# AGE's INFLUENCE on Workplace Safety

By Kelly Muhammad and Cheryl (Cheri) Marcham

**ACCORDING TO THE NATIONAL SAFETY COUNCIL** (NSC, n.d.), the total cost of work injuries in 2019 was an estimated $171 billion. This estimate includes wage and productivity losses, medical expenses, administrative expenses and employers' uninsured costs. In that same year, an estimated 105 million workdays were lost due to injuries (NSC, n.d.). This report does not provide any specific details or any characteristics about the injured. However, knowledge of certain characteristics of the injured such as age can be critical information. This type of information could be useful in the development of workplace hazard prevention and mitigation programs.

Much has been written about the "silver tsunami" and the aging workforce. The term "older worker," as defined by the Age Discrimination and Employment Act, refers to anyone age 40 and older (U.S. Department of Labor, n.d.-a). Some believe that as the workforce continues to age, so does the need for OSH professionals and their organizations to work creatively to redesign jobs and work processes to accommodate older workers (Freeman, 2004). The CDC (2015) provides a great deal of resources that address safety and injury prevention for the aging workforce. But at the same time, CDC (2019) reports that young workers have high rates of job-related injuries. Workers' demographics and characteristics are some factors that should be considered when implementing safety programs. A mixed-methods analysis study of statistical data, scholarly articles and online sources was conducted to review the dearth of information available on age, injury rates and workplace safety to determine whether a worker's age has an impact on injury rates and, if so, how OSH professionals can modify safety programs to address it.

## Quantitative Research Methods & Results

To initially evaluate the impact of age on injury rates, a quantitative analysis of incidence rates of workplace injuries and illnesses of U.S. workers and median days away from work was performed on data extracted from the Bureau of Labor Statistics (BLS). The Fair Labor Standards Act sets a minimum working age of 14 but imposes restrictions for youth under age 18 from being employed in hazardous occupations in the U.S. (U.S. Department of Labor, n.d.-b). However, one does not need to work in a hazardous occupation to suffer a workplace injury or illness. After a brief review of how the BLS grouped age ranges in its current population survey, the minimum age to be considered for this study was 16. Also, note that OSHA (2005) considers workers ages 14 to 24 to be young workers. For the purposes of this study, workers under age 25 are referred to as young or younger workers.

The incidence rates per 10,000 full-time workers are grouped by ages 16 to 19, 20 to 24, 25 to 34, 35 to 44, 45 to 54, 55 to 64, and 65 and older for the years 2014 to 2018 were collected from the BLS Nonfatal Occupational Injuries and Illnesses Requiring Days Away From Work report (Table 1).

A quantitative analysis conducted using a one-way analysis of variance showed that the effect of age was significant, $F(6,28) = 21.98$, $p = < .0001$. Post hoc analysis using Tukey least-square means revealed the mean incidence rates were statistically higher for age groups 16 to 19 ($M = 108.58$, $SD = 4.22$), 45 to 54 ($M = 109.64$, $SD = 5.17$) and 55 to 64 ($M = 113.70$, $SD = 2.62$) than all other age groups (Table 1). The literature attributes the

### KEY TAKEAWAYS

- **A worker's age has an impact on the injury rate. Safety concerns and issues are faced by both younger and older workforce age groups.**
- **Safety professionals should focus on intervention methods that will mitigate the hazardous influences encountered by all age groups.**
- **While workers age 65 and older have the second-lowest injury rate of all age groups, the older the workers, the more time they may need to spend away from work to recover from injuries and illnesses suffered at work.**

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**TABLE 1**

### MEAN INCIDENCE RATES OF FULL-TIME WORKERS, 2014-2018

**Mean incidence rates of full-time workers ages 16 to 65 and older for the years 2014 to 2018.**

| Year | Incidence rate per 10,000 full-time workers by age group | | | | | | |
|---|---|---|---|---|---|---|---|
| | 16 to 19 | 20 to 24 | 25 to 34 | 35 to 44 | 45 to 54 | 55 to 64 | 65 and older |
| 2014 | 107 | 105 | 96 | 104 | 117 | 116 | 94 |
| 2015 | 110.5 | 98.3 | 92.9 | 102.6 | 112.8 | 115.8 | 89.2 |
| 2016 | 101.9 | 98.1 | 90.4 | 96.3 | 107.9 | 113.8 | 89.8 |
| 2017 | 112.1 | 96.3 | 89.1 | 90.8 | 106 | 109.5 | 92.1 |
| 2018 | 111.4 | 100.9 | 86.5 | 91.7 | 104.5 | 113.4 | 98.3 |
| Mean | 108.58 | 99.72 | 90.98 | 97.08 | 109.64 | 113.7 | 92.68 |

**Note. Data from "Injuries, Illnesses and Fatalities," by BLS, 2019.**

The results suggest that a worker's age, whether younger or older, can influence a injury rate and, therefore, overall worker safety.

incidence rates to members of the 55 to 64 age group's likelihood to cognitive and physical decline, which leads to injuries and illnesses (Marquié et al., 2010; Ropes, 2013). Younger workers, such as those in the 16 to 19 age group, also have a higher risk of injuries on the job (Siow et al., 2011). The literature also proclaims that younger workers lack the proper experience and skills to handle hazardous situations on the job (Nykänen et al., 2018). The results suggest that a worker's age, whether younger or older, can influence the injury rate and, therefore, overall worker safety.

To further evaluate the impact of age, the authors collected the reported median days away from work by worker age for the years 2014 to 2018 from the BLS Nonfatal Occupational Injuries and Illnesses Requiring Days Away From Work report (Figure 1).

The analysis of the median days away from work revealed that workers' median days away from work increase as the workers' age groups increase. This indicates that the older the workers, the more time they may need to spend away from work to recover from injuries and illnesses suffered at work. Specifically, the age group 65 and older had the second-lowest incidence rate of injuries (Table 1, p. 35) but the longest amount of time away from work if an injury occurs (Figure 1). If the appropriate intervention methods are applied, the median days away from work can be greatly reduced.

## Qualitative Research Methods & Results

To better understand these statistics, a qualitative analysis of information found in the scientific literature was performed. A systematic approach was used to identify relevant studies using the keywords "age," "aging," "workforce," "workplace," "safety," "influence," "impact," "injury," "accidents," "occupation," "older," "young," "younger," "intervention" and "workers." Combinations of these keywords such as "aging workforce" and "workplace safety" were also used in the search of electronic databases. Relevant studies published in English were extracted from scholarly and peer-reviewed journals, and organized into three categories: identified safety issues and concerns, recommended intervention methods, and comments. Table 2 captures information for older workers and Table 3 (p. 38) captures information for younger worker age categories. Both tables identify safety issues and concerns faced by older or younger workers in that study, recommended intervention methods, the outcome of the recommended methods and any additional pertinent information identified in the study.

## Older Workers

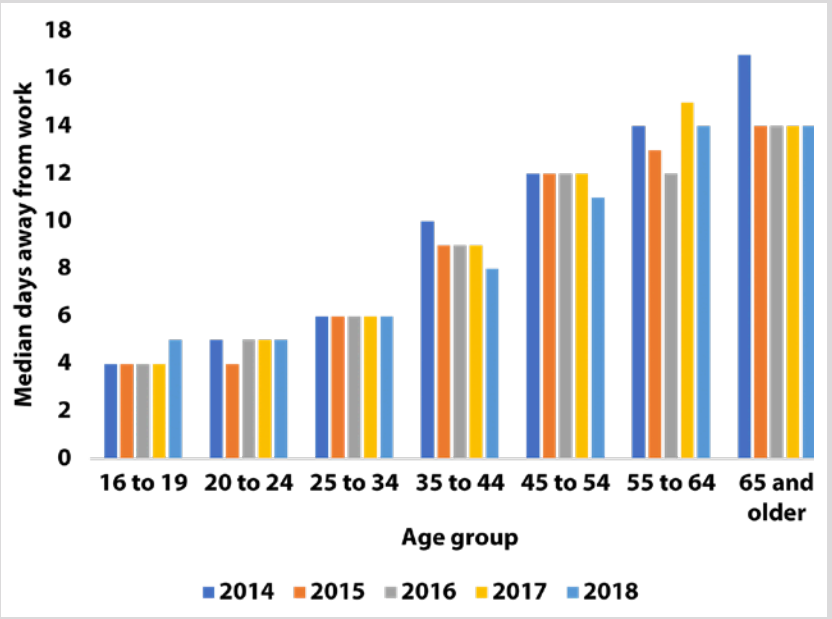
The information acquired from this qualitative analysis revealed that most safety concerns faced by older workers were longer recovery times from injuries and illnesses, risks of higher fatality rates, and the decline of physical and cognitive functions. Older workers may have less frequent injuries and illnesses than younger workers, but when an injury or illness occurs, it is more serious than that of a younger worker (Silverstein, 2008) with longer recovery times in comparison to younger workers (Choi, 2009). Older workers have higher fatality rates because they are more susceptible to underlying health problems (Gorina et al., 2005). Although older workers are susceptible to the same injuries and illnesses as other age groups, the most common injuries suffered by older workers are injuries to the back and shoulders (Choi, 2009).

There are also some physical and cognitive issues that explicitly affect the aging workforce (Kowalski-Trakofler et al., 2005). As humans age, reduced functions may occur including cognitive and physical functions, both of which may impact a worker's ability to perform job tasks. Cognitive aging is typically referred to by researchers as age-related changes such as decline in memory, intelligence, language, attention, decision-making, learning and information processing (Kowalski-Trakofler et al., 2005). Physical aspects include strength, speed of movement, range of motion, motor skills, healing after injuries and fatigue (Choi, 2009). Physical and cognitive functions are believed to begin to decline once a worker reaches age 40 (Choi, 2009).

## Younger Workers

Many safety concerns faced by younger workers are a higher risk of workplace injuries and underreporting of workplace injuries and illnesses. Workplace injury rates are higher among younger workers in comparison to older aged worker groups (Choi, 2009). Younger workers have a higher risk of workplace injuries across all industries in comparison to older workers (Pek et al., 2017; Runyan et al., 2012). This may be due to factors such as inadequate training and supervision, which were identified as the main causes of the

**FIGURE 1**
**MEDIAN DAYS AWAY FROM WORK DUE TO INJURIES & ILLNESSES BY AGE, 2014-2018**




**Note. Data from "Injuries, Illnesses and Fatalities," by BLS, 2019.**

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younger workforce's higher injury rates (Sámano-Ríos et al., 2019). Other factors that would contribute to younger workers having higher workplace injury rates in comparison to older workers are young workers accepting workplace injuries as "part of the job" and feeling powerless and intimidated to voice safety concerns to management (Breslin et al., 2007). In the study conducted by Breslin et al., hazards identified by young workers varied depending on the job task but the most common were physical, chemical, biological and environmental. Physical hazards included slippery walking surfaces, handling large equipment or equipment with hot surfaces, and working with sharp tools such as knives (Breslin et al., 2007). Chemical hazards included working with chemicals such as pool chemicals. Biological hazards included exposure to germs such as dealing with money as a cashier. Environmental hazards included working in extreme temperatures and poor weather conditions (Breslin et al., 2007). While working in hazardous conditions such as those mentioned, some common injuries sustained were scrapes, cuts, burns and musculoskeletal strains (Breslin et al., 2007). In addition to workplace hazards, young workers are less likely to report injuries and illnesses or even file for workers' compensation benefits (Clarkson et al., 2018).

**TABLE 2**
## IDENTIFIED SAFETY CONCERNS & RECOMMENDED INTERVENTIONS FOR OLDER WORKERS

| Identified safety concerns faced by older workers | Comments | Recommended intervention methods |
|---|---|---|
| Musculoskeletal injuries | The involvement of expert consultants could have immediate and long-term effects (Freeman, 2004). | Involve a variety of experts to aid management with innovative and cost-effective solutions (Freeman, 2004). |
| Psychological and physical issues: cognitive and physical decline | •More research is needed to determine relation between age and job skills/task requirements (Kowalski-Trakofler et al., 2005).<br>•Older workers report less frequent access to occupational training and fewer opportunities to learn new skills on the job (Marquié et al., 2010).<br>•Some organizations are unwilling to invest resources in older workers (Ropes, 2013).<br>•Intergenerational learning is effective and appeals to older worker learning styles and motivations (Ropes, 2013). | •Ergonomic interventions, more physical training (Kowalski-Trakofler et al., 2005)<br>•Mental stimulation in the workplace (Marquié et al., 2010)<br>•Intergenerational learning for older workers (Ropes, 2013) |
| More serious but less frequent injuries and illnesses than younger workers | Need for implementation and evaluative research (Silverstein, 2008) | Known challenges should be used as predictors (Silverstein, 2008). |
| Higher risk regarding occurrence of fatal incidents and take longer to recovery from injuries | •Research is needed to refine job skills and task requirements in relation to age (Choi, 2009).<br>•Concern exists regarding financial sustainability of public pension system (Bande & López, 2015).<br>•More research is needed for extending working life beyond age 65 (Varianou-Mikellidou et al., 2019). | •Employ ergonomic interventions, wellness and fitness programs, modify training strategies for older workers (Choi, 2009).<br>•Reallocate older workers toward tasks with lower incidence rates or mandatory retirement at age 65 (Spanish countries, not U.S.; Bande & López, 2015).<br>•Proposed measures should be designed and adopted at early stages (Varianou-Mikellidou et al., 2019). |
| Injuries lead to more disability | Employers must understand age-specific exposures within industries that put workers at higher risk (Kachan et al., 2012). | Injury prevention programs targeting specific age groups for workers in high-risk occupations (Kachan et al., 2012) |
| Farm workers had the most injuries and deaths | No clear positive effect from studied interventions. Older workers' specific age-related aspects not addressed in program designs (Nilsson, 2016). | Apply interventions in injury prevention, increase knowledge of safety and health tasks and practices, increase use of safety equipment (Nilsson, 2016). |
| Health and wellness | Program should target health not disease. Companies fail to give attention to the problem and therefore fail to fully implement program (Magnavita, 2018). | Health promotion (Magnavita, 2018) |

**Note. Workers age 40 and older are referred to as older workers.**

### Intervention Methods

Successful intervention methods that address workplace safety aspects and concerns of young workers were difficult to find. A common theme found in the research was the recommendation of safety programs that specifically target younger workers. Some researchers suggest workplace safety education be provided in schools prior to employment (Nykänen et al., 2018). More specifically, Holizki et al. (2008) suggest that injury prevention strategies be delivered to students before the usual dropout age of 16. Employers should provide an open and safe working environment that will educate younger workers on their rights in the workplace and encourage young workers to report all injuries and risk exposures (Tucker et al., 2014).

Successful intervention methods that address the aspects and concerns of aging workers were also difficult to find. Some researchers recommend matching older workers with less hazardous or risky job tasks as an intervention method that would reduce the injury rate in older workers (Bande & Lopez-Mourelo, 2015). Silverstein (2008) has proposed that if the known challenges of aging workers are used as predictors and are anticipated and addressed in programs and policies, the problems resulting from those challenges can be prevented and the consequences of those problems can be reduced. Varianou-Mikellidou (2019) echoes this suggestion by proposing that the measures used to minimize age-related risks be designed and adopted at the early stages of early working life and carried out until retirement. Researchers also recommend using health promotion as an intervention method. Health promotion programs that target worker overall health would benefit both the worker and the organization (Magnavita, 2018).

Large corporations benefit from health promotion programs that potentially lead employees to healthier lifestyles and, in return, the organizations get longevity in employees. These types of programs are designed to improve employee health and productivity. For example, "high risk" manufacturing employees within The Boeing Co. participate in an industrial athlete program designed to "give Boeing employees the resilience to engage in a lifetime of physically demanding work and play" (Fleury, 2015, p. 10). This program is

comprised of three elements in a multidimensional approach using symptom intervention (to identify discomfort before injuries can occur), work conditioning (to improve strength and flexibility to reduce the likelihood of injury) and work hardening (if an injury has occurred; Fleury, 2015). Studies have shown that more than 95% of the annual participants in the symptom intervention program remain symptom-free after intervention, the conditioning program reduces the likelihood of injury by 30%, and 85% of the work hardening participants returned to their pre-injury jobs with 100% return to work overall (Fleury, 2015). Applying a similar program tailored to each age group and incorporating knowledge of age's impact on potential workplace injuries could prove beneficial and not only reduce the amount of time needed for recovery but also prevent injuries from occurring.

## Conclusion

According to the literature review and the analysis of the quantitative data, a worker's age has an impact on the injury rate. The decline in physical and psychological aspects has played a role in the influence of injuries and illnesses sustained by older workers. Younger workers' lack of experience and skills to handle hazards in the workplace are contributing factors that influence the injuries and illnesses suffered by young workers. The safety concerns and issues faced by both workforce age groups support the information and results found in the quantitative analysis and explains the median days away from work and the mean incidence rate outcomes for those age groups.

The studies also presented several recommended intervention methods. The most common or popular intervention method presented for young and old workforces recommended programs that targeted specific age groups. However, none of the entries had any successful evaluated intervention methods on record. More research on the effects of applied recommended intervention methods is needed. Intervention methods that will mitigate the hazardous influences encountered by both age groups are recommended.

Based on the information provided in the literature, a customized workplace safety plan is recommended. The workplace safety plan should be customized for each employee based on age group and job tasks, should be designed and implemented at the early stages of employment, and should follow the employee throughout the individual's service with the organization or until retirement. The plan should be designed to anticipate the aging of a worker and should incorporate and address many aspects such as ergonomics, education and training, wellness and fitness programs. Based on the literature, the development of the safety plan should be a team effort and should involve the participation of various experts and consultants. The application of a customized workplace safety plan could possibly reduce the median days away from work and incidence rates, improve an organization's safety culture and efficiency, and boost worker morale. Further research is needed to verify

**TABLE 3**
## IDENTIFIED SAFETY CONCERNS & RECOMMENDED INTERVENTIONS FOR YOUNGER WORKERS

| Identified safety concerns faced by young workers | Comments | Recommended intervention methods |
|---|---|---|
| Increased risk of injury on the job | • Fewer fatal injuries reported for younger workers (Salminen, 2004).<br>• Education on workers' compensation, entitlement benefits and reporting processes should be provided to all employees regularly with frequent refreshers (Siow et al., 2011).<br>• Improvements needed for young worker safety. Evidence of successful interventions is minimal (Runyan et al., 2012).<br>• Managers should encourage proactive safety behaviors such as being open to hearing young workers' opinion on safety (Pek et al., 2017). | •Programs targeting young workers may help establish good foundation early on safety practices (Siow et al., 2011).<br>•Development of safety programs that included participation of various stakeholders (Runyan et al., 2012)<br>•Parents, supervisors and coworkers could help implement prevention methods by encouraging young workers to be safe at work (Pek et al., 2017).<br>•Need to integrate injury prevention strategies with organizational contexts (Laberge et al., 2014).<br>•Efforts should be made to improve learning paradigms such as situated learning and community of practice (Laberge et al., 2014) |
| Complaints are systematically silenced. Feel powerless or intimidated when voicing concerns about safety | Younger workers accept workplace injuries as part of the job (Breslin et al., 2007). | Work safety programs that focus exclusively on educating young workers about their rights in the workplace (Breslin et al., 2007) |
| 10% of injuries occur during the first week of work | Almost all serious injuries to young workers are preventable (Holizki et al., 2008). | Prevention strategies need to be delivered to students before age 16, which is the usual dropout age (Holizki et al., 2008). |
| Construction workers at increased risk for occupational injuries | Enhanced injury prevention methods along with health behavior education for young workers could be beneficial Dong et al., 2014). | Construction interventions needed to address preventable risk factors (Dong et al., 2014). |
| Less likely to report hazards, injuries and workers' compensation, self-blame, perceived low severity, reactions of others | Need to empower younger workers to report workplace safety concerns to their employers (Clarkson et al., 2018). | •Work safety programs that focus on educating young workers about their rights in the workplace (Clarkson et al., 2018)<br>•Employers should educate young workers on importance of reporting injuries (Tucker et al., 2014).<br>•Employers should provide an open and safe working environment that will encourage young workers to report all injuries and risk exposures (Tucker et al., 2014). |
| Exposed to hazards in the workplace with limited experience and skills | Future research needed to study relationships between safety behaviors, cognitive factors and incidents (Nykänen et al., 2018). | School-based safety training and future intervention development (Nykänen et al., 2018) |

**Note. Workers under age 25 are referred to as younger workers.**

whether the recommended workplace safety plans are feasible, efficient and could be retrofitted for workers employed prior to the deployment of the plans. **PSJ**

## References


Bande, R. & López-Mourelo, E. (2015, Feb.). The impact of worker's age on the consequences of occupational accidents: Empirical evidence using Spanish data. *Journal of Labor Research, 36*(2), 129-174. https://doi.org/10.1007/s12122-015-9199-7

BLS. (2019). Injuries, illnesses and fatalities. www.bls.gov/iif

Breslin, F.C., Polzer, J., MacEachen, E., Morrongiello, B. & Shannon, H. (2007). Workplace injury or "part of the job"? Towards a gendered understanding of injuries and complaints among young workers. *Social Science and Medicine, 64*(4), 782-793. https://doi.org/10.1016/j.socscimed.2006.10.024

CDC. (2015). Productive aging and work: Safety and health outcomes. www.cdc.gov/niosh/topics/productiveaging/safetyandhealth.html

CDC. (2019). Young worker safety and health. www.cdc.gov/niosh/topics/youth/default.html

Choi, S.D. (2009). Safety and ergonomic considerations for an aging workforce in the U.S. construction industry. *Work, 33*(3), 307-315. https://doi.org/10.3233/WOR-2009-0878

Clarkson, L., Blewett, V., Rainbird, S., Paterson, J.L. & Etherton, H. (2018). Young, vulnerable and uncertain: Young workers' perceptions of work health and safety. *Work: A Journal of Prevention, Assessment and Rehabilitation, 61*(1), 113-123. https://doi.org/10.3233/WOR-182788

Dong, X.S., Wang, X. & Largay, J. (2014). Job exposures, health behaviors and work-related injuries among young construction workers in the United States: A 12-year follow-up study. *Occupational and Environmental Medicine, 71*(6), A43-A44. https://doi.org/10.1136/oemed-2014-102362.134

Fleury, D. (2015). Boeing provides employees a safe landing with a first-class return to work program. *@Work, 7*(2), 9-12. http://dmec.org/wp-content/uploads/2013/02/@Work-Magazine_May-2015.pdf

Freeman, E.J. (2004). Union-management solutions for preventing workplace injury of older workers. *Work, 22*(2), 145-151. https://bit.ly/3gRIk7e

Gorina, Y., Hoyert, D., Lentzner, H. & Goulding, M. (2005). Trends in causes of death among older persons in the United States. Aging Trends, No. 6. National Center for Health Statistics. https://bit.ly/35LHweZ

Holizki, T., McDonald, R., Foster, V. & Guzmicky, M. (2008). Causes of work-related injuries among young workers in British Columbia. *American Journal of Industrial Medicine, 51*(5), 357-363.https://bit.ly/3d4n4tG

Kachan, D., Fleming, L.E., LeBlanc, W.G., Goodman, E., Arheart, K.L., Caban-Martinez, A.J., Clarke, T.C., Ocasio, M.A., Christ, S. & Lee, D.J. (2012). Worker populations at risk for work-related injuries across the life course. *American Journal of Industrial Medicine, 55*(4), 361-366. https://doi.org/10.1002/ajim.21994

Kowalski-Trakofler, K.M., Steiner, L.J. & Schwerha, D.J. (2005, Dec.). Safety considerations for the aging workforce. *Safety Science, 43*(10), 779-793. https://doi.org/10.1016/j.ssci.2005.08.014

Laberge, M., MacEachen, E. & Calvet, B. (2014). Why are occupational health and safety training approaches not effective? Understanding young worker learning processes using an ergonomic lens. *Safety Science, 68,* 250-257. https://doi.org/10.1016/j.ssci.2014.04.012

Magnavita, N. (2018). Obstacles and future prospects: Considerations on health promotion activities for older workers in Europe. *International Journal of Environmental Research and Public Health, 15*(6), 1096. https://doi.org/10.3390/ijerph15061096

Marquié, J.C., Duarte, L.R., Bessières, P., Dalm, C., Gentil, C. & Ruidavets, J.B. (2010). Higher mental stimulation at work is associated with improved cognitive functioning in both young and older workers. *Ergonomics, 53*(11), 1287-1301. https://doi.org/10.1080/00140139.2010.519125

National Safety Council. (n.d.). Work injury costs. https://bit.ly/3gNLOZr

Nilsson, K. (2016). Interventions to reduce injuries among older workers in agriculture: A review of evaluated intervention projects. *Work, 55*(2), 471-480. https://doi.org/10.3233/wor-162407

Nykänen, M., Sund, R. & Vuori, J. (2018). Enhancing safety competencies of young adults: A randomized field trial (RCT). *Journal of Safety Research, 67,* 45-56. https://doi.org/10.1016/j.jsr.2018.09.012

OSHA. (2005). Young workers. https://bit.ly/35L1wyf

Pek, S., Turner, N., Tucker, S., Kelloway, E.K. & Morrish, J. (2017). Injunctive safety norms, young worker risk-taking behaviors, and workplace injuries. *Accident Analysis & Prevention, 106,* 202-210. https://doi.org/10.1016/j.aap.2017.06.007

Ropes, D. (2013). Intergenerational learning in organizations. *European Journal of Training and Development, 37*(8), 713-727. https://doi.org/10.1108/EJTD-11-2012-0081

Runyan, C.W., Lewko, J. & Rauscher, K. (2012). Setting an agenda for advancing young worker safety in the U.S. and Canada. *Public Health Reports, 127*(3), 246-252. https://doi.org/10.1177/003335491212700303

Salminen, S. (2004). Have young workers more injuries than older ones? An international literature review. *Journal of Safety Research, 35*(5), 513-521. https://doi.org/10.1016/j.jsr.2004.08.005

Sámano-Ríos, M.L., Ijaz, S., Ruotsalainen, J., Breslin, F.C., Gummesson, K. & Verbeek, J. (2019). Occupational safety and health interventions to protect young workers from hazardous work—A scoping review. *Safety Science, 113*, 389-403. http://doi.org/10.1016/j.ssci.2018.11.024

Silverstein, M. (2008). Meeting the challenges of an aging workforce. *American Journal of Industrial Medicine, 51*(4), 269-280. https://doi.org/10.1002/ajim.20569

Siow, S., Ngan, K., Yu, S. & Guzman, J. (2011[TA2]). Targeting prevention programs for young and new healthcare workers: What is the association of age and job tenure with occupational injury in healthcare? *American Journal of Industrial Medicine, 54*(1) 32-39. https://doi.org/10.1002/ajim.20914

Tucker, S., Diekrager, D., Turner, N. & Kelloway, E.K. (2014). Work-related injury underreporting among young workers: Prevalence, gender differences, and explanations for underreporting. *Journal of Safety Research, 50*, 67-73. https://doi.org/10.1016/j.jsr.2014.04.001

U.S. Department of Labor. (n.d.-a). Age discrimination. www.dol.gov/general/topic/discrimination/agedisc

U.S. Department of Labor. (n.d.-b). Workers under 18. www.dol.gov/general/topic/hiring/workersunder18

Varianou-Mikellidou, C., Boustras, G., Dimopoulos, C., Wybo, J.-L., Guldenmund, F.W., Nicolaidou, O. & Anyfantis, I. (2019). Occupational health and safety management in the context of an aging workforce. *Safety Science, 116*, 231-244. https://doi.org/10.1016/j.ssci.2019.03.009



**Kelly M. Muhammad, GSP, LSO,** is an environment, health and safety specialist and laser safety officer for the Laser & Electro-Optical Systems research and development facility at The Boeing Co. She holds an M.S. in Occupational Safety Management and a B.S. in Aerospace and Occupational Safety from Embry-Riddle Aeronautical University. Muhammad is a member of ASSP's New Mexico Chapter. She also holds memberships with Laser Institute of America and Society of Women Engineers.

**Cheryl L. (Cheri) Marcham, Ph.D., CSP, CIH, CHMM, FAIHA,** is an assistant professor and program chair for the Master of Science in Occupational Safety Management degree program in the College of Aeronautics Worldwide Online Campus for Embry-Riddle Aeronautical University. She holds a B.S. in Biology from Arizona State University, and an M.S. and Ph.D. from the University of Oklahoma Health Sciences Center Department of Occupational and Environmental Health. She serves as a director on the Board for Global EHS credentials (formerly ABIH) and previously served on the board of directors of American Industrial Hygiene Association (AIHA) and Board of Certified Safety Professionals. Marcham is a professional member of ASSP's Oklahoma City Chapter and is an AIHA Fellow.