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The Aging Workforce And Their Impact On Workplace Injuries

James D. Feske

THE AGING WORKFORCE AND THEIR IMPACT ON WORKPLACE INJURIES

by

Jim Feske
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This thesis, submitted by Jim Feske in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

_____
Dr. David Flynn, Chairperson

_____
Dr. Daniel Biederman

_____
Dr. Patrick O'Neill

This thesis is being submitted by the appointed advisory committee as having met all of the requirements of the School of Graduate Studies at the University of North Dakota and is hereby approved.

_____
Wayne Swisher
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Jim Feske
December 5, 2014

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To my wife Megan and daughter Emma,
I cherish your love and support more than anything on Earth.

ABSTRACT

Workplace safety is critical for any organization. Creating a culture of safe behavior and developing safe surroundings can take a lot of time and effort, so it is important for firms to fully understand their risk exposures and their areas of focus for reducing or eliminating those risks. This analysis focuses on the aging American workforce and the impact on injury frequency rates. The aging workforce has been the focus of many analyses, but this analysis differs in that it focuses solely on their effects, if any, on injuries reported to the Occupation Safety and Health Association (OSHA).

Over time, individuals have continued to live longer and longer. Workplace safety must keep up with the aging workforce. Age 55 was once considered retirement age, but with the longevity of life, employees are continuing to work well into their sixties and seventies while still allowing themselves ample time for retirement. The study utilizes age 55 as the comparison cutoff point, allowing for a significant amount of the workforce headcount to be examined in the analysis and accounting for the deterioration of physical capabilities as individuals age. The results ultimately show that workers 55 and over are, in fact, more likely to be injured in the workplace than their younger counterparts. This information can prove valuable to firms looking to implement safety initiatives in the workplace and allow them to better understand the scope of employee impact and focus of attention.

CHAPTER I

INTRODUCTION

Safety, an important factor in running an effective and efficient business, must be ingrained in the mind of each and every employee within an organization. Whether it is promoting safe actions, safe movements, or safe positioning, there are many variables to consider when approaching a culture of safety within the workplace. Companies must methodically review potential hazards and create a process for minimizing those hazards, such as performing job hazard analyses that identify areas of risk within each position's job requirements. But what happens if the hazard is the age of the worker? This is a dilemma that many companies face. Such is the case at Walmart, where older employees are more likely to be found at the greeter or cashier position than in the more physically demanding shelf-stocking position. This analysis examines the aging of the workforce and the impact on workplace injuries. It attempts to answer such questions as "Should my organization be concerned about increased injuries due to our aging workforce" and "What kind of impact do older workers have on my incident rates?"

In order to best measure and monitor a goal, it is best to have a key performance indicator (KPI) to provide a suitable baseline for the study. In the case of workplace injuries, the Occupational Safety & Health Association (OSHA) provides an injury rate for organizations to follow. The frequency rate, a calculation of the number of injuries during any span of time, multiplied by 200,000, then divided by the number of labor hours during

that span of time, reflects the injury rate of 100 full-time employees in a year. Ultimately the frequency rate can be utilized by firms as a benchmarking tool to compare themselves against their industry's rate, or perhaps against other industries, and can even be used to compare key demographic groups such as age and gender. The Bureau of Labor Statistics (BLS) releases an annual report that breaks down the OSHA frequency rates of nearly every industry in the nation, as well as age and gender rates. It is for this reason that the OSHA frequency rate is utilized to capture the impact of older workers. The outcomes and findings will assist organizations in further understanding their frequency rate variations over time. It will also help them better understand their age group allocation variances, and most importantly, as workers age do they actually impact the organization's frequency rate.

A company's frequency rate is more than just a number, it is a KPI for many variables. By tracking their rate, a company can follow the successes and failures of safety initiatives, the behavior of employees, and identify vulnerabilities and risk exposures requiring remedy. Tracking the rate for key areas or facets within an organization allows a clearer focus on employees and their exposures to hazards within their job. A job requiring quick reflexes, such as a bus driver, may be more difficult for an older employee to perform since muscle reflexes deteriorate as individuals age.

Different jobs present different hazards, but this study uses a simple aggregation of all jobs in United States in order to provide a clear and concise outcome. This aggregation alleviates the need to account for age range impacts on certain job roles. For instance, the younger workforce may find themselves working entry-level positions in various food and beverage roles or construction, while the older workforce participants fall into a different scope of work activity altogether. These responsibilities, and the variances within groups of

responsibility, become much less significant when a combined rate is used for an entire age group.

When developing safety programs and initiatives, organizations must consider many variables regarding their workforce, perhaps key demographic variables that fall within protected classes such as age and gender. According to the U.S. Equal Employment Opportunity Commission, a worker cannot be treated less fairly due to his/her age. The Age Discrimination in Employment Act (ADEA) protects workers age 40 and over from discrimination by the employer, which makes it important that companies react appropriately when handling safety related issues involving older workers (eeoc.gov). Though age and gender are protected classes, they can still be drivers for workplace safety initiatives and can contribute to how avenues of the programs can address and benefit the safety for both the focused classes and the rest of the employees.

As an example, let us assume that an organization is attempting to reduce injuries due to trip and falls. One contributing factor could be light, or the lack thereof. Many studies have proven that as people get older their vision begins to be greatly impacted, affecting their ability to see in darker environments. According to the American Optometric Association (AOA), individuals begin to experience eyesight deterioration in their early to mid-forties. The vision deterioration results in the need for additional lighting as well as individuals having issues with glare and color perception (aoa.org). If an organization finds that the majority of employees injured by trip and falls are indeed older employees, then an increase in lighting levels and luminosity would aid in providing better sight and vision for all employees. The additional light benefits everyone and serves as a solution that alleviates the concern of reacting solely to a core, protected class of individuals. This fix would also

keep the firm clear of potential legal issues related to the protected class, as employers are unable to reprimand an employee due to their age.

The objective of the current analysis is not to derive the safety measures and KPIs necessary to reduce injury rates, but instead it is to allow for a more focused attention on whether the age of workers actually plays a role in the safety of the organization. As previously mentioned, the age of an employee falls within a protected class, but in some instances it is the protected class status that makes the employee a target of attention when analyzing the injury data of workers, just as job tasks or years of experience can impact injury frequency. Eyesight is affected, physical strength can be reduced, and mental performance can deteriorate as we get older. Fair (2007), in a study titled "Estimated Age Effects in Athletic Events and Chess", shows clearly that performance of physical activities, such as running and sprinting, deteriorates as age increases.

Figure 1, which spans from age 35 to 99, shows data that reflects the deterioration factors over time for three key activities. The Age Factor variable, a measure of deterioration over time, can be interpreted as a percentage of deterioration from the age 35. For example, the sprinting factor at 65 is 1.27, which means that the deterioration rate over those 30 years is 27%. It can be seen in the graph that the endurance factor of the more physically demanding activities, long-distance running and sprinting, deteriorate quicker and at a higher level than the mental activity of chess. This visualization of performance deterioration makes it easy to understand how older workers can be impacted by the physical activities of a job, yet can completely fulfill the mental aspects of the job. Knowing that performance can deteriorate over time, though less for mental than for physical abilities, opens the door for concern amongst the workplace management.

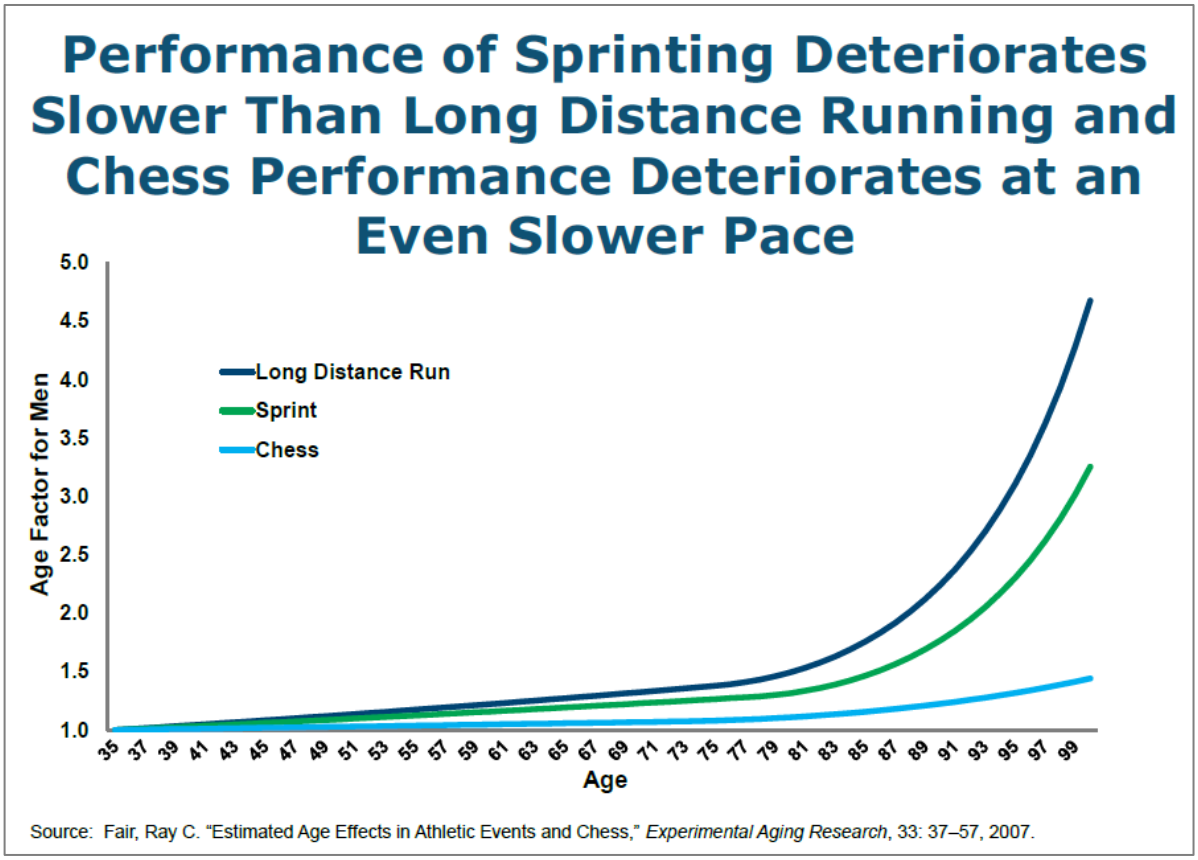

Figure 1: Activity Performance with Age. The performance of activities as age increases.

A task that once seemed menial for a 35 year old is now, potentially, much more strenuous for a 65 year old. Increasing the safety of a job task or function can be very costly, so when reviewing the cost-benefit analysis of modifying a task to increase its safety measures, this analysis can provide a benchmark for employee impact and age relevance within the scope of the safety efforts. The analysis relies strictly on OSHA injury counts only.

CHAPTER II

LITERATURE REVIEW

There have been numerous studies conducted that look at workplace injuries and the impact of the aging workforce. Whether it is an analysis from Occupational & Environmental Medicine examining the differences in workplace injury severity, or a paper from PMA Companies illustrating *Capitalizing on an Aging Workforce* (Nogan, 2009), there is a wide range of analyses available. However, the National Council on Compensation Insurance (NCCI) is the authoritative resource for topics covering workforce demographic analysis and workplace injury reporting. Papers such as *Workers Compensation and the Aging Workforce* (Restrepo & Shuford, 2012) and *Claims Characteristics of Workers Aged 65 and Older* (Wolf, 2010) showcase the NCCI's ability to dig deep into the injury data and derive valuable findings from the massive data they are able to acquire from organizations. While reviewing the plethora of analyses available as resources, the key piece of literature used as a basis for this analysis is the NCCI's paper titled *Age as a Driver of Frequency and Severity* (Restrepo, Shuford, & Sobel, 2006).

The current thesis analysis mirrors the objectives of the previously stated analyses. Providing insight as to whether or not age drives injury frequency rates is vital to better understanding how to approach the aging workforce, which is why the NCCI's paper was chosen as a benchmarking tool for the current study. The paper, completed in December

2006, breaks down the workforce into five key demographic groups, spanning from ages 20 to 64. Later in the paper they have additional analysis broken into only two key demographic groups, with 20-34 year olds in one group and those aged 45-64 in the other group. In both cases (five groups vs. two), the reasoning for excluding workers under 20 and over 64, as explained by authors Restrepo, et. al, was due to the fact that these workers combined to account for an insignificant portion of the total number of people in the workforce. Later in their paper, the authors incorporate these age groups to provide a more holistic analysis of the age range diversities.

In addition to the breakdown of age groups within the analysis, there are other key variables to note within the NCCI's analysis. First, their data focuses on injuries resulting in the worker missing at least one day of work. Referred to as days-away-from-work (DAFW), this variable represents just a subset of all workplace incidents. An injury involving the worker missing a day of work involves a more severe injury, so utilizing the DAFW variable is an effective way to capture the more severe injuries that took place. The study is then able to analyze how the severe injuries differ between the age groups.

Second, the NCCI's data spans a short period of time, extending from 1994-1999. This allowed the researchers to easily show shifts within their data and results in a very concise manner, since their time-series graphs were based on annual data and they had only 6 data points per series. In many cases the data was condensed to showcase age range allocation without the use of a time-series, which means they simply combined the 6 years of data for each age range into one data-point. Though effective in the case of the NCCI's analysis, it would not be possible to utilize this method in analyses spanning multiple decades, as the data can change dramatically when encompassing a larger amount of time.

A final noteworthy aspect of the analysis is that the authors' efforts were focused primarily on explaining exactly why these severe injuries, and their associated workers' compensation claim costs, were impacted differently by the multiple age groups. It was during these further analyses that the authors decided to merge age ranges and drop the age group counts down from five to two. This allowed them to further analyze the larger buckets than have the breakdown of many silos. Though the NCCI's cost analysis methods are not used here, the NCCI's paper does provide many great features that act as starting points for deeper analysis.

Understanding the breakdown of the age range groups is an important first step in interpreting the results and key takeaways of the paper. As previously mentioned, the workforce under 20 was excluded, which meant the first age range captured 20 year olds up to 24 year olds. From there the age ranges spanned 10 years (25-34, 35-44, 45-54, & 55-64). It is immediately noticeable that the 20-24 age range is a noteworthy group since it includes half as many ages as the other groups, but when that fact is combined with the assumption that the age range falls within the key age for college students, it makes good sense that the age range ends at an age when most individuals are graduating college and joining the workforce as full-time employees. This allows for the older four age ranges to drive the analysis and act as the key components for age impact. Additionally, it sets up the age range groups to end at convenient ages of 54 & 64, years in an individual's life when retirement, social security, pensions, 401Ks, and IRAs begin to directly impact the immediate decisions people are making regarding their short-term goals in life. All of these variables can affect workforce participation, so it is critical to take this into account when understanding the analysis results.

The NCCI's analysis was driven by the evaluation of costs associated with the injuries and the monetary impact they have on the organizations handling the claim. It was stated that a major contributor to claim costs is the wage earned by the employee. This may be intuitive in hindsight, however it is the significance of the impact that makes it most impressive. It was found in the study that "differences in wages explain a third of the difference in indemnity severity" (Restrepo, Shuford, & Sobel, 2006), meaning that though the claim costs are higher for older workers with severe injuries, a third is due to their higher wages. The authors go on to explain that as workers get older, their wage increases. This is true in most cases, the exception being circumstances when a worker seeks post-retirement employment in a reduced capacity role. Aside from these individuals, it can be safely assumed that employees become more valuable and have increased asset potential as they continue to age.

The impact of earnings on indemnity severity tells us that older workers make more money, but it does tell us that older workers are more likely to be injured. The severity factor impacts the bottom-line, but the financials are not the focus of this analysis. What we are truly interested in finding out is if the older workers are driving the overall frequency rate. Through data captured from the Bureau of Labor Statistics (BLS) reflecting incidents involving days away from work (DAFW), the authors were able to show in a simple line chart that the frequency rate decreases as the age ranges increase. Figure 2, spanning from 1994-1999, shows that the frequency rate for 25-34 year olds is roughly 17 per 1,000 workers, compared to 11 for workers 55-64. This initial data interpretation can be telling in that younger workers are experiencing incidents with higher magnitudes of injury, since they missed at least one day of work due to the injury.

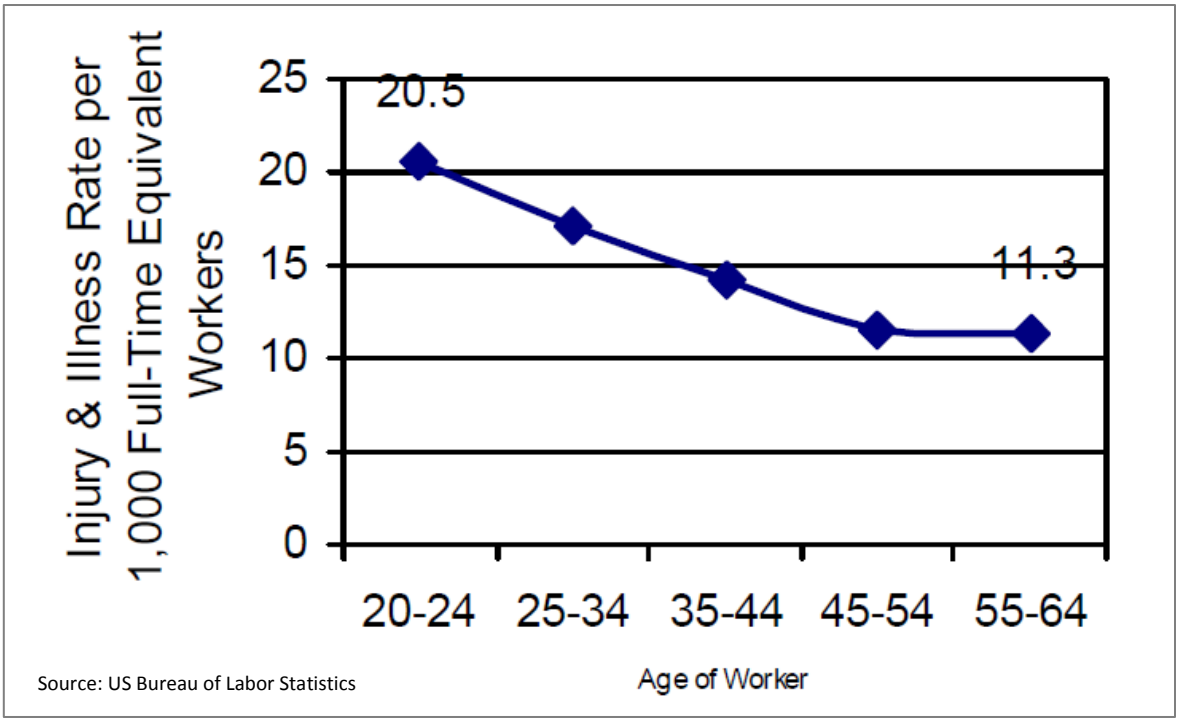

Figure 2: Injury Frequency by Age of Worker. Frequency of nonfatal injuries/illnesses involving days away from work decreases as age of workers increases from 1994-1999.

The severity of the injury is a primary indicator for determining costs related to workers compensation claims. A more severe injury will cost more in medical and rehabilitation costs, as well as additional costs associated with handling the claim and any future compensation for disabilities due to the injury. In addition to workers compensation claim costs, additional costs are incurred by an organization such as loss of productivity and experience when the employee is unable to work, along with expenses related to hiring and/or backfilling a position, which consists of training costs and any on-boarding processes that have to be taken.

Many of the aforementioned NCCI research papers related to age impacts on workplace injuries have a mild focus on the monetary or severity aspect of the injuries. It is in the *Age as a Driver of Frequency and Severity* analysis, by authors Restrepo, et. al, that

the financial data digs deeper to capture the root cause for this monetary discrepancy. As previously mentioned with the BLS DAFW trend, the younger age ranges had higher frequency rates of injuries, but when it comes to medical costs associated with lost time cases, the older age groups have the highest cost per claim. The researchers reviewed this discrepancy and found that one third could be explained by wage. In addition to wage, half of the discrepancy can be explained by the duration of the claim being open, meaning that older workers are getting paid for longer periods of time than their younger counterparts. These factors, along with the fact that older claimants receive an average of 24% more in lump sum payments (represents 17% of discrepancy), combine to account for 97% of the difference in indemnity payments. This leaves just 3% due to all other outside factors (Restrepo, Shuford, & Sobel, 2006).

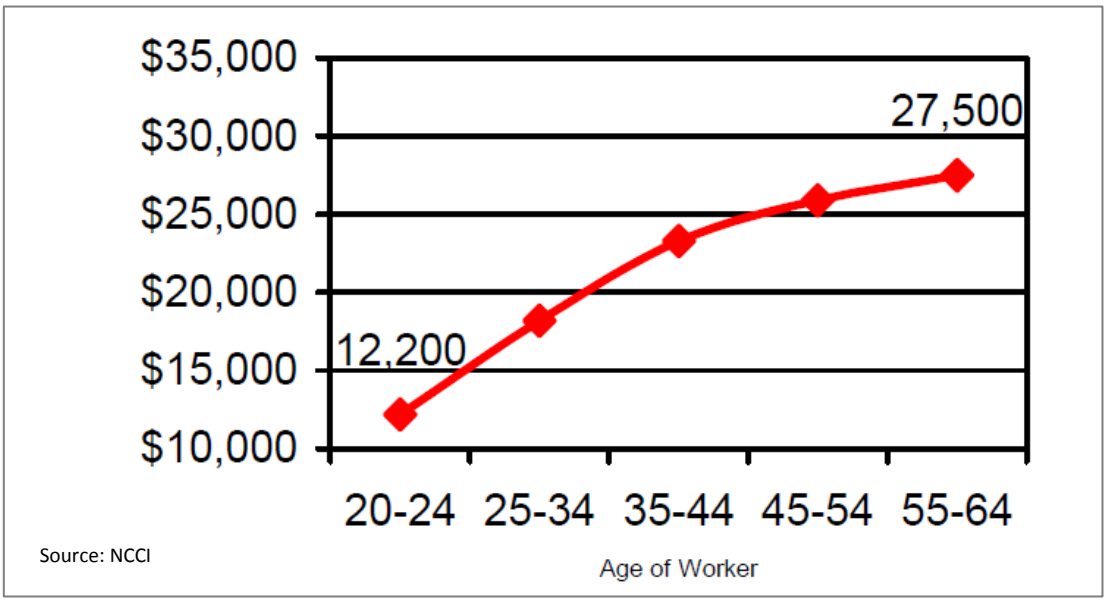

Figure 3: Injury Severity by Age of Worker. Average indemnity and medical costs for lost-time claims reported at 18 months increases as age of worker increases.

These financial allocations are extremely beneficial data points to consider when researching the monetary impact of older workers, but the downside is that the data spans a

timeframe when the economy was recovering and may have been impacted by workforce participation reductions for older workers. With the stock market seeing record levels under the Clinton administration, it provided a much-needed cushion for those workers seeking retirement. The effects of this can be seen using output of the National Retirement Risk Index (NRRI). The index measures "the share of working households who are at-risk of being unable to maintain their pre-retirement standard of living in retirement" (Munnell, Webb, and Golub-Sass, 2012). The NRRI's results show that the percentage of households "at-risk" went from 38% in 1995 to 53% in 2010. The authors attribute the increase to the bursting of the housing bubble, interest rates falling to record lows, and the rise in the retirement age for Social Security.

During the second of President G.W. Bush's terms in office, the economy crumbled beneath many people's feet, leading to drastic declines in retirement and savings accounts, negatively impacting the ability for the aging workforce to retire or remain retired. For many workers retirement had to be postponed, and in some unfortunate cases, those people that were in retirement had to rejoin the workforce. That is why Dr. Martin Wolf's 2010 study titled *Claims Characteristics of Workers Aged 65 and Older* is so important when grasping a holistic view of the older workers within the workforce. With data from the BLS captured in 2007, Dr. Wolf shows that the participation rate of those 65 and over encompasses a small fraction of the workforce and injury/illness cases, roughly 2.0% each (Wolf, 2010). However, what he does show early in the study is the percentage of the age population that is either employed or seeking employment.

Figure 4 clearly shows that the older age group reached a minimum employment seeking value in 1988 when just 11% of individuals 65 and over were in the workforce or

seeking employment. Fast forward to 2008 and we see that within the same age range 17% were willing to work. This 50% increase in the labor force participation rate is definitely noticeable, as is the jump from 55% to 65% for individuals 55-64, another key demographic of this analysis. Considering that the economic crisis began in 2006-07 and lasted years beyond 2008, it is well within reason to assume that the labor force participation rate for those 55 and over would continue to climb as the severity of the economic depression increased. Those that were looking forward to retirement were forced to hang onto their jobs for years beyond their initial intention.

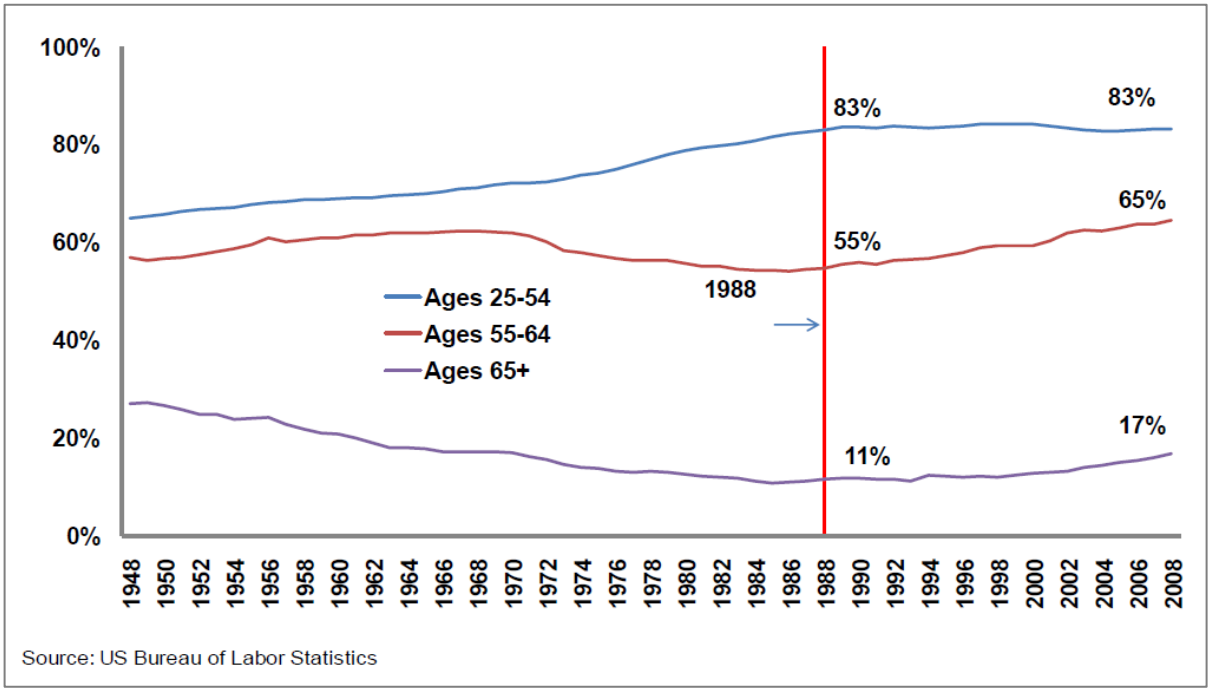

Figure 4: Percent of Working Age Population at Work or Looking for Work.

To better understand these shifts in labor force participation rates, it is helpful to look at the overall population from which these rates are derived. As the baby-boomer generation continues to age, they are falling into age ranges relevant to the study. As seen in the

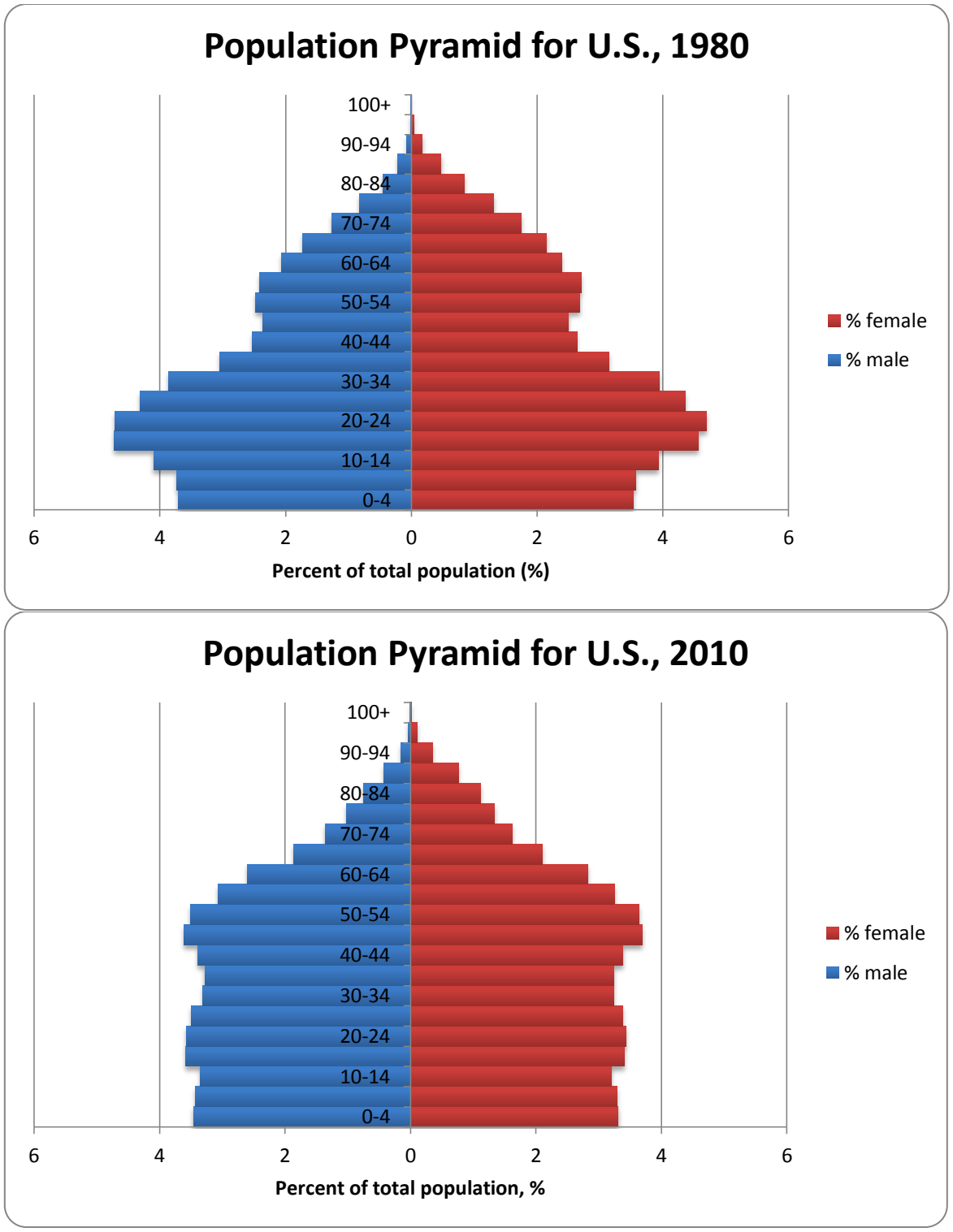

Figure 5: Population Pyramids for 1980 and 2010. (census.gov)

population pyramids in Figure 5, the 30 years between 1980 and 2010 clearly show that the baby-boomers have shifted from composing of the majority of the population in their twenties and thirties in 1980, to the majority of the population in their forties and fifties in 2010 (census.gov). This dramatic shift in the population serves as an indicator to the shifts of the workforce allocation over time.

Along with the increase in the older population in 2010, it can also be seen in the pyramids that the population distribution is much more uniform in 2010 than in 1980. There were 3 age ranges in 1980 that each individually accounted for over 4% of the population. Fast forward to 2010 and we see that the single highest age range accounts for only 3.7% of the population (45-49 year olds). The uniformity of the pyramid for 2010 suggests that although there may be a greater number of older workers in the workforce, their workforce allocation is not as lopsided as it was in 1980. This is an important takeaway from the pyramids since the baby-boomers' allocation will shift into the sixties and seventies age ranges. As they begin to retire, there will be an increased need for the younger population to take over those jobs. Similar to the crisis in China with their lack of younger workers to take care of the retirees, the U.S. could face a similar issue (Hvistendahl, 2011). Without enough younger workers, employers may be required to seek workers from outside of the country. This paper utilizes workforce allocation as a normalizing factor of the incident rate allocation, which allows for the ability to account for the effect of baby-boomers over time.

Though the monetary factors and findings are important takeaways from these studies, they still do not answer the question of whether or not older workers impact the OSHA frequency rate of an organization. They provide insight once an injury has taken place, and they solidify the preconceived notions that older workers are more costly to heal

when severely injured, but the analyses fail to inform the reader as to whether or not they play an important role in the OSHA rate. Many of the top organizations, both domestically and globally, utilize basic analyses and output to help drive their business. A snapshot is all that is utilized in many cases before a decision is made. Some of the most fundamental questions can be the building blocks for full-scale project implementation. If a safety program can greatly impact the well-being of their employees on a grand scale, and at the same time impact the key measurement of workplace injuries (i.e. the OSHA rate), then in many cases the efforts are put forth towards the project without the luxury of deeper analysis of the data. It is for this reason that it is imperative to fully understand whether the older workforce does in fact make an impact on the overall frequency rate. The outcome of this question, along with findings of the current analysis, will allow proper and appropriate actions to be taken when needed and can also be used in conjunction with the many studies already conducted regarding claim costs and severity variables.

CHAPTER III

ANALYSIS DATA

Over the past century, the lifespan of people in the United States has grown at a tremendous pace as the scientific methods of medicine and healthcare have been developed faster than at any other time in history. In the first half of the twentieth century, it was expected that people would work a steady job until the age of 55, at which time they could retire and live out the remaining ten years of their life in a comfortable manner. However, individuals are now living to be, on average, nearly 80 years old. Factor in the benefits of healthcare, along with the increase of an employee's wage over time, and it is clear that individuals can continue to work well into their sixties and still enjoy ten or fifteen years of retirement.

The aging workforce can be a much welcomed addition and necessary resource for an organization looking to capitalize on experience and leadership. With 30 to 40 years of experience in the workplace, a 55 year old is now able to be utilized for another ten years to train a new generation of individuals entering the workforce. This would not have been an option for firms in the 1960s and 1970s, as a 55 year old would have been near retirement and not available for an extensive amount of time.

As individuals continue to stay with a company, it is customary in most environments that their wages continue to increase along with any additional benefits. These

benefits, along with the increased expense of handling injuries of older workers, are additional costs that can put a strain on a company that could potentially hire a younger worker at a much lower cost. The costs and benefits of the aging workforce can be a bit of a conundrum for most organizations, but what it does present is an additional option that was not available thirty or forty years ago.

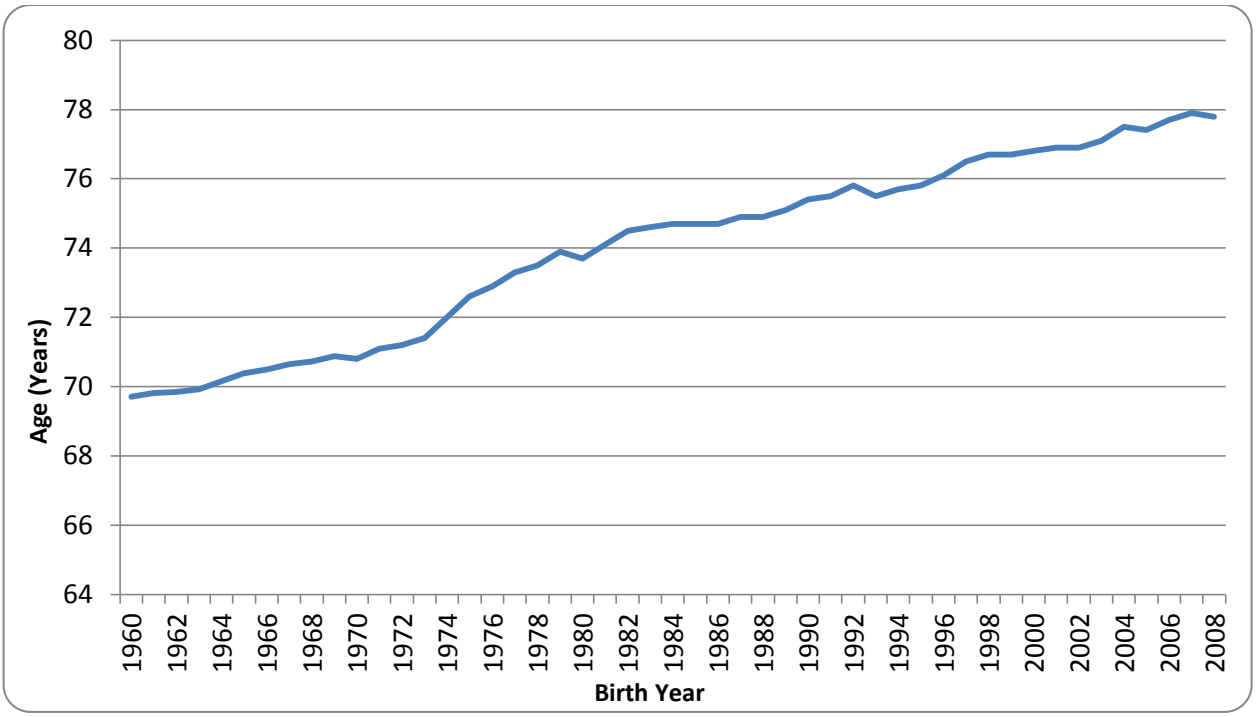

Figure 6: Lifespan at Birth (Men and Women). Spanning nearly fifty years, the lifespan of both men and women have continued to increase over time. (census.gov)

Since the 1960s, the life expectancy for men has grown from 67 years old in 1960 to 75 in 2008, a 13% increase. With nearly as impressive growth, the life expectancy for women increased by 10% during the same timeframe, jumping from 73 in 1960 to 80 in 2010. In addition to the lengthening of life expectancy, the cost of living longer now lingers. Adding 7 years to one's life now requires more money. Food, shelter, medical care, transportation, assisted living, utilities, and inflation all contribute to a necessity for working later in life. These rising costs can easily outweigh an individual's retirement income

(401Ks, pension plans, social security) and must be accounted for prior to retirement, since no one wants to run out of money later in life and enter the workforce in their last years.

Working later in life can be a challenge for both the individuals and the organizations employing them. Medical costs increase as people get older, something that must be considered by all parties involved. The aging worker is continuing to put themselves at a greater risk by performing the job functions required, and the organization is in the position of putting an aging worker in direct risk of injury. Whether the job role is taking place in an office environment or on a construction site, there are plenty of risks of injury. In fact, simple injuries such as a slip or trip can lead to severe injuries similar to falling from an elevated height or being caught in a piece of machinery. In fact, according to the Bureau of Labor Statistics, the most common workplace events leading to more severe injuries involve overexertion and bodily reaction. It can be a simple body movement that an individual is not used to performing on a routine basis, which can lead to them having to miss days of work. Take into consideration if the injury involves a worker in their late 50s or 60s and the severity of the injury can be compounded greatly.

The threat of more severe injuries is definitely a consideration for all parties involved. With more severe injuries come greater costs, especially when dealing with Workers' Compensation. The cost of handling a claim, assuming responsibilities within the claim handling process, and paying medical care costs for the life an employee, can quickly add up for an organization. Having high risk workers can quickly compound claims costs, potentially leading to higher healthcare costs for all employees. Whether the extra costs are passed onto the employee or the employer is just an additional worry that neither party wants to have to consider.

The goal then becomes capturing those high risk employees and isolating them in an effort to reduce cost and increase safety awareness. Older workers can be easily labeled as targets for severe injuries, due to their overall deteriorating health and weakening muscle core. The potential for individuals to contract illness increases with age while their bodies' ability to fight infection decreases, opening the door to greater exposure of risk for an organization. Yet with age comes wisdom and knowledge. Spending over twenty or thirty years in the workforce can definitely allow an individual to "learn the ropes" of the business, allowing for a lower likelihood of injury, thus decreasing their risk of injury with age. The younger worker, though fit and healthy, may find themselves in a position of greater risk and higher propensity for injury. Body positioning, knowledge of the workplace, and awareness of their surroundings can all attribute to how someone navigates through a safe or unsafe day-to-day environment.

Incidents can happen at any time and in any place. The incident data shown in the current analysis reflects injuries deemed as reportable to OSHA. OSHA stands as the leading force in workplace safety. Their standards are followed at a national level, allowing organizations to follow processes and procedures industry-wide, regardless of what industry they fall into. Having a level playing field makes it easier for organizations to measure themselves against others, setting benchmarking standards and gaining an understanding of how to properly conduct a safe work environment. OSHA also provides training, outreach, education, and assistance to organizations, enabling a streamlined approach to standards and a complete understanding of rules and regulations that are being enforced by the agency.

In addition to setting standards, OSHA tracks incidents annually by industry. Incidents and labor hours are utilized to capture an incident rate per 100 full-time workers

(200,000 labor hours annually). With a simple calculation, organizations can measure their rate against their industry average, or any industry for that matter. To capture the rate, an organization multiplies their number of incidents for a given year times 200,000, and divides that by the number of labor hours in their organization for the given year. The log of incidents and labor hours are shared with OSHA so complete rates can be compiled and shared by OSHA. These rates are heavily tracked by organizations as a measurement of employee safety.

Frequency rates can be calculated on multiple levels just as long as the incidents and labor hours can be tallied by the same variable. It's most common to see rates based on OSHA recordability, but they can also be calculated by injury severity, employee demographics, employee work status, job types, and numerous other variables. The rates all assist in better understanding key areas of focus, as well as acting as normalizing agents for tracking the impact of injuries. In the current analysis, the data focuses on OSHA recordable injuries (those incidents reported to OSHA) broken out by the age of the employee at the time of the injury.

The raw data being utilized for this analysis was captured from a major U.S. firm, comprising of both the incident data and the workforce allocation data. The data itself, serving as merely a sample of the entire nation's population, has allocation values that are nearly identical to the population value (see Table 1). Because the incidents and the workforce allocations are the same for both the sample and the population, it was determined to move forward with assuming that the population would respond to the same analytical tests that the sample is being tested against, making the results of the study applicable to the entire population.

2012 Workforce Allocation		
Age Group	**Firm**	**Nation**
Under55	79%	79%
55&over	21%	21%

Table 1: Firm vs. National Workforce Allocation. Total allocation comparison between individual firm and nation.

By analyzing OSHA injuries instead of all workplace injuries, it allows for a greater consistency within the data. Many organizations encourage reporting all incidents, regardless of injury severity or OSHA recordability. For instance, Near Miss reporting is quickly becoming a leading indicator for workplace injury. According to the National Safety Council, a Near Miss is "an unplanned event that did not result in injury, illness, or damage, but had the potential to do so". (nsc.org)

These reports, though vital and necessary for identifying vulnerabilities within an organization, do not serve as a uniform measurement. If an area or individual decides to file a Near Miss for an incident in their area, there is no process in place to ensure that a Near Miss report is filed for the same incident in another area. This misappropriation of reporting can cause an organization to make decisions based on skewed data. Ultimately, there must a process in place that captures proper reporting and review of the safety needs within the company. Without such efforts, the aggregated Near Miss data can be an irrelevant collection of data. Whereas with OSHA injury filings, there is a clear process that an organization must follow in determining whether an injury needs to be reported to OSHA and everyone has a clear understanding of the data.

The OSHA recordability determination process is quite complicated in nature, but companies and organizations are provided with clear instructions regarding recordability and

they must follow those instructions as deemed appropriate. In a condensed version, an OSHA recordable injury is a workplace injury in which the employee sought treatment by a physician or other health care professional, had days away from work, restricted work, or the incident resulted in a fatality. Having these outlines for determination allows organizations to follow a system in their recordkeeping process and lends itself to a more apples-to-apples analysis approach.

CHAPTER IV

METHODOLOGY & RESULTS

Initial analysis of the data included simple review of the raw data, as well as summarized views of the data. Spanning from 1982-2012, the data covers over 30 years of OSHA incidents and workforce allocation. Upon initial review, it is clearly seen that the allocation for both injuries and workforce have increased over time. Figure 7 shows that the movements of both incidents and workforce allocation over time, for workers 55 & over, are highly correlated. This lets us know immediately that the injuries of older workers are following suit with the number of workers in the workforce. It also shows that the proportion of injuries is not abnormal. For example, in 2012 the percent of the workforce 55 and over was 21%. In that same year, they accounted for 21% of OSHA injuries. This

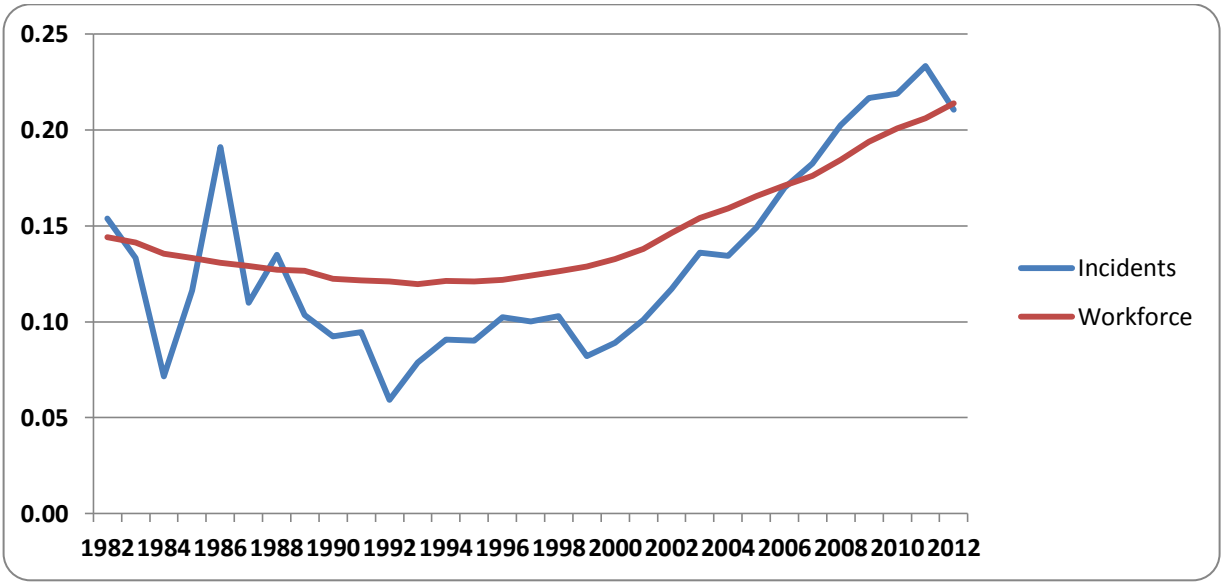

Figure 7: Incident and Workforce Allocations for Workers 55 and Over. (census.gov)

equality shows that the data can be used for further analysis without the concern of having to account for a disproportionate number of workers versus injuries.

As previously stated, the key component of the analysis is to answer whether or not older workers have an ill-proportioned allocation of incidents versus younger workers. To keep it simple, the analysis was conducted with workers under 55 in one bucket versus workers 55 and over in the other bucket. Initial review of the data, along with understandings collected from prior research studies, lent themselves towards the direction that older workers did not have a more significant impact. However, through the current analysis it was actually concluded that older workers do have a significantly higher allocation of incidents compared to younger workers.

Utilizing applicable incident counts and workforce participation headcounts allowed for proper normalization of the data, as well as a more holistic approach to the data since all other factors are removed (e.g. job roles, industry type). By capturing both incidents and headcounts, the current analysis is able to analyze the data at the individual level and not depend on data that could be biased or filled with null or missing values. This approach allows for better understanding of methodology application across all business units. In order to move forward with full analysis of the data, phase 1 of the analysis had to show that the sample and population displayed the same incident and workforce allocation values.

As previously stated, the incident and workforce data were captured from a major U.S. firm that is diversified in the types of job categories, thus the data serves as a sample of the national data. The more recent years of data that were available at both the corporation's and nation's level were compared to ensure that the results of the sample analysis could be applied to the general population (see Table 1 on page 22). As shown in the table, the

allocation values are nearly identical between the firm and nation, allowing for the study to move forward utilizing the sample and then applying the findings and results to the population.

Phase 2 of the current analysis serves as the key data point in identifying the variation levels between the two age groups. As previously stated, the purpose of the current analysis is to identify whether older workers are more likely to have a workplace injury versus their younger counterparts. In order to best conduct the analysis, it was determined that an Odds Ratio (OR) calculation be conducted in order to properly analyze the data.

The OR acts as a determination of the relative risk between the two groups (those under 55 years and those 55 and over), as well a look into whether a worker was injured or not. The 2x2 table construct of the odds ratio calculation accounts for all four scenarios in which a worker does or does not get injured while in either age group. The ability to analyze all 4 buckets makes this calculation very powerful and is the ideal analysis tool for the current analysis' datasets. The assumptions of the calculation are also minimized due to the construct of the incident and workforce data. The OR assumes that the individuals are independent of each other, which is true in the data. In addition, concerns of low counts are not an issue with the datasets being utilized. The ability to eliminate assumptions and concerns with the OR makes the calculation very relevant towards the pursuit and objective of the current analysis.

As shown in Figure 8, the calculation utilizes counts for each bucket. For instance, n11 represents workers under 55 years old that did not get injured, whereas n22 represents workers 55 and over with an injury.

$$OR = \frac{n_{11}/n_{12}}{n_{21}/n_{22}} = \frac{n_{11}\ n_{22}}{n_{12}\ n_{21}}$$

Figure 8: Odds Ratio Formula. (Formula image captured from sas.com)

The outcome of the calculation is ultimately a ratio, allowing the analyst to determine if one bucket has a higher relative risk compared to the other buckets. An OR value of 1 means that there is not a significant difference between the groups. As the OR moves away from 1, either higher or lower, the significance gets greater.

Statistic	Value	95% Confidence Limits	
Odds Ratio	1.1907	1.0878	1.3032

Table 2: Odds Ratio Output Results

As shown in the results in Table 2, the OR value for workers 55 and over with an injury was calculated to be 1.1907. This means that workers 55 and over have a 19% higher likelihood of being injured than workers under 55. With the 95% confidence limits both above 1.00, we can state that the OR value is significant at the 95% confidence level. In addition to the OR value, the chi-squared calculation was conducted on the data, resulting in a value of 14.3648. Since the value exceeds the chi-squared critical value of 3.84, it allows for the conclusion that workers 55 years old and over have a higher likelihood of being injured in the workplace than workers under 55 years old.

These findings, when applied to forecasted population projections, can provide insight into future injury counts and costs. According to the U.S. Census Bureau, by the year 2040, the population of individuals 55 and over will increase to over 120 million from 2012's count of 79 million (census.gov). In addition to the rise in population, the BLS is projecting that the workforce participation for those individuals will increase by 1% by the year 2022 (bls.gov). Assuming the participation rate holds at the 2022 level, workers 55 and

over will experience nearly a half million more injuries in the year 2040. This increase, jumping from ~800,000 injuries in 2012 to 1.25 million in 2040, is cause for concern amongst organizations, as these claims are costly. With these findings, it is in the best interest of companies to find ways to mitigate these injuries and attack the issue sooner than later. As the baby boomer generation continues to age and maintain a presence in the workplace, it is logical that firms keep their safety in the forefront of their safety initiative efforts.

CHAPTER V

CONCLUSION

The content of this thesis, and the presented outcomes of the applicable analyses throughout the study, are potentially vital pieces of information for any organization looking to impact or reduce their workplace injuries and the corresponding OSHA frequency rate with respect to an aging workforce. At a time when more and more firms are reacting to data and making data-driven decisions, it is vital for them to fully understand exactly how a safety initiative can impact their workplace injuries. Throughout the study it has been clearly shown that older workers make up a significant proportion of the workforce and that they do, in fact, account for a significant amount of OSHA incidents.

In understanding this key takeaway, it is also important to remember that this thesis study was aimed at solely looking at the impact of OSHA incidents. Additional studies have been conducted by multiple organizations that look at injury severity (beyond OSHA recordable) and the associated costs of those more severe injuries. However, the current analysis has a primary focus unlike other studies available, and the final output is easily understood. When the results of the current analysis are combined with existing studies, it provides a holistic vantage point for organizations when they begin to develop safety initiatives in the workplace and they attack areas of focus and attention within their organization.

Though the outcome of the analysis may open the door for further discussion and future analysis opportunities, it does allow for a better understanding and direction of travel

when approaching blue-sky safety initiatives for employees. By providing additional insight into preconceived notions that older workers have a significant allocation of incidents in the workplace, organizations can better focus their safety efforts on creating work environments equipped to handle the aging workforce and set themselves up for future success should the workforce continue to maintain a high level of aging workers.

The results of the current analysis shed light on the realm of OSHA recordable injuries for the entire workforce, but future analyses could be conducted to dig further into the aging workforce. Breaking down the data by gender would allow for a better understanding if males or females have a higher likelihood of injury as they age. Another possibility would be to individually analyze certain industries to better understand how the aging workforce impacts injury rates in different job tasks and responsibilities. As previously stated, individuals may have completely different jobs earlier in their career, thus resulting in a plethora of diverse job requirements and surrounds in different jobs and industries.

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