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potential confounders. Compared to white, non-Hispanic workers, minority workers were more likely to have lower socioeconomic statuses (e.g., lower educational attainment, lack of health

interval (CI) 1.003-1.007] per one degrees C change in humidex. In the spline analyses, we observed a nearly linear association of humidex with the risk of a traumatic injury. Effect estimates were higher among younger (18-24 years) and older (>54 years) workers, workers with lower extremity injuries, workers with less job experience, smaller employers, workers working in Western Washington, and time of injury before 12:30 hours, although CI of effect estimates overlapped in stratified analysis categories. Conclusions In this study of Washington outdoor construction workers, increasing maximum daily humidex was associated with increasing traumatic injury risk. Further work should explore mechanisms of the association between heat exposure and traumatic injuries. Injury prevention efforts targeted at construction should address heat-related risk factors. In addition, heat awareness campaigns should address outcomes beyond heat-related illness.

Choi, S. D. (2015). "Aging Workers and Trade-Related Injuries in the US Construction Industry." *Saf Health Work* 6(2): 151-155.

The study was designed to identify any trends of injury type as it relates to the age and trade of construction workers. The participants for this study included any individual who, while working on a heavy and highway construction project in the Midwestern United States, sustained an injury during the specified time frame of when the data were collected. During this period, 143 injury reports were collected. The four trade/occupation groups with the highest injury rates were laborers, carpenters, iron workers, and operators. Data pertaining to injuries sustained by body part in each age group showed that younger workers generally suffered from finger/hand/wrist injuries due to cuts/lacerations and contusion, whereas older workers had increased sprains/strains injuries to the ankle/foot/toes, knees/lower legs, and multiple body parts caused by falls from a higher level or overexertion. Understanding these trade-related tasks can help present a more accurate depiction of the incident and identify trends and intervention methods to meet the needs of the aging workforce in the industry. © 2015, Occupational Safety and Health Research Institute.

Choi, S. H., et al. (2013). "Factors associated with smoking among operating engineers." *Workplace Health and Safety* 61(9): 385-392.

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OBJECTIVES: This study was designed to evaluate the effects of safety and health training on work-related injury in the construction industry. **METHODS:** Union health insurance records, union training records, and workers compensation data for 1993 and 1994 were analyzed for more than 8000 construction laborers in Washington State. **RESULTS:** After controlling for demographic factors, laborers who received safety and health training during the study period were 12% (95% confidence interval [CI] = 0.75-1.02) less likely than nontrained laborers to file for workers compensation. Among workers 16 to 24 years old, training was associated with a 42% (95% CI = 0.35-0.95) reduction in claims. **CONCLUSIONS:** These findings provide evidence of the effectiveness of safety and health training in preventing occupational injuries among construction laborers, particularly among younger workers. However, the results cover only a limited time and the long-term effects remain unclear.

Dong, X. S., et al. (2022). "Psychological distress and suicidal ideation among male construction workers in the United States." *Am J Ind Med* 65(5): 396-408.

BACKGROUND: Male workers in the US construction industry have a higher suicide rate than other workers in the nation. However, related research on this population remains sparse. This study evaluated psychological distress and suicidal ideation in these workers, and possible underlying factors. **METHODS:** Data from the National Survey of Drug Use and

Lipscomb, H. J., et al. (2014). "How well are we controlling falls from height in construction? Experiences of union carpenters in Washington State, 1989-2008." *Am J Ind Med* 57(1): 69-77.

Background: Falls from height (FFH) continue to cause significant morbidity and mortality across the construction industry. Methods: By linking data on work hours with workers' compensation records, rates of work-related injuries resulting from FFH and associated days away from work were evaluated among a large cohort (n=24,830) of union carpenters in Washington State from 1989 to 2008. Using Poisson regression we assessed rates of FFH over the 20-year period while adjusting for temporal trend in other work-related injuries. Patterns of paid lost days (PLDs) were assessed with negative binomial regression. Results: Crude rates of FFH decreased 82% over the 20-year period. Reductions were more modest and without demonstrable change since 1996 when adjusting for the temporal reduction in other injuries. Younger workers had higher injury rates; older workers lost more days following falls. Rates of PLDs as(s)1 ollop woryeath negaf(1)-2 (r)-712s fr weased 82% (pe)4 (r)-2 (on)]TJm (

ability of firm characteristics measured during 2011-2013 to predict time-loss claim rates in the following year, 2014. RESULTS: Claim rates in 2014 varied by construction industry groups, ranging from 0.7 (Land Subdivision) to 4.6 (Foundation, Structure, and Building Construction) claims per 100 FTE. Construction firms with higher average WC premium rates, a history of WC claims, increasing number of quarterly FTE, and lower average wage rates during 2011-2013 were predicted to have higher WC claim rates in 2014. CONCLUSIONS: We demonstrate the ability to leverage administrative data to identify construction firms predicted to have future WC claims. This study should be repeated to determine if these results are applicable to other high-hazard industries. Practical Applications: This study identified characteristics that may be used to further refine targeted outreach and prevention to construction firms at risk.

Mazurek, J. M. and M. D. Attfield (2008). "Silicosis mortality among young adults in the United States, 1968-2004." *Am J Ind Med* 51(8): 568-578.

BACKGROUND: To describe silicosis deaths in young (aged 15-44) adults in the U.S. during 1968-2004. METHODS: We analyzed the National Center for Health Statistics multiple cause-of-death records. RESULTS: Compared with silicosis decedents aged ≥ 45 years ($n = 15,643$), young decedents ($n = 237$) were more likely to have silicosis listed as the underlying cause of death (74.3% vs. 48.2%, $P < 0.001$), to be female (9.3% vs. 2.2%, $P < 0.001$) and black (37.1% vs. 11.7%, $P < 0.001$). Twenty-nine young silicosis decedents had industry and occupation information available. Occupations in construction and manufacturing industries were associated with significantly elevated proportionate mortality ratios for young silicosis deaths. CONCLUSIONS: Silicosis deaths occur among young adults. Because these deaths are likely to reflect more intense and recent exposures, the follow-back investigations into the work sites where these individuals were exposed to silica should be conducted.

Mehta, R. K. and M. J. Agnew (2010). "Analysis of individual and occupational risk factors on task performance and biomechanical demands for a simulated drilling task." *International Journal of Industrial Ergonomics* 40(5): 584-591.

The purpose of this study was to evaluate age- and gender-dependent effects of shoulder fatigue on task performance and muscular responses of a drilling task commonly observed within the construction industry. Twelve younger (18-35 years) and ten older (45-60 years) participants, balanced by gender, were recruited from the local community. Task performance (task completion times and errors made), muscle activity of the anterior deltoid (static, mean, and peak amplitude probability density function), coactivity indices of the upper and lower arm, and perceived discomfort ratings were obtained for a series of drilling tasks at three levels of task difficulty, before and after manifestation of shoulder fatigue. To induce fatigue, participants performed a sustained sub-maximal fatigue task at 40% of their maximum voluntary shoulder exertion. Fatigue decreased task completion times, irrespective of age and gender. Higher errors were observed in the fatigued condition, especially for younger participants. Females showed higher shoulder muscle activity compared to men. Additionally, fatigue resulted in lower shoulder APDF measures compared to the no-fatigue condition. Muscle recruitment patterns differed within the fatigue condition, with higher coactivity indices in the upper and lower arm muscles compensating for decreases in shoulder muscle activity. Task difficulty was not found to affect any dependent measures. Participants reported higher discomfort in the fatigued state; this effect was more prominent in females. Overall, this study demonstrated, through objective and subjective measures, that task performance and biomechanical demands are affected by

fatigue, and that this effect varies with individual factors such as gender and age. Relevance to industry: This paper explored the influence of task demands (fatigue and task difficulty) and individual factors (gender and age) of a drilling task on the development of musculoskeletal injuries of construction workers. The results may contribute towards an understanding of the interplay of certain occupational task demands and worker characteristics on common musculoskeletal injuries.

a family member also works) impacts hazard exposures and safety practices. **PARTICIPANTS:** Participants included 187 North Carolina construction workers 14 to 17 years old who were surveyed about their jobs. **METHODS:** We conducted stratified analyses using cross-tabulations and chi-square statistics to measure associations between workgroup size (i.e., the total number of workers on a jobsite) and family-firm connections (yes/no) and hazard exposures (e.g., saws) and safety practices (e.g., supervision). **RESULTS:** Having a family-firm connection was associated with fewer hazard exposures and greater safety practices. Youth who worked on jobsites with a larger workgroup (11-50 workers) reported more hazards but also more safety practices. **CONCLUSIONS:** Family-firm connections, in particular, may have a protective effect for youth in construction. Even though the statistical significance of our findings on workgroup size was limited in places, the pattern of differences found suggest that further research in this area is warranted.

Rauscher, K. J., et al. (2011). "Work-related fatalities among youth ages 11-17 in North Carolina, 1990-2008." *Am J Ind Med* 54(2): 136-142.

BACKGROUND: Local and national surveillance systems are in place that identify occupational deaths. However, due to certain restrictions, they are limited in their ability to accurately count these deaths among adolescent workers. **METHODS:** In this population-based study, we relied on primary data from the North Carolina medical examiner system to identify and describe all work-related fatalities among North Carolina youth under age 18 between 1990 and 2008. **RESULTS:** We identified 31 work-related deaths among youth ages 11-17. The majority occurred between 1990 and 1999. Most occurred in construction and agriculture. Vehicles and guns were responsible for the majority of deaths. **CONCLUSIONS:** Although the prevalence of adolescent work-related fatalities has seen a decline in North Carolina, the 31 deaths we detected signal a failure of the systems in place to prevent young worker fatalities. More remains to be done to protect the lives of adolescent workers.

Rauscher, K. J., et al. (2010). "Construction firm practices and manager beliefs regarding the employment and safety of teenaged employees: a North Carolina based study." *Work* 37(2): 145-154.

OBJECTIVE: The objective of this study was to examine the reported practices of construction firms and the beliefs of firm managers/supervisors with respect to employing youth under age 18 and ensuring their safety. **PARTICIPANTS:** The participants in this study were firm representatives from 54, mostly small to medium sized, construction firms in North Carolina. **METHODS:** Survey responses were analyzed for the entire sample and within strata of firm size (1-10, 11+ employees) using descriptive statistics. Percentages and 95% confidence intervals were calculated. Chi-square tests were used to test for statistical significance in differences between firm sizes. **RESULTS:** The findings suggest limits in the adequacy of safety training given to youth in construction, particularly in light of the minimal experience firms require of young hires, that managers' beliefs about the causes of young worker injury are largely focused on worker behaviors rather than on the presence of hazards, and that managers' compliance with child labor laws may be hampered by their lack of knowledge of these laws and an ambivalence toward their usefulness and enforcement. **CONCLUSIONS:** While larger studies are needed to confirm and advance these findings, when considered along with prior studies, they demonstrate the need to improve the safety of the construction environment for youth. The development of new educational interventions by health and safety professionals

Schwatka, N. V., et al. (2013). "Age in relation to worker compensation costs in the construction industry." *Am J Ind Med* 56(3): 356-366.

BACKGROUND: A better understanding of how workers' compensation (WC) costs are affected by an aging US workforce is needed, especially for physically demanding industries, such as construction. **METHODS:** The relationship between age and injury type on claim costs was evaluated using a database of 107,064 Colorado WC claims filed between 1998 and 2008 among construction workers. **RESULTS:** Mean WC costs increased with increasing age for total cost ($P < 0.0001$), medical costs ($P < 0.0001$), and indemnity costs ($P < 0.0001$). For each one-year increase in age, indemnity, and medical costs increased by 3.5% and 1.1%, respectively. For specific injury types, such as strains and contusions, the association between age and indemnity costs was higher among claimants aged ≥ 65 compared to claimants aged 18-24. **CONCLUSIONS:** Our findings suggest that specific injury types may be partially responsible for the higher indemnity costs among older construction workers, compared with their younger coworkers.

Seixas, N. S., et al. (2004). "Predictors of hearing threshold levels and distortion product otoacoustic emissions among noise exposed young adults." *Occup Environ Med* 61(11): 899-907.

AIM: To examine the relations between noise exposure and other risk factors with hearing function as measured by audiometric thresholds and distortion product otoacoustic emissions. **METHODS:** A total of 456 subjects were studied (393 apprentices in construction trades and 63 graduate students). Hearing and peripheral auditory function were quantified using standard, automated threshold audiometry, tympanometry, and distortion product otoacoustic emissions (DPOAEs). The analysis addressed relations of noise exposure history and other risk factors with hearing threshold levels (HTLs) and DPOAEs at the baseline test for the cohort. **RESULTS:** The cohort had a mean age of 27 (7) years. The construction apprentices reported more noise exposure than students in both their occupational and non-occupational exposure histories. A strong effect of age and years of work in construction was observed at 4, 6, and 8 kHz for both HTLs and DPOAEs. Each year of construction work reported prior to baseline was associated with a 0.7 dB increase in HTL or 0.2 dB decrease DPOAE amplitude. Overall, there was a very similar pattern of effects between the HTLs and DPOAEs. **CONCLUSIONS:** This analysis shows a relatively good correspondence between the associations of noise exposures and other risk factors with DPOAEs and the associations observed with pure-tone audiometric thresholds in a young adult working population. The results provide further evidence that DPOAEs can be used to assess damage to hearing from a variety of exposures including noise. Clarifying advantages of DPOAEs or HTLs in terms of sensitivity to early manifestations of noise insults, or their utility in predicting future loss in hearing will require longitudinal follow up.

Simeonov, P., et al. (2011). "Postural stability effects of random vibration at the feet of construction workers in simulated elevation." *Appl Ergon* 42(5): 672-681.

The risk of falls from height on a construction site increases under conditions which degrade workers' postural control. At elevation, workers depend heavily on sensory information from their feet to maintain balance. The study tested two hypotheses: "sensory enhancement"--sub-sensory (undetectable) random mechanical vibrations at the plantar surface of the feet can improve worker's balance at elevation; and "sensory suppression"--supra-sensory (detectable)

random mechanical vibrations can have a degrading effect on balance in the same experimental settings. Six young (age 20-35) and six aging (age 45-60) construction workers were tested while standing in standard and semi-tandem postures on instrumented gel insoles. The insoles applied sub- or supra-sens

Vosbikian, M. M., et al. (2017). "The Impact of Safety Regulations on the Incidence of Upper-Extremity Power Saw Injuries in the United States." *Journal of Hand Surgery* 42(4): 296.e291-296.e210.

Purpose Over 50,000 power saw-related injuries occur annually in the United States. Numerous safety measures have been implemented to protect the users of these tools. This study was designed to determine which interventions, if any, have had a positive impact on the safety of the consumer or laborer. **Methods** We queried the National Electronic Injury Surveillance System database for hand and upper-extremity injuries attributed to power saws from 1997 to 2014. Demographic information including age, sex, date of injury, device, location, body part involved, diagnosis, and disposition was recorded. We performed statistical analysis using interrupted time series analysis to evaluate the incidence of injury with respect to specific safety guidelines as well as temporal trends including patients' age. **Results** An 18% increase in power saw-related injuries was noted from 1997 (44,877) to 2005 (75,037). From 2006 to 2015 an annual decrease of 5.8% was observed. This was correlated with regulations for power saw use by the Consumer Safety Product Commission (CPSC) and Underwriters Laboratories. Mean age of injured patients increased from 48.8 to 52.9 years whereas the proportion of subjects aged less than 50 years decreased from 52.8% to 41.9%. These trends were most pronounced after the 2006 CPSC regulations. **Conclusions** The incidence of power saw injuries increased from 1997 to 2005, with a subsequent decrease from 2006 to 2015. The guidelines for safer operation and improvements in equipment, mandated by the CPSC and Underwriters Laboratories, appeared to have been successful in precipitating a decrease in the incidence of power saw injuries to the upper extremity, particularly in the younger population. **Clinical relevance** The publication of safety regulations has been noted to have an association with a decreased incidence in power saw injuries. Based on this, clinicians should take an active role in their practice as well as in their professional societies to educate and counsel patients to prevent further injury. © 2017 American Society for Surgery of the Hand

Yang, L., et al. (2021). "Assessing disabling and non-disabling injuries and illnesses using accepted workers compensation claims data to prioritize industries of high risk for Oregon young workers." *J Safety Res* 77: 241-254.

INTRODUCTION: Young workers are especially vulnerable to occupational injuries and illnesses. There is a continued need to investigate injury burden among young workers across demographics and industry to inform t

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(35.6%) and "work-related musculoskeletal disorders (WMSDs)" (19.5%). High risk industries included agriculture, construction, and manufacturing for both genders combined. For female

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