Aging Workforce and Their Safety and Health Concerns in the Construction Industry

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The aging population is an increasingly urgent issue worldwide. A report by the United Nations indicates that in 2015, there were approximately 66.5 million people aged 60 and over in the U.S., accounting for 20.7 percent of the U.S. population. As the number of aging workers increases in the construction industry, their injuries appear to be more severe than those of younger workers, and it is becoming necessary to take a proactive approach to injuries and illnesses of older workers. In this regard, non-fatal injuries and illnesses among the aging workforce in the construction industry have not received the attention necessary to understand and address this issue. Musculoskeletal disorders (MSDs) are a common illness among older workers, and the rate of MSDs steadily increases with age. The objective of this study is to identify safety and health concerns of the aging workforce and suggest possible interventions for providing a safe work environment for older workers in the U.S. construction industry. This paper discusses three intervention strategies: ergonomic solutions, wellness programs, and safety climate. The ergonomic solutions are predominantly concerned with new and emerging technologies like exoskeleton devices. Second, the types and benefits of wellness programs for the aging workforce are addressed. Lastly, this work discusses developing inclusive safety climate through an increased understanding of the characteristics of an aging workforce.

Key Words: Aging workforce; Construction industry; Safety; Injury and Illness; Intervention

Introduction

The aging population is an increasingly critical issue world-wide. According to the United Nations (2015), the process of population aging is defined as "an increasing proportion of older persons in a population," especially when the proportion of people aged 60 and over account more than those aged 15 and under. Notably, the pace of growth of the population aged 60 and over is higher than any other age group globally. As this pace of growth continues, it increases the dependency ratio that both children and elderly have on those of working age not only through family financial support but also public transfer programs (United Nations, 2015). The UN's report also showed that there were approximately 66.5 million people aged 60 and over, accounting for 20.7 percent of the U.S. population in 2015. Moreover, this number is forecasted to increase to 92.9 million (26.1%) by 2030, and 108.3 million (27.9%) by 2050. The aging of the society affects the composition of the able workforce, and the construction industry has been facing similar demographic changes over the past decades (CPWR, 2013).

Most tasks and jobs in the construction industry demand high physical ability, and demand that workers spend most of their time standing, bending, reaching, and lifting heavy and oversized equipment and materials. Also, the work environment has a larger potential of hazards such as slips, trips, falls, and vehicle incidents compared to other industry sectors (Schwatka, Butler, & Rosecrance, 2011). These exposures make the construction industry one of the most dangerous sectors with a high percentage of occupational injuries, illnesses, and deaths (Choi, 2015). As the number of aging workers increases in the construction industry and their injuries tend to be more severe than those of younger workers, it is necessary to have a proactive approach to prevent injuries and illnesses. Employers should provide supportive methods for older workers to enhance their workability and accommodate weakness because it has a significant impact on productivity, safety, and cost (Silverstein, 2008). However, only a few recent studies have focused on health and safety of aging workforce in the U.S. construction industry (Choi, 2015; Choi, Rosenthal, & Hauser, 2013; Dong, Wang, Fujimoto, & Dobbin, 2012; Schwatka et al., 2011; Choi, 2009).

The objective of this study is to identify safety and health concerns of the aging workforce and suggest potential interventions for providing a safe work environment for older workers in the U.S. construction industry. As this study is conceptual, health and safety issues related to older construction workers are linked together through an extensive literature review. The specific research questions are as follows: 1) what are the health and safety concerns of the aging workforce in the construction industry? and 2) what possible intervention strategies could be used to improve health and safety of older construction workers? Based on these questions, a conceptual framework was proposed to understand safety and health concerns of the aging workforce (Figure 1).

Physical and cognitive changes emerge as the human body ages. These changes increase the risk of having fatal and non-fatal occupational injuries. In this study, the risks of fatal and non-fatal injuries with aging were defined, and the relationship between aging and occupational injuries in the construction industry were analyzed. After that, possible intervention methods were reviewed based on causes and types of injuries of older construction workers including ergonomic solutions, wellness program, and safety.

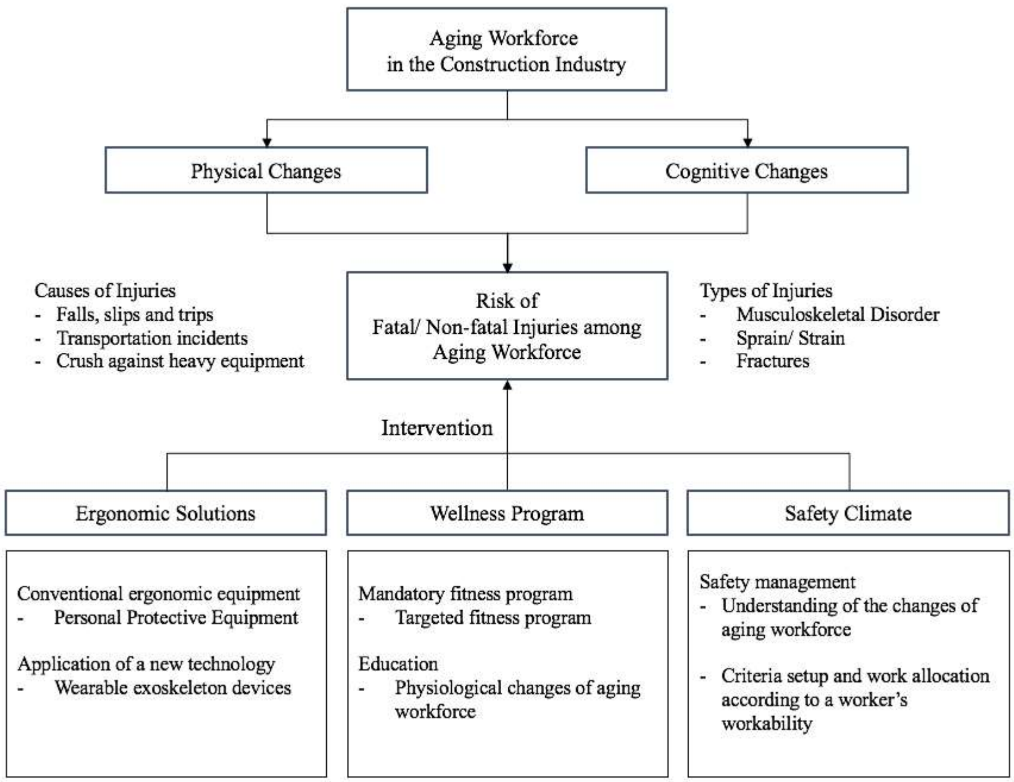

Figure 1: Risks and interventions for occupational injuries of aging workforce

Aging Workforce in the Construction Industry

There is no consensus among aging-related studies on what age constitutes "old," but the Bureau of Labor Statistics (BLS) typically utilizes the age of 55 as a reference of an older worker for their statistics. The primary factor of the increase in age of workers is the baby boomer generation, considered those who were born between 1946 and 1964, whose ages will be 55 years and over in 2020 (CPWR, 2013). Also, individuals tend to remain in the workforce longer because of financial concerns and longer life expectancies (Schwatka et al., 2011). As society ages, it is inevitable that the workforce will be comprised of older workers. According to CPWR (2013), the average age of workers in the construction industry has steadily increased, from 36.0 in 1985 to 41.5 in 2010, and 42.7 years old in 2016.

Interestingly, regardless of physical and cognitive deterioration, aging does not decrease work productivity of older workers (Silverstein, 2008). These veteran workers have accumulated knowledge of their work and work processes and are familiar with handling equipment (Choi, 2009). These employees also tend to be loyal and self-sacrificing (Lowe, Levitt, & Wilson, 2008). However, older workers are more vulnerable to injury due to a decrease in physical strength, bone density, respiratory capacity, vision, and hearing and an increase in recovery time (Truxillo, Cadiz, & Hammer, 2015). Given the aging rate of the construction workforce, it is critical to understand older workers' physical and cognitive changes and support their needs.

Aging and Physical and Cognitive Changes

Aging causes several changes, including the decrease of physical capacities and cognitive functions, which can impact workability (Truxillo et al., 2015). Physical capabilities decrease with age, and this increases the risk of injuries. Examples of physical changes include vision and hearing impairment and chronic musculoskeletal problems (Dong, Wang, & Daw, 2012). The sensory defects of eyesight and hearing reduce the accuracy of perception and can cause problems in communication. Musculoskeletal deficiencies, especially for those above 50 years of age, reduces strength, flexibility, and power of muscle and balance, which can increase the risk of falls and trips (Silverstein, 2008). These changes can cause including slower reaction times, decreased joint mobility, reduced elasticity of tissues, and loss of strength (Dong et al., 2012; Choi, 2009). In addition, aging affects cognitive functions, including processing speed, memory, and selective attention (Silverstein, 2008). Due to degenerated cognitive function, older workers are more likely to make errors and respond slowly, and this consequently increases risks of occupational injuries. The age-related physical and cognitive changes are not directly related to work productivity (Silverstein, 2008), but the changes with aging have an impact on health and safety in their work environment. These changes are positively related to increased risks of injuries and illnesses among the older construction workers (Dong et al., 2012; Choi, 2009).

Fatal and Non-Fatal Injuries and Illnesses among Aging Workers in the Construction Industry

In addition to a declining physical and cognitive ability, aging is related to occupational health and safety issues of the workers. According to relevant studies, the number of injuries is less, but the severity is higher among older workers compared to younger workers (Choi, 2009; Silverstein, 2008). The injuries among an older worker group tend to be more detrimental than their counterparts because: 1) they have more workdays lost per accident on average including non-fatal injuries, 2) they often receive higher amount of compensation, and 3) they are more likely to die from fatal injuries (CPWR, 2013; Dong et al., 2012; Schwatka et al., 2011; Choi, 2009; Silverstein, 2008). Consequently, this may result in a substantial loss when older workers get injured in the workplace.

According to BLS (2015), falls, slips, and trips are the most common causes of fatal injuries in the construction industry among all ages (Figure 2). Older workers are more likely to show a higher severity and quantity of injuries from falls (Dong et al., 2012). The second most common injury is transportation incidents (Figure 2) and driving ability is usually affected by aging. Cognitive abilities, including memory, judgment, ability to make a decision, and quick reaction time are required for drivers, but these diminish with aging (National Institute for Occupational Safety and Health, 2016). Their physical changes of eyesight and hearing loss impact perception of surroundings such as signs, sirens, and warning noises from other cars.

Musculoskeletal disorders (MSDs) is a common illness among older workers, and the rate of MSDs increases steadily with age. The disorder is caused by repeated behaviors, overexertion, lifting or bodily reaction by unnatural behavior (Schneider, 2001). Older workers in the construction industry are more likely to be injured with sprains and strains in their ankles, feet, and toes, while younger workers are more likely to get injured via cuts, lacerations, or contusions to their fingers, hands, or wrists (Choi, 2015). Older workers have different causes and types of injuries compared to younger workers, so the safety of older workers in the workplace should be taken into account over and above general occupational safety.

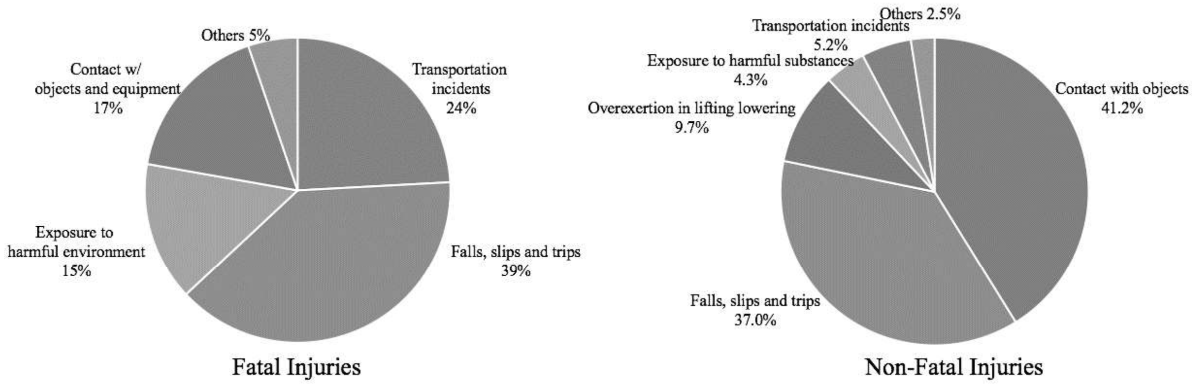

Figure 2: Causes of fatal and non-fatal injuries in the construction industry 2015 (Based on BLS CFOI and IFF data)

Interventions

As shown above, the aging of the construction workforce is inevitable, and a healthy and safe work environment for older construction workers should be ensured. To reduce injury rates, the government and construction companies have implemented various types of interventions, such as legislation, safety campaigns, and new safety equipment. Interestingly, a study indicated that safety campaigns reduced the injury rate, whereas legislation interventions increased the injury rate (Lehtola, van der Molen, Lappalainen, Hoonakker, Hsiao, Haslam, Hale, & Verbeek, 2008). A new safety equipment such as a robotic device can reduce physical loads and awkward working postures that lead to Musculoskeletal Disorders (MSDs). For example, an exoskeleton was implemented to support physical labor in car assembly lines (Sylla, Bonnet, Colledani, & Fraisse, 2014). Based on the research on the common injuries of older workers, this paper suggests three possible interventions to reduce and prevent these injuries.

Ergonomic Solutions

As mentioned, MSDs are one main type of common injuries in the construction industry (Schwatka et al., 2011). Cumulative Trauma Disorder (CTD) occurs with repetitive motion, forceful exertion, vibration, mechanical compression, and sustained or awkward posture, and is a part of MSDs (McMahan & Phillips, 1999). CTD can be controlled by adapting ergonomic, which is equipment designed to help workers increase comfort and work efficiency. It enables workers to enhance work productivity and ensure safety in the work environment by preventing injuries (Roper & Yeh, 2007; McMahan & Phillips, 1999).

To support workers with labor-intensive responsibilities, exoskeleton technology is suggested in addition to conventional ergonomic methods. Wearable exoskeleton devices are a type of robotic exoskeletons where the system cooperates with the user instead of working alone like an autonomous robot (Exoskeleton Report LLC, 2015). These devices augment the users' physical ability by covering the human body either entirely or partly with electricity or human movements. Wearable devices have been utilized from military to medical purposes, such as reducing the load of objects, remaining a particular posture longer, and supporting rehabilitation (Chu, Kazerooni, & Zoss, 2005; Kiguchi, Esaki, & Fukuda, 2005; Naruse, Kawai, Yokoi, & Kakazu, 2003). Kazerooni (2008) categorized types of the exoskeleton and human augmentation technology, including lower, upper, and intelligent assist devices. For instance, Chu et al. (2005) developed Berkeley Lower Extremity Exoskeleton (BLEEK), which consists of two powered leg parts, a power supply unit, and a backpack-like frame. The device allows the user to lift and carry heavy loads with minimal effort and extends the timeframe to handle the objects without the loss of body ability including agility and power.

In this sense, wearable exoskeleton devices can be considered as a remediation technique for injury prevention in the construction industry. The National Institute for Occupational Safety and Health posted the first blog about the application of the wearable devices in the construction industry in 2016 on the Centers for Disease Control and Prevention (CDC) official website (Lowe, Dick, Hudock, & Bobick, 2016). From the perspective of improving health and safety on construction sites, the benefit of wearable exoskeleton devices is to reduce musculoskeletal loads. Since MSDs are caused by being under postural constraints, carrying and controlling heavy objects, and using same body parts repeatedly, the devices can mitigate the causes of MSDs by bearing the heavy and repeating loads on behalf of the workers (Melchior, Roquelaure, Evanoff, Chastang, Ha, Imbernon, & Leclerc, 2006; National Research Council, 2001). Therefore, wearable exoskeleton devices can also decrease the occurrence of work-related MSDs and injuries to workers backs, shoulders, and other joint injuries, which are pervasive in the construction industry (Zingman, Earnest, Lowe, & Branche, 2017). For instance, a new workplace exoskeleton, the MAX, is designed to let the human body carry extra weight and redirect all that weight into the ground (Ashley, 2017). Furthermore, the wearable devices not only reduce safety risk but also increase the productivity of workers and the quality of work (Butler, 2016). There is a great potential safety and health benefit of utilizing exoskeleton machines to help aging workforce avoid MSDs and work more efficiently through supporting their physical abilities.

Wellness Program

Health can be defined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (World Health Organization, 2017). Therefore, wellness programs, such as services found at the UC Davis Student Health and Counseling Center, should include emotional, environmental, financial, intellectual, occupational, physical, social, and spiritual wellness. However, in this paper, to target the major injuries and illnesses of the aging workforce in construction, the meaning of wellness programs is limited to initiatives designed to improve the physical and cognitive functional health of employees, such as company-sponsored exercise programs and health-related education.

Promoting wellness programs can help not only employees protect their bodies from work-related injuries, but also employers reduce the safety risk of the aging workforce and financial benefit from lower health-insurance premiums (Scheidt, Humpherys, & Yorgason, 1999). When creating a wellness program, a company can either take an active or mandatory approach. Exercise programs can mitigate the decrease in body strength and functionality by muscle deterioration (Landi, Marzetti, Martone, Bernabei, & Onder, 2014). In fact, most construction safety managers have exercise programs in place as a part of their mandatory approach that aims to prevent accidents through daily warm-ups onsite. However, establishing a specific exercise program for the aging workforce would be necessary considering the increasing number of aging workforce. These programs may lower the occurrence rates of MSDs that make up a significant portion of the work-related injuries (Choi, 2015).

A fitness program alone, however, is not the solution to this emerging problem. Education for aging workers that helps them understand their physiological changes could be a proactive approach to avoiding injuries (Choi, 2015). Furthermore, worksite fitness and exercise programs for the aging workers paired with the education would promote them to make healthier behavior choices and reduce risk-taking behaviors.

With the deterioration of physical ability, aging influences mental capabilities; research points to the decline of cognitive performance, including sensorimotor performance, decision time, and memory (Laflamme & Menckel, 1995). For instance, older adults are slower than younger people to perform multiple tasks simultaneously (Silverstein, 2008). However, the age-related mental decline can be moderated and compensated by mental activity and training (Salthouse, 2006; Haight, 2003).

Safety Climate in the Construction Industry and among Aging Workers

Safety climate is related to organization's culture and attitude towards health and safety, and it has a direct impact on enforcement of rules and regulations within the organization (Choi, 2009). Instilling a culture of safety is not only about providing policy and regulations for workers but also increasing their willingness to improve the safety in the workplace. Values of a culture that supports safety include the concept of commitment, communication, supportive environment, supervisory environment, worker's involvement, personal appreciation of risk, appraisal of physical work environment and work hazards, and competence (Mohamed, 2002).

Construction safety managers who understand the physical and cognitive changes of the aging workforce can manage the increased risks associated with aging by assigning appropriate tasks to an aging workforce. Construction managers can balance the proportion of workload of team members accordingly. The managers can consider pairing up younger and older workers based on physical demands of tasks and spread the physical workload to reduce the exposures to excessive and heavy physical tasks (Building Construction Industry Training Organisation, 2013). With regards to cognitive changes, older people are slow to respond to the continuous changes of information from the physical environment and equipment (McMahan & Sturz, 2006). For instance, driving heavy machinery on construction sites may not be appropriate for the aging workforce. Also, the understanding of MSDs can establish new criteria by specifically managing manual workers who are exposed to postural constraints or repetitive work motions. The recognition of mental and physical changes in workers would decrease the accident rates and eventually improve health and safety of the aging workforce on construction sites.

Challenges for Implementing Interventions

Although the magnitude of the impact of the suggested interventions on increased work performance and decreased occupational injuries is not definite, it is evident that implementing the interventions is key to achieving the safety of the aging workforce and reducing the risk to the workers. However, there are several challenges to adopt the solutions.

First, there is no long-term research on the utilization of exoskeletons, and their side effects or symptoms of usage (Zingman et al., 2017). The U.S. National Institute of Standards and Technology has attempted to map out the potential hazards of the use of exoskeletons, and standards for the safety of the exoskeleton use have been set out in Europe in 2016, but the data of the long-term use of the devices is not sufficient (Zingman et al., 2017). Also, proper standards for construction is required to be developed before applying the devices to workers.

Another challenge is that even though wellness programs eventually give employers benefits, the employers who seek immediate gains on their investment on the wellness programs may not invest in these programs. Also, training an aging workforce on new technology is necessary to protect them from work-related injuries and to increase productivity (Building Construction Industry Training Organisation, 2013). This training would cause added cost for employers, and the returning of investment of this training might not be immediately achieved.

Lastly, it is demonstrably challenging to keep a sound safety climate on construction sites. Most workers and construction managers are often under pressure to complete tasks and maintain a tight construction schedule. This work pressure often encourages construction managers to turn a blind eye to workers violating safety rules, which hinders the ability to achieve high safety performance (Sawacha, Naoum, & Fong, 1999).

Conclusion

This study reviewed the health and safety concerns related to the aging construction workforce. Aging causes changes in one's physical capacities and cognitive functions, and it can increase occupational risks. Because tasks in the construction industry are often dependent on physical ability, the safety of older workers is more susceptible to physical and cognitive changes. As the number of older construction workers increases annually, so does the significant loss of related costs for employers.

Despite recent attention to the research of an aging workforce in the construction industry, only a few studies on safety and health issues of older workers have been conducted. This study reviewed physical and cognitive changes of older workers and suggested possible interventions based on the changes to reduce work-related injuries and illnesses. Ergonomic solutions, especially exoskeleton technology, can help older workers increase their workability without risk of getting injured. Wellness programs, education, and a strong safety climate aide in the mitigation of risk associated with older workers.

This research suggested interventions focused on ergonomics, wellness programs, and safety climates. However, more potential interventions are available, such as improvement in physical environment, supportive policies, and redesigning work schemes on job sites (Silverstein, 2008). Future study should focus on a variation of interventions to prevent occupational injuries and illnesses among older construction workers. In addition, evaluation and validation of interventions are critically needed to address this emerging issue.

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