional capacity. Chronological age does not accurately predict biological age, as declines in physiological and cognitive function are greatly influenced by genetics, nutrition, disease, medications, exercise, and other environmental factors [3, 4]. Nonetheless, approximately two of three Americans aged 65 years or older cope with multiple chronic health conditions, including arthritis, diabetes, asthma, chronic obstructive pulmonary disease (COPD), and heart failure [5]. These diseases, as well as risk factors contributing to the development of chronic disease, significantly impact an individual's ability to remain in the workforce and avoid work-related illness and injury. Additionally, in characterizing occupational health risks in older workers, it is important to recognize that early- and mid-life environmental and occupational exposures may affect the response of an individual to occupational stressors later in life. While some early-life exposures have a cumulative effect on a given health response or outcome, others may predispose an individual to experience more overt adverse responses from subsequent occupational exposures later in life [6–12].

Though not unique to the aging population, active members of the workforce are generally healthier than similarly aged non-working adults. In what is commonly referred to as the healthy worker effect, this phenomenon frequently confounds cross-

sectional epidemiologic studies that compare morbidity and mortality rates in workers with those of the less healthy general population, resulting in the appearance of lower rates in workers despite their potentially hazardous environmental or occupational exposures [13]. The challenge to maintain better-than-average health in older workers, who constitute a substantial and growing at-risk population, is an important one and underscores the need to better understand the special occupational and safety risks faced by aging workers. These risks vary by occupation and industry and may be differentially influenced by disparate prevalence rates of chronic health conditions among older workers across industry sectors [14]. While the greatest number of older adults are employed in manufacturing, retail, financial services, professional and business services, and educational and health services [15], the percentage of the labor force comprising workers aged 55 years and older is increasing in the majority of industry sectors (Table 24.1).

24.3.1 Occupational Chemical Exposures

Age-related changes in pulmonary function, body composition, hepatic volume and blood flow, xenobiotic metabolizing enzyme activity, and renal function affect the absorption, distribution, metabolism, and elimination of occupational toxicants that may alter the biologically effective dose reaching target organs in older adults [16, 17]. Further, these effects may be exacerbated by pre-existing chronic health conditions as well as myriad pharmaceutical agents used to treat these conditions [18]. Consequently, similar exposures between younger and older adults may result in significantly different internal doses and total body burden of hazardous occupational pollutants.

24.3.2 Musculoskeletal Risk Factors

Loss of muscle mass and strength with age influences physical work capacity in older adults and increases the risk of muscle fatigue and falls [19]. Combined with an age-related decrease in bone mineral density and architectural deterioration of bone, particularly among postmenopausal women, these falls increase the risk of bone fractures in older workers [20]. In addition, owing

Table 24.1 Percentage of industry labor forces comprising workers aged 55 years and older

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Industry										
Mining	12.2%	14.5%	16.2%	16.4%	16.8%	16.5%	17.3%	16.7%	18.4%	18.3%
Construction	11.5%	12.0%	11.7%	12.0%	12.9%	14.6%	15.9%	16.5%	16.8%	18.6%
Manufacturing	14.6%	14.9%	15.8%	16.5%	17.4%	18.1%	18.8%	19.8%	20.4%	22.0%
Wholesale and Retail Trade	15.4%	15.3%	15.9%	16.6%	17.2%	17.6%	18.3%	18.9%	19.1%	19.4%
Transportation and Utilities	16.3%	17.9%	17.6%	18.2%	18.4%	19.6%	21.3%	21.8%	23.9%	25.3%
Information	11.4%	12.2%	13.0%	14.0%	14.2%	15.2%	16.4%	16.2%	17.8%	18.5%
Financial Activities	17.4%	17.9%	18.4%	18.8%	19.0%	19.7%	20.3%	21.0%	22.3%	23.5%
Professional and Business Services	15.1%	15.7%	16.9%	17.2%	17.9%	18.3%	19.4%	20.2%	20.0%	21.4%
Education and Health Services	16.9%	18.0%	18.9%	19.6%	20.2%	21.1%	22.2%	22.9%	23.3%	23.7%
Leisure and Hospitality	9.7%	9.4%	9.9%	9.9%	10.4%	10.7%	11.3%	11.6%	11.9%	12.0%
Public Administration	17.4%	17.8%	19.0%	20.1%	20.2%	21.4%	22.2%	22.5%	23.1%	23.5%

Source: Adapted from Ref. [15].
Note: This population survey was conducted by the US Census Bureau for the Bureau of Labor Statistics.

to declines in muscle strength, ligament elasticity, and joint and cartilage degeneration, older workers are potentially at increased risk of other work-related musculoskeletal disorders [21, 22].

24.3.3 Hearing Loss

The aging population is at high risk of developing hearing loss from both the normal aging process (presbycusis) and from nonoccupational noise sources, with a well-established monotonic increase in the prevalence of hearing loss with increasing age [23]. While the most common occupational risk factor for hearing loss is noise exposure, occupational exposure to chemical solvents may also contribute to occupationally induced hearing loss [24–26]. Whatever the cause, hearing loss may have significant safety and work performance implications for the aging workforce, as multiple investigators have observed an increase in the risk of occupational injuries among workers with impaired hearing [27–30].

24.3.4 Visual Impairment

As with hearing loss, decrements in visual function are extremely common in older adults due to a normal loss of visual acuity as well as prevalence of age-related eye diseases, including glaucoma, cataract, and macular degeneration [31]. Though the epidemiologic evidence of an association between decrements in visual function and occupational injury is equivocal [32], impaired vision must be considered when evaluating potential risk factors in the workplace [30, 33].

24.3.5 Cognitive Function

Similar to physiological function, age-related change in cognitive performance is characterized by a high degree of interindividual variability [34, 35]. However, in general, declines in recall, real-time processing, and novel problem solving (i.e., episodic memory and fluid intelligence) are observed with increasing age. On the other hand, maintaining acquired knowledge and processing familiar information (i.e., scientific memory and crystallized intelligence) tend to incrementally increase with age until beyond the age of

50 [35–38]. Although it would seem reasonable to speculate that age may be negatively associated with work performance due to cognitive decline, this has not been conclusively substantiated in the scientific literature. In addition, there is little empirical evidence demonstrating increased occupational health and safety risks among older adults due to a decline in cognitive ability or performance [27, 36]. Studies evaluating age-related change in cognitive function as a risk factor for occupational accidents have generally observed that declines in perceptual processing and decision making may be offset in older workers by experience and expertise [27, 39, 40]. However, the degree to which acquired skill and knowledge may compensate for age-related changes in cognitive function has not been extensively studied and is likely to vary greatly by occupation [36].

24.3.6 Age-Related Differences in Occupational Illness and Injury

Somewhat paradoxically, older workers who, for the reasons described in the preceding text, are more susceptible to adverse health effects resulting from exposures to occupational stressors, experience lower rates of occupational illness and injury compared to younger adults [2, 36, 41]. Although not completely understood, this may be explained in part by age-related advantages in experience and expertise, safety and health awareness, motivation, and opportunities for employment in lower-risk, that is, managerial and administrative, occupations. However, there is a positive association between age and time away from work as a result of occupational illness or injury, signifying that relative to their younger counterparts older workers tend to experience more severe occupational illness and injury and require more time for recovery (Fig. 24.3) [2, 42, 43]. It would therefore reasonably follow, and has been consistently demonstrated, that older workers experience higher rates of fatal injuries in the workplace relative to younger workers [36, 44].

24.4 Importance of Prolonging the Work Ability and Wellness of Older Workers

Maintaining the health, wellness, and work ability of older workers is an increasingly important priority [2, 45]. There are important

reasons for this. Older workers are becoming a progressively greater part of the workforce. Thus, maintaining their ability to work productively and effectively—"work ability"—is critical to older workers and to their employers. Work ability reflects the balance between a person's resources (e.g., health, functional abilities, education, competence, values, attitudes) and work demands. A questionnaire-based work ability index was initially developed in Finland but has now been used in many countries. Early studies of municipal employees over 45 years of age showed that, over an 11-year period, the work ability index declined significantly in 30% of workers, remained relatively unchanged in 60%, and improved among 10%. Factors related to management, ergonomics, and lifestyle were associated with both decline and improvement. A better work ability index has been associated with a longer work life and improved quality of a person's active period after retirement [46]. Thus, there might be great benefit realized through interventions to preserve work ability.

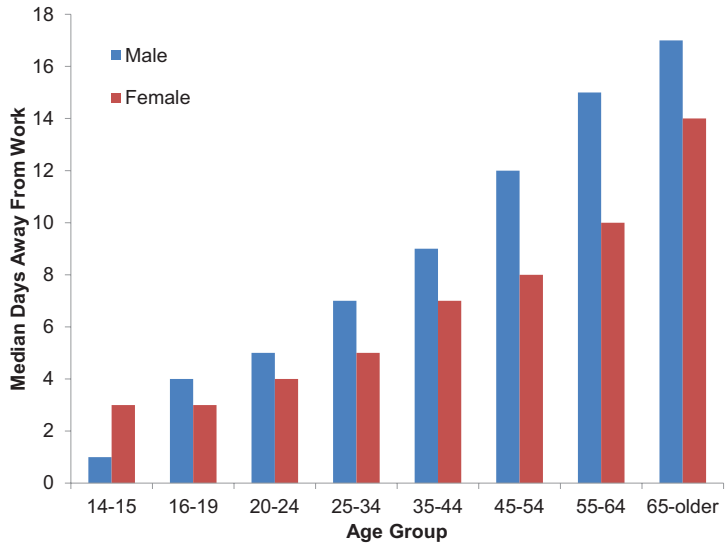

Figure 24.3 Median days away from work as a result of nonfatal occupational illnesses and injuries. Occupational injuries account for the vast majority of reported cases; chronic occupational illnesses (e.g., respiratory and cardiovascular) that develop over longer periods of time are likely undercounted [42].

Taking steps to make the workforce, including the older workforce, healthier also has great potential to reduce health care costs. As noted earlier, the burden of chronic disease in older Americans is massive; two of three have multiple chronic conditions, and treating them consumes 66% of the US health care budget [5, 47]. Many of these conditions, including diabetes, arthritis, high blood pressure, heart disease, asthma, chronic respiratory diseases, cancer, and depression, have the potential to be prevented or mitigated through preventive lifestyle and workplace interventions. There is clearly great potential benefit in reducing the burden of these conditions and their associated cost of treatment.

A healthier workforce has potential economic benefits even greater than savings in health care costs. On average, for each dollar spent on workers' medical and pharmacy costs, employers also lose two to three dollars of productivity. These costs can come from presenteeism (when employees are present but not fully productive), absenteeism, and disability [47]. Thus, a healthy workplace benefits workers, employers, and society as a whole [48] (Table 24.2).

Table 24.2 Benefits of a healthy workplace to an organization and its employees

Organizational benefits	Employee benefits
- A well-managed health and safety program	- A safe and healthy work environment
- A positive and caring image	- Enhanced self-esteem
- Improved staff morale	- Reduced stress
- Reduced staff turnover	- Improved morale
- Reduced absenteeism	- Increased job satisfaction
- Reduced presenteeism /increased productivity	- Increased skills for health protection
- Reduced health care/insurance costs	- Improved health
- Reduced risks of fines and litigation	- A healthier family and community

Source: Adapted from Ref. [48].

24.5 Current Approaches to Maintaining Work Ability in Older Workers

Current thinking suggests that the best way to optimize the health and well-being of a workforce is through a multifaceted approach that integrates traditional occupational health protection (protecting workers from occupational hazards) with health promotion (efforts to promote wellness by addressing a range of factors that affect health and wellness, including factors not related to work) [47]. Health promotion includes, but is not limited to, interventions to promote healthy behaviors, such as exercise, good nutrition, smoking cessation, and good sleep hygiene, and other interventions, such as workplace policies that help employees to live with chronic diseases like diabetes or asthma or provide access to workplace-based chronic disease management programs.

It is important to recognize that factors commonly considered to be "non-work" can be greatly impacted by work and vice versa. For example, a workplace that provides healthy dietary choices in its vending machines and cafeteria is promoting good nutrition. Similarly, one with a smoke-free policy that also provides access to support for smoking cessation can help to reduce the burden of tobacco use; or one that monitors schedules and avoids rotating or irregularly scheduled shifts can help to promote better sleep hygiene. These "non-work" factors can also greatly affect occupational safety and health. For example, sleep deprivation can impair performance and result in accidents and injuries. Because "work" and "non-work" health factors are so inextricably linked, implementing strategies that cut across homes, communities, and workplaces is needed to create a "24/7 culture of health" that maximizes worker health, improves quality of life on and off the job, and optimizes the chances that all workers remain well and retain work ability as they age [2].

Another way to retain work ability in older workers is to create and implement "age-friendly" programs and policies in the workplace. Prioritizing workplace flexibility; giving additional control over work schedules, conditions, and locations; using adaptive technology and designing work tasks to meet older workers' physical needs; managing workplace hazards that are more challenging for older workers; accommodating medical self-

care in the workplace and time away for health visits; and requiring aging workforce management skills training for supervisors are examples of ways to make the workplace more age friendly [2]. One specific example of an innovative program that increased retirement age by about three years comes from a manufacturing company that offered extra paid days off after age 58, enabling workers to rest after particularly demanding periods of work. Another is an energy company that offered older workers an opportunity to reduce working time by 20% with the salary reduced by 10% and pension benefits maintained at 100% [49].

Guidance is available to assist in setting up an integrated health protection/health promotion program. It is important to have an organized, inclusive approach to program development [48] (Table 24.3). The National Institute for Occupational Safety and Health (NIOSH) has established a "Total Worker Health™" (TWH™) program. Its website provides web links to numerous resources developed by NIOSH and others [50]. The Centers for Disease Control and Prevention (CDC) National Healthy Worksite Program website is another very useful source of information [51].

Table 24.3 Steps in the development of a healthy workplace

- Ensure management support.
- Establish a coordinating body representative of all levels and sectors of the workplace.
- Conduct a needs assessment.
- Prioritize needs.
- Develop an action plan.
- Implement the plan.
- Evaluate the process and outcome.
- Revise and update the program.

Source: Adapted from Ref. [48].

24.6 Conclusions

Aging workers represent a growing and potentially at-risk population that merits particular attention. The relationship

between age and occupational health and safety risks is complicated by the heterogeneous nature of this population with respect to functional status, chronic health conditions, and behavior. It is further complicated by age-related benefits that may serve to protect older workers from certain occupational health and safety illnesses or injuries [2]. Nonetheless, as the workforce continues to age, it is essential that the occupational health and safety risks posed to older workers are adequately assessed and mitigated [52]. These risks may be better understood through additional epidemiologic research identifying risk factors for loss of work ability with aging, including information about specific occupations and industry sectors. Further, additional research evaluating the efficacy and effectiveness of integrated health protection and health promotion programs as well as age-friendly workplace practices and policies are much needed and will be of great value in developing recommendations for the preservation of work ability and risk reduction among older workers.

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