A SOCIAL DEMOGRAPHIC STUDY OF THE LIKELIHOOD OF SUSTAINING AN OCCUPATIONAL INJURY RESULTING IN DEATH

A Thesis

by

RACHEL LYNN TRAUT

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

May 2007

Major Subject: Sociology

A SOCIAL DEMOGRAPHIC STUDY OF THE LIKELIHOOD OF SUSTAINING AN OCCUPATIONAL INJURY RESULTING IN DEATH

A Thesis

by

RACHEL LYNN TRAUT

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Approved by:

Chair of Committee,	Dudley L. Poston
Committee Members,	Rogelio Saenz
	William Alex McIntosh
Head of Department,	Mark Fossett

May 2007

Major Subject: Sociology

ABSTRACT

A Social Demographic Study of the Likelihood of Sustaining an Occupational Injury Resulting in Death. (May 2007).

Rachel Lynn Traut, B.A., University of Texas at San Antonio

Chair of Advisory Committee: Dr. Dudley L. Poston, Jr.

This thesis explores occupational fatalities to American males for the years 1998 and 1999. The focus is on predicting the likelihood that the individual will sustain an occupational injury resulting in death based on an occupational status score. Demographic variables measuring Southern residence, race, ethnicity, marital status, education and age were also included in analyses. Research questions include whether or not individuals in higher status occupations are at a decreased risk of sustaining an occupational fatality, and how the demographic variables included effect occupational fatalities. Using data from death certificates allowed me to measure the individual’s occupational status based on their “usual occupation” and find out whether or not differences exist. The thesis involves two analyses, one with the sample comprised of only males between the ages of 25 and 55 and one including only married males between the ages of 25 and 55. Logistic regression is employed as the method of analysis to model the odds of the risk of sustaining an occupational fatality that results in death.

The results of the first model found only marital status to be positively and significantly related to occupational fatalities. Black, Hispanic, South and education were found to be negatively related to occupational fatalities. The main hypothesis of this thesis was not supported, however because the regression shows that with each increase

on the occupational status index, no significant increase or decrease occurred in sustaining an occupational injury that resulted in death.

In the second regression that included only married males, many of the relationships no longer existed. Hispanic and the education variable both lost statistical significance. The only variables to maintain significance were black and South, which were both associated with a decreased risk of sustaining an occupational injury that resulted in death. Problems with the occupational status index as a predictor for the likelihood of sustaining an occupational fatality and restrictions of the data may be the main issue that resulted in a lack of findings.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

TABLE Page

CHAPTER I

INTRODUCTION

It has been said that while other cultures work to live, in America we live to work. So what happens when the work that we do threatens the life that we live? Working is an important and very essential aspect of American life. Typically the value of working outweighs the costs, but what if the costs were not outweighed by benefits and pay? This is the case when occupational fatalities occur. Accidents are by definition unintentional and therefore unavoidable. However, previous research indicates that accidental deaths do tend to occur disproportionately in low-wage, low-skill and consequently low status jobs. When the occupation affects the amount of risk of fatal injury to which an individual is exposed, steps may be taken to reduce the risks and help save lives.

I became interested in studying occupational fatalities when I began work as a graduate student in sociology and demography. When taking my first demography class I learned that individuals with lower socioeconomic status have higher mortality. In the context of the class and previous sociology classes that I had taken, this fact was not surprising, nor should it be. It is well known that individuals who have better jobs will make more money and therefore will be able to access better health care, eat better and more nutritious foods, and have access to more information about keeping themselves healthy (see Marmot, Kogevinas and Elston 1987 and Marmot, Shipley and Rose 1984). The connection of a healthy lifestyle to longevity is something that most people understand, without or without the support of academic studies supporting it. Many

---

This thesis follows the style of *American Sociological Review*.

people think that the key to a long, healthy life involves a health lifestyle that involves eating well, regular doctor visits, and staying away from risky behavior. Although in the case of most people this is true, there are circumstances that go beyond the individual and can be attributed to the society and environment in which the individual is a part. When an individual is put at disproportionate risk, this is something that should be looked at in great depth to try to find out what is happening in these situations that can be avoided.

There are many factors that relate to one's death. Studies have found that death occurs disproportionately to individuals based on their race, ethnicity, sex, education, age, occupation and income (Rogers, Hummer and Nam 2000). In the United States adult mortality has taken on a new dynamic in the twentieth century. Chronic diseases can be treated, and with widespread immunizations many diseases are scarce or no longer exist in the United States. At the beginning of the twentieth century the life expectancy of an infant born in the United States was on average about forty-nine years. By the 1960's this had risen to about seventy years (Rogers et al 2000:3). At the start of the twenty-first century, it had risen to almost 77 years in 2000 (U.S. Dept of Health and Human Services, 2001). People are living longer lives and prolonging their adult years. The social advances that have occurred have been substantial. In future years the progress may be just as staggering. The environment into which an individual is born has massive effects on their mortality and how long they can expect to live. As Rogers, Hummer and Nam point out in their 2000 book, Living and Dying in the United States, "The influence of social forces on mortality…[have] remained relatively stable or even increased over time" (Rogers et al 2000:5). Beyond the individual level, many issues in the greater society play an important part in an individual's survival. In this thesis I will try to show

how the work environment of an individual is one of the factors that affect mortality, even though it is one of the easiest factors to manipulate. The work environment is under scrutiny by many government agencies and worker's unions; however the problem of occupational fatalities remains an issue for adult survival in the United States today.

The preliminary discussions on mortality in my demography classes and the individual and societal conditions that affect it made me think about the connection to my own life experiences. In 1985 an oil rig called the Glomar Arctic II was stationed in the North Sea. On January 16th two men went into a pump room to investigate a problem when an explosion occurred. This explosion cost the lives of the two men and injured two others. One of the men who died was my father, John Traut. At the time I was only two years old and too young to understand the circumstances around his death. Recently I have become more interested in the accident. My father was the chief engineer on the rig and was educated and highly trained. Common sense would suggest that these types of deaths should be rare and typically concentrated in lower wage jobs and with workers with lower skills. I began to wonder how common occupational fatalities in occupations like my father's are. I also thought about how the status of the occupation is related to fatalities. Was what happened to my father something that happened frequently? Or was it something that occurred more than most people imagine?

I will analyze the dynamics of occupational fatalities for the years 1998 and 1999 in the United States. Many researchers have explored the occurrence of occupational fatalities based on various demographic characteristics. The majority of occupational fatality research examines changes over time, to specific demographic groups or in specific occupations. However, in this thesis the focus will be on occupational categories and the increased or decreased likelihood of death associated with those occupations. Instead of looking at the occurrence of occupational fatalities in certain occupations, I will analyze the relationship between the numbers of occupational fatalities and the status level of the occupations. I hope to show which occupations suffer the greatest losses. By pinpointing certain occupations as “high risk,” steps might be taken to increase the precautions for these workers at greatest risk.

Many labor intensive occupations where the individuals take risks in performing their jobs compensate the workers with high pay. These types of professions might not be low skill because the worker may need to undergo training or certification in order to perform the work. However the job may not require high educational attainment because higher degree may not be factors important for employment in these fields. Some examples of fields that are high income and low educational attainment would be in construction and the use and operation of heavy machinery. In these cases the connection between mortality and occupation may not depend on income since income may not be an indicator of a worker’s level of risk. This brings an interesting dynamic to the study of occupational fatalities; high risk populations may be spread throughout different industries and not concentrated among the lowest status occupations in the United States.

Much of the research done on occupational fatalities is conducted by governmental agencies that concentrate solely on the health and wellness of the American worker. The Centers for Disease Control, CDC, is one of the governmental agencies with the largest scope of research in the field of occupational fatalities. The CDC has a special division named the National Institute for Occupational Safety and Health (NIOSH). This is one of many federal agencies that circulate standards and regulations for the safety of workers in the United States. There are other agencies that are also concerned with worker safety, and they develop specific regulations according to occupation. Some of these agencies include: the Occupational Safety and Health Administration, the Federal Railroad Administration, the Mine Safety and Health Administration, the Federal Highway Administration, and the Employment Standards Administration. However, the NIOSH is the only federal agency that conducts research and makes recommendations that are intended to prevent and reduce work-related illnesses and injuries. The existence of these types of agencies suggests the severity of the problem that occupational injuries and illnesses pose for the American worker.

Declines of occupational fatalities can be seen in recent decades, with the lowest rates and numbers of occupational fatalities found in the latest year of the CDC study spanning from 1980 to 2000. In 1980 there were 7,343 fatalities reported, compared to 4,956 in 2000. This translates to a rate of 7.39 per 100,000 workers in 1980 and only 3.66 per 100,000 workers in 2000 (Sestito et al 2004:45). Although this represents an overall trend of a decrease in occupational fatalities over the study period, the persistence of this problem still indicates there is still a risk to the American worker.

The impetus for this thesis stemmed from persistent questions about how individual factors are related to mortality. Is there a relationship between an individuals' occupation and the risk of suffering an occupational fatality? If such a relationship exists, what are the factors of that work that contribute to an increased or decreased risk in sustaining this type if injury? To answer these questions one must look at the individual's occupation and industry, the occupational status, and demographic characteristics of the worker to see if the most direct connection between occupation and mortality—occupational fatalities—affect workers disproportionately. I propose to look at occupational status, along with other independent variables and job related injuries that result in death.

Following this introductory chapter, Chapter II is a literature review of past research on the relationship between occupations and mortality. This will include the most current research from the leading governmental agencies, studies concentrating on occupational fatalities with a variety of independent variables and literature on the relationship between occupation and mortality incorporating different demographic variables.

CHAPTER II

LITERATURE REVIEW

Literature on the subject of mortality spans decades and explores many facets of what differentials exist in mortality and what these differentials mean to the individual and to the greater society. Mortality is also one of the foundations of demography and is frequently studied in the social sciences. In the 1996 article “Population Studies in Mortality”, Preston reviews research done on mortality by looking at articles published on the topic in the past fifty years in the journal *Population Studies*. Preston tells us that during this period demography has increased its attention to morality studies: “mortality was a topic that could stand on its own, rather than be forced to enter the field through its association with fertility, population structure, or growth. Mortality rates were interesting because they were important indicators of living conditions” (Preston 1996: 525). Preston tracks articles in *Population Studies* that involve mortality and individual level correlates through the 1970’s to the 1980’s. Before that time, looking at mortality differences based on region was more typical. In the 70’s and 80’s “relatively new techniques such as hazard models, logistic regression, and log linear analysis, [became] increasingly available in push button form, permitt[ing] far more precise assessments of the impact of various characteristics on the risk of dying” (Preston 1996:534). Finally Preston cites the apparent recession in interest in child mortality is likely due to the increased impact that adult mortality has on “mortality variation, both temporal and spatial, even in less developed countries” (Preston 1996:536). For demography in the twenty-first century, the study of adult mortality will likely be the future of research on how populations change.

Data for the National Institute of Occupational Safety and Health (NIOSH) are among the most comprehensive data on occupational injuries and illnesses in the United States. The data come from the National Traumatic Occupational Fatality (NTOF) surveillance system which "was developed in the 1980's by the NIOSH to fill in the gaps of knowledge of work related injury deaths in the United States…NTOF supports descriptive analytical epidemiological uses of the data, such as describing the nature and magnitude of occupational injuries and fatal injury trends, identifying risk factors, testing hypothesis and setting safety research priorities" (Sestito 1994: 305). The NTOF collects, analyzes, and interprets data on injuries, hazards, and exposures from the death certificate data. The NTOF surveillance system includes death certificates in which the individual was 16 years or older, the cause of death is classified as E800 to E999 (meaning the cause of death was external) and the injury at work question is marked as positive in hopes of preventing future deaths and injuries (Sestito et al 1994: 305). NTOF is the most comprehensive source of data on occupational injury fatalities prior to 1992. It includes only non-intentional causes of death, thereby excluding homicides, suicides, non-intentional poisoning and choking. Most studies that look at occupational fatalities use some form of death certificate data in order to encompass a large number of cases from the population. The data from the NTOF surveillance system are seen as among the most reliable and cover the most cases of occupational fatalities.

Although the NIOSH found an overall reduction of occupational injuries from 7,343 in 1980 to 4.956 in 2000 (a reduction of 33 percent), the problem still remains and deserves further attention. Between the years 1980 and 1995, over 93,000 workers were fatally injured while working in the United States. This is an average of 6,200 people dying each year from consequences of their everyday work. The NIOSH states that the leading causes of traumatic occupational fatalities are motor vehicle accidents, homicides, machines, falls, electrocution, and falling objects (Marsh and Lane 2001). Figure 2.1 is a chart compiled by the NIOSH and included in the 2004 Worker Health Chartbook; it shows the annual rate of fatal occupational fatalities by cause of death.

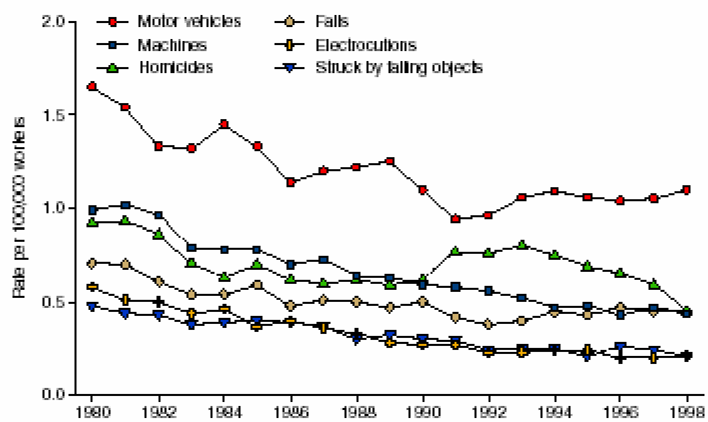

Figure 2.1 Rate of Occupational Fatalities by Cause of Death: United States, 1980-1998

As we can see, most causes of death steadily decline through the study period; however, deaths caused by motor vehicle crashes rose and fell throughout the study ending with a rate of more than one per 100,000 workers. These increases in motor vehicle crashes are likely the demonstration of deaths due to highway related incidents—the only type of occupational injury that shows an increase over the time of the study. There was an increase of 18.5 percent in highway related incidents (Sestito et al 2004: 44). Homicides also show a pattern of rising and falling through the study period. In

Figure 2.1 we can see that in 1998 homicide rates eventually fell after showing an increase through much of the 1990's. This further demonstrates that while every occupation has its own specific injury risks, some occupations put workers in situations that have higher fatal injury risks than others.

The majority of occupational fatalities occurred to men in 2002 according to the NIOSH study; about 92 percent of all cases were males even though females comprise about 46 percent of the workforce. Also the majority of occupational fatalities occurred to workers between the ages of 25 and 54 years old. Figure 2.2 is a chart from the 2004 Worker Health Chart book that shows the distribution of occupational injuries by age in 2002.

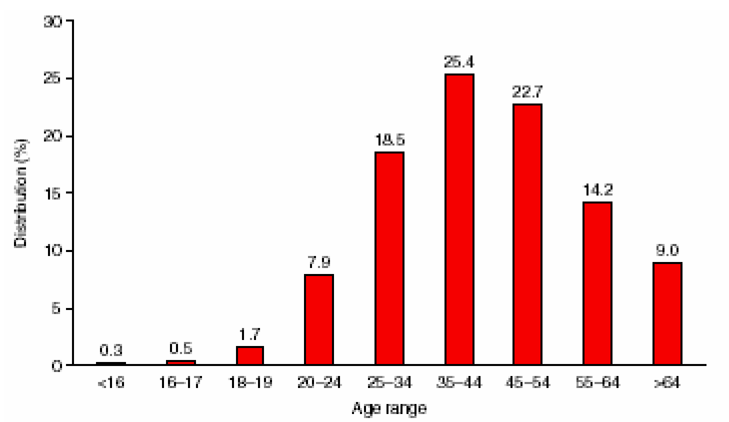

Figure 2.2 Distribution (percentage) of Occupational Fatalities by Age: United States, 2002

Two-thirds of all occupational injuries that occurred in 2002 occurred in the age group of 25 to 54. This age group also comprises the largest percentage of U.S. workers overall. According to the Bureau of Labor Statistics (BLS) there were 135 million employed workers in 2002, 96.5 million of whom where between the ages of 25 and 54. This section of the population constitutes 71.5 percent of all US workers in 2002 (Sestito 2004: 3). We can see that the highest rates of occupational fatalities occurred in the age group 35-44 with 25.4 percent, followed by 22.7 percent in those between the ages of 45-54. The majority of occupational fatalities in 2002 occurred to white, non-Hispanic workers (71 percent). Hispanic workers constituted about 15.2 percent of occupational fatalities and black non-Hispanic workers comprised 8.9 percent. The states with the highest occupational fatality rates are: Alaska, Wyoming, Montana, Idaho, West Virginia and Mississippi (Sestito 2004: 44).

Figure 2.3 contains two graphs from the 2004 Chartbook that demonstrate the transition some states have made in terms of the rate and number of occupational fatalities through the study period.

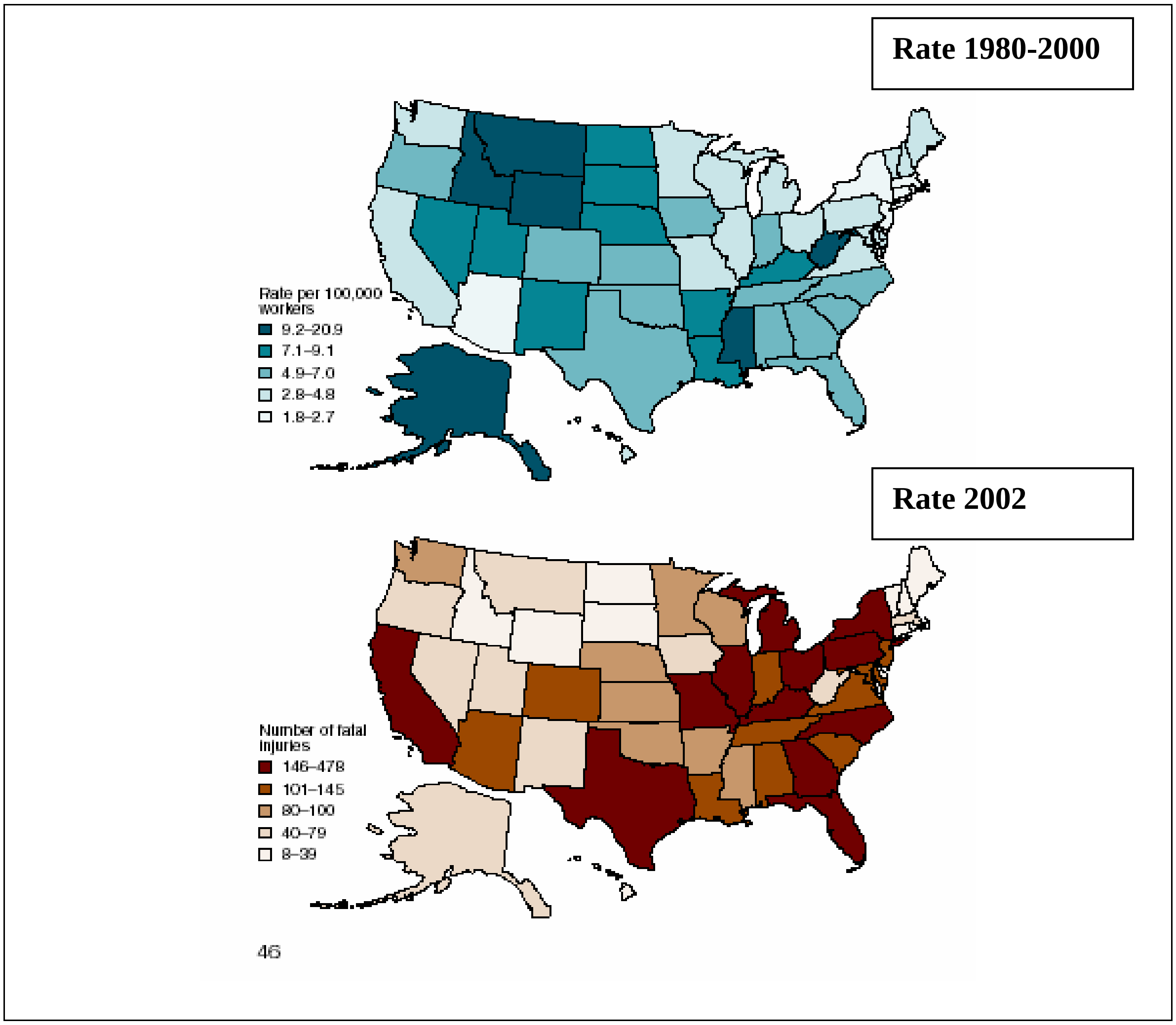

Figure 2.3 Rate of Occupational Fatalities by State: 1980-2000 and 2002

The highest rates of occupational fatalities between the years 1980 and 2000 were not generally in one specific region, except for the concentration in the northern states of Idaho, Montana and Wyoming. In the second chart we can see that in the year 2002 states like Texas, Florida and California, which had lower rates between the years of 1980 and 2000, show some of the highest numbers for the year 2002. California had the highest number of occupational fatalities with 478 in 2002. The high numbers found in

California, Texas, Florida and New York surely reflect the large populations in those states; in fact cities in Texas, New York and California are seven of the ten most populous cities in the United States (US Census Bureau 2005). Obviously the states and cities with the most workers will have the greatest number of at-risk individuals.

Numbers and rates of occupational fatalities also vary by occupation. Inherently some occupations deal with higher risk than others. This may be due to the equipment used, the environment that the individual is working in, or a host of outside factors that can influence risk of injury and death. Park (2002) identified some of the risk factors associated with traumatic work injuries; these include faulty design and inadequate use of machines, cables and pipes; unanticipated machine movements; defects in the design of machines or equipment; insufficient training in safe use of equipment; poor workplace conditions and organization and adverse workplace cultures about the need to eliminate hazards. As demonstrated by the major causes of workplace accidents, we can see that some occupations are riskier than others since most low-risk occupations (like managerial or professional occupations) have little or no contact with these types of equipment or do not involve the hazardous kinds of hands-on work.

Figure 2.4 (Worker Health Chartbook 2004) is a visual demonstration of the distribution of fatal injuries by occupation for the year 2004.

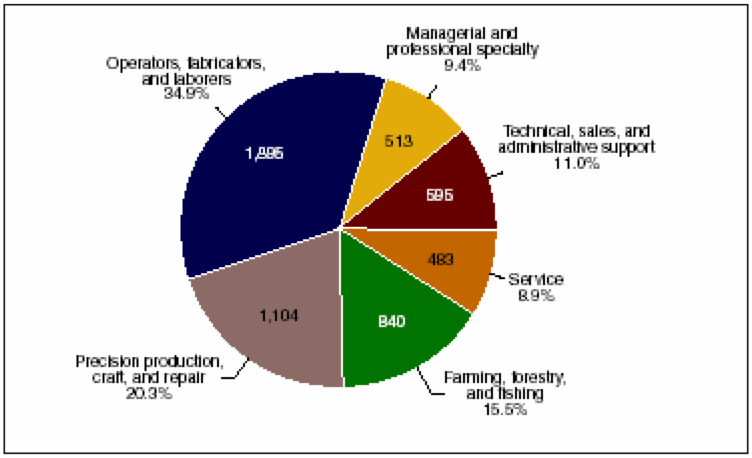

Figure 2.4 Number of Occupational Fatalities by Industry, 2004

The majority of the occupational fatalities occurred in only two occupations: operators, fabricators, and laborers; and precision production, craft and repair workers. These two occupational categories comprise 34.9 percent and 20.3 percent respectively of the occupational fatalities that occurred in the year 2002. This translates into 2,999 deaths from these two categories in 2002 out of the total of 5,524 deaths for that year.

Specifically Park laid out some of the valuable reasons why analyzing and identifying occupational fatalities are so important: "For policy: rates allow comparing industrial sectors, assessing time trends, estimating costs and impacts, setting regulatory priorities, and allocating research resources,…For prioritizing and targeting exposure-identification efforts: rates permit identifying high risk employee groups within nominal classifications in individual workplaces and industrial sectors" (Park 2002:355). By looking at rates we can find who is at the highest risk, whether based on their age, race, industry or occupation. By identifying these factors we may be able to improve conditions through safety inspections and adequate training.

As we can see from the extensive research done by agencies such as the NIOSH, occupational fatalities are an important issue that merits further investigation. Variations in occupational fatalities are evident according to a host of demographic variables. In the following section I will discuss some of the most pertinent literature concentrating on the effects of occupation on individual mortality.

Occupation as a Mortality Indicator

Occupation is an interesting approach for the study of mortality differences. An individual’s job is usually based on education, skill, and choice, which makes occupation different from ascribed attributes like sex, race and ethnicity in which an individual has no control. Many studies focus on the effects of job status on mortality. There is a well established relationship between occupation and mortality that shows individuals in lower status occupations have higher mortality risks. Often, these findings can be attributed to the connection that occupation holds with income and educational attainment. This means that an individual’s income and educational attainment are seen to be the real indicators of mortality rather than the actual occupation that an individual holds (Johnson et al 199:355). Preston (1977) describes education as an investment that an individual can make against future mortality. We can treat “education as a means to a higher end: higher income, higher status and better living and working conditions” (Preston 1977: 12). The amount of education that an individual has will ensure more money, more status, and better access to safe living and working conditions—all factors that can potentially improve and prolong one’s life. In this respect, any time that an individual puts towards education will be returned in additional years of life.

Some studies prefer to use educational attainment as an indicator of social class instead of occupation since education is usually fixed early in life and one's occupation can change throughout life (Christenson and Johnson 1995). Although occupation is not always the best indicator of social class, for the purposes of this thesis occupation will be a vital component to studying work related injuries that result in death. Although the effect of education and income on mortality is evident, with the study of occupational fatalities I will be more concerned with the actual occupation that a person holds. Fatal injuries happen because of involvement with certain aspects of work, and while the education that a person has is important in the attainment of the occupation, occupational fatalities are more concerned with the risk posed by performing everyday work. In this thesis occupation will be analyzed as a job status variable which incorporates issues such as income, education and skill level.

Johnson and colleagues point out that while social status is an important variable in occupational mortality differences, mortality differences are evident across occupations; understanding individual occupations thus contributes to the understanding of occupational mortality (Johnson et al 1999:356). Differences in mortality are highly influenced by aspects of occupation like exposure to carcinogens, occupational accidents, and stress levels; these all affect an individual's mortality (Johnson et at 1999:356). In their study Johnson and colleagues used the National Longitudinal Mortality Study (NLMS) to find out how different occupations affect individual's mortality. For the major occupational groups they found that "risk generally increases across the occupation spectrum in moving from the professional, highly skilled occupations to the less skilled, more labor intensive occupations" (Johnson et al 1999:362). Even after adjusting for household income and educational attainment, these risks remained significant regardless of race (Johnson et al 1999:362). Surprisingly, their study also found that after adjusting for household income and education, farming occupations had a lower risk that those in the professional/technical groups. These findings allowed them to assert that “specific occupational exposures are more important than social status groupings in describing the effects of occupation on mortality” (Johnson 1999:362). The authors suggest that future studies in the area of occupational mortality should use rankings of “occupational stress, job demand and control, decision latitude, types of relationships between co workers, degree of physical hazards, and substantive complexity” (Johnson et al 1999: 366).

As Moore and Hayward found in their 1990 study of the mortality of men and their occupations, “sizable mortality differences between occupations emerge that cannot be reduced to education, income or health effects…” (51). Not all effects that occupation has on mortality are due to socioeconomic status or the educational level of the individual. Moore and Hayward used data from the National Longitudinal Survey of Mature Men to analyze occupational differentials in mortality between the years 1966 and 1983. They found that “the rate of mortality is reduced by the substantive complexity of the longest [held] occupation, while social skill and physical and environmental demands of the latest occupation lower mortality” (Moore and Hayward 1990:31). This supports findings that workers over the age of 55 have higher risks for occupational fatalities, especially in occupations that have high physical demands. Moore and Hayward’s study indicates that there is something to be learned about mortality differences by occupation.

Martinello and Meng (1992) discuss studies that "[found] a positive and significant relationship between injury rates and earnings" (334). The relationship between earnings and job hazards has implications for the study of occupational fatalities because earnings and occupational status are interrelated. Job status is related to skill, earnings and educational attainment. In their analysis of workplace risks, Martinello and Meng found that workers are often compensated with higher wages for working in higher risk occupations, if the higher risk is associated with severe injuries. Occupations that have higher rates of non-serious injuries do not compensate the worker with higher wages and benefits (Martinello and Meng 1992: 343). This finding remained regardless of whether or not the worker was in a worker's union. In this thesis the use of an occupational status variable would be ideal to grasp not only the connection between occupation and fatal injury risk but also the relationship between occupation, earnings and status.

Another interesting concept that was discussed in the book Living and Dying the USA (2000) is the healthy worker effect. Rogers, Hummer and Nam define the healthy worker effect as the "mortality gap between those who work and those that do not" (Rogers, Hummer and Nam 2000:143). Past research has shown that people that work are usually healthier than those that do not work. This may be because they are healthier at the time of their hire, or because unhealthy individuals are forced to quit their jobs because of health-related issues. In relation to the study of occupational fatalities, this means that individuals that sustain occupational injuries are the "healthiest" portion of the population.

Based on the assumption of the healthy worker effect, “in an industry free of free of significant life shortening hazards, both morbidity and mortality rates within the workforce of interest are likely to be lower than that in the general population” (Li and Sung 1999: 225). Not only are workers more likely to be hired if they are in good health, but after they are hired they are more likely to have access to health care and medical services (Li and Sung 1999: 226). Another confound of the healthy worker effect is the survivor effect. This means that a healthy worker is more likely to continue working than a non-healthy individual (Li and Sung 1999: 228). The healthy worker effect and the survival effect both influence the likelihood of an individual sustaining a fatal or a non-fatal occupational injury. If data permit, an incorporation of length of employment that the individual had at the time of the injury would enable the complete assessment of the effect of a worker’s health on occupational fatalities. However, the use of death certificate data does not allow this type of distinction.

A study by Baillargeon and colleagues (1998) compared the effect of the healthy-worker effect among male and female occupational cohorts. They found that both the male and female cohorts exhibited characteristics of the healthy worker effect based on their standardized mortality ratios calculated for individuals hired between 1944 and 1978 until death or the study’s end in 1986. For females, those over the age of forty exhibited the greater healthy worker effects than the over forty group, but this was the opposite finding for males in the study. Males that were hired after the age of forty exhibited a stronger healthy worker effect than those hired before age forty (Baillargeon et al 1998: 371). According to race, non-whites were found to demonstrate a stronger healthy worker effect than whites and the effect for whites weakens over time, unlike the non-white group. The study also found that differences in occupational class explained the majority of the gender differences; this means that the types of jobs that males and females were performing at the nuclear facility that was being studied had very different types of jobs. The consequences of the healthy worker effect may have implications for the study of occupational fatalities since the type of occupation or industry will be incorporated into the analyses performed in this thesis.

Occupation has been found to have differing effects on mortality. In the case of occupational fatalities, the individual's occupation is of specific interest because of the risks posed to the worker. In the next section I discuss some current studies that look specifically at fatalities that occur as a result of an injury sustained at work.

Occupational Fatality Studies

Regardless of cause, injury is the leading cause of death for persons under the age of 45 (Russell et al 1991:1613). In terms of the injuries, occupational fatalities are said to account for one-sixth of all fatal injuries to individuals in the United States between the ages of 17 and 64. In the 1991 study by Russell and colleagues, the issue of data sources for identifying occupational injuries is explored yet again. This time they are concerned with how representative the "injury-at-work" work variable, found on death certificates, are for gauging occupational fatalities in the United States. This study reiterates past findings that show NIOSH data only identifying occupational injuries by the injury-at-work variable, unlike other sources that combine different surveillance systems. To explore the potential and expected undercount, the authors examine occupational fatalities in Oklahoma that occurred between the years 1985 and 1986. To compare them to state death certificates, the authors used data from three separate sources:

“Occupational Safety and Health Administration (OSHA) fatality/catastrophe reports, workers compensation reports, and medical examiner reports” (Russell 1991). The authors confirmed that the injury took place during work by comparing the data to workers’ compensation court records and police accident reports if necessary. Of the total 299 male deaths, 82 percent were identified by medical examiner reports, 72 percent were identified through death certificates, 57 percent through workers’ compensation reports, and 24 percent through OSHA fatality/catastrophe reports (Russell 1991).

The study also found that for some causes of injuries, some industries and occupations were less often identified by the injury-at-work variable on death certificates; these included deaths like traffic deaths, industries like mining, agriculture and service and occupations like farmers, transportation and material moving operatives and precision production, and craft and repairers (Russell 1991). Death certificates are useful because of their potential to identify a large number of cases. However most researchers agree that measurement improvements are necessary in order to plan and implement policies to reduce the overall number of occupational fatalities in the United States.

A study by Bailer and colleagues in 1998 uses an updated surveillance system of occupational fatalities to explore both adjusted and unadjusted rates of injuries between the years 1983 and 1992. In the 1980’s there were about 6,300 reported occupational fatalities, which is a rate of seven per 100,000 workers (Bailer et al 1998). Bailer and colleagues used an updated version of the National Traumatic Occupational Fatalities (NTOF) surveillance system with “employment estimates [from the BLS] to explore whether trends in rates of fatal injuries exist above and beyond differences that might be explained by changes in demographic, industry or occupational characteristic” (Bailer et al 1998:485). The rate calculated is the number of fatal occupational injuries divided by the number at risk (person years lived) (Bailer 1998). The study found 51,964 fatal injuries among 1,120,507,788 person-years of employment for the years 1983 to 1992.

Overall they found a decline in fatal injury rates in nine out of the ten industries (all but wholesale trade saw a decline) and in nine out of eleven occupations (increases were found in sales occupations and machine operators, assembly and inspectors). For the first three years studied, the occupational fatality rate consistently stayed at about 5.3 per 100,000 workers. However, after the first three years studied the rate remained below 5 per 100,000 with a low in 1992 of 3.8. Like many other studies there were differences found between rates of fatal injuries by demographic variables. The fatal injury rate for men was 13 times larger than that rate for women. The rates for black and white workers were similar, at 4.8 and 4.6 per 100,000 respectively, while the rate for the "other" racial group was slightly lower at 3.8 per 100,000 workers. The industries found to have the highest unadjusted rates were mining, agriculture, forestry, fishing and construction. Conversely, the industries with the lowest unadjusted rates were finance, real estate and insurance. The study also found the highest rates of occupational fatalities in the occupations of transportation and material moving and farming, fishing and forestry and the lowest rates in the clerical/administrative support jobs. Fatal injury rates by age were found to be similar to those found in other national level studies; rates increased steadily in each age category with the highest rate in workers 65 and over.

In the study by Richardson and Loomis (1997) examining occupational fatalities in North Carolina in the 1980's, reductions were found in the overall occupational fatality rate. Although there was a reduction in the fatal injury rates, there was an increase in the rates in industries, although they actually declined in size over the study period. There was a [n]otable increase in fatal injury rates occur[ing] in food manufacturing (182 percent increase) and tobacco manufacturing (253 percent increase)" (Richardson and Loomis 1997: 2). The authors attribute the increase of fatalities in these waning occupations to the increased risk introduced when the same amount of work has to be done by fewer people. These overall reductions were not necessarily due to the restructuring of the economy toward service and retail jobs and away from high risk occupations like textiles, apparel, furniture and food manufacturing industries. Instead the reductions were likely due to medical advancements that reduce the risk of death from sustaining an occupational fatality.

In a 2004 study by Richardson and colleagues, higher injury rates for southern workers were found, compared to non-southern workers, in every category of gender and race/ethnicity. This study used the NIOSH's National Traumatic Occupational Fatalities (NTOF) surveillance system. No exclusions were made with respect to sex or age. "Adjustments for employment structure accounted for most of the difference in rates between non-Black and Black men in the South; however, after we accounted for employment structure, higher rates persisted for southern workers than for non-southern workers (and particularly for Hispanic workers in the south)" (Richardson 2004:1761). These findings suggest that working conditions that the southern workers face are less safe compared to non-southern workers in comparable jobs. The authors suggest that the high fatality rates among Hispanic workers may be due to the employers not investing in safety training and equipment. This may occur because Southern Hispanic workers are more likely to be short-term or undocumented workers, thereby not receiving adequate attention to their safety by employers.

The 2005 study by Dembe and colleagues looks at the effects of race and ethnicity on the medical care an individual receives after sustaining an occupational injury. They set out to see if minority, low-wage, immigrant and migrant workers face difficulties and encounter barriers while trying to get care for job-related ailments. This information can have effects on the occupational fatalities experienced by minority low-wage, immigrant and migrant workers. Anecdotal stories demonstrate that these types of workers are more likely to have disputed worker's compensation claims than non-minority workers. If these workers are encountering resistance to appropriate medical care, there is a better chance that their work-place injuries could escalate into fatalities. They found that Hispanic workers were less likely to see a physician for work-related injuries and were less likely to receive prescription medicines. These types of problems have the potential of placing Hispanic workers at a greater risk of occupational fatalities.

Occupation offers many important factors for health and survival. Johnson, Sorlie and Backlund say in their 1999 article about occupation and mortality in the U.S. "conditions in the workplace affect one's health and survival" (Johnson, Sorlie and Backlund 1999:355). The occupation may expose the worker to adverse conditions such as pesticides or dust from coal in mines. The occupation may put the worker in risky situations like working at dangerous heights or with heavy machinery. The occupations may also cause stress on the individual which can have adverse health effects. "[The] income and status received from an occupation influence choice of community environment and social circle of friends. These in turn influence access to quality of medical care, the cleanliness and safety of surroundings, and the convenience of healthy foods—all factors important to better health and survival" (Johnson, Sorlie and Backlund 1999:355). These factors affect occupational fatalities that result from occupation related illnesses in which an illness or injury may result from inadequate health care or other medical factors.

Many labor intensive occupations where the individual is taking risks in performing the job compensate the worker with high pay. These types of professions might not be considered low skill because the worker may need to undergo training or certification in order to perform the work. However the job may not require high educational attainment because higher degrees are not necessarily factors important for employment in these fields. Some examples of fields that are high income and low educational attainment are construction and the use and operation of heavy machinery.

Farming Occupations

Recently occupational fatalities in farming occupations are receiving attention. Farming occupations are seen as an at-risk group with special conditions that make the study of farming fatalities an important focus of research.

Hard and colleagues conducted a study in 1999 that concentrated on deaths associated with agricultural work. They calculated agricultural production fatality rates with data from two sources, namely the NTOF and the Census of Fatal Occupational Injuries (CFOI). The employment rates used to calculate fatalities were derived from the Current Population Survey (CPS). Some of the most important findings of the study were the increased risk associated with black and Hispanic workers even though the majority of farm workers are white males (Hard et al 1999:155). Females were identified as having a higher proportion of death due to injuries inflicted by animals or being caught in running equipment, even though females overall account for a small proportion of all agricultural related fatalities identified by either surveillance system. So even though the scope of the study found discrepancies between the two surveillance systems, there was overall agreement in the patterns of deaths to agricultural workers.

The authors found an undercount in the number of agricultural related occupational fatalities that were identified by the NTOF. This is likely due to the difficulty in identifying agricultural workers by using the "usual occupation" variables included on death certificates used by NTOF surveillance system. The NTOF will attribute the death to the usual occupation even when the cause of death described suggests involvement in agricultural development (Hard et al 1999:156). Also, the NTOF by design does not include deaths to individuals under 16 years of age. Hard and colleagues state that "CFOI identifies occupational fatalities from diverse data sources, including death certificates, workers' compensation records, news media and investigative reports…CFOI does not exclude any occupational fatalities based on age"(Hard et al 1999:156). Accordingly, the CFOI has been said to identify more cases of occupational fatalities than other surveillance systems.

A similar article in the Journal of Occupational and Environmental Medicine studied all machinery-related occupational fatalities from 1980 to 1989. This study by Pratt and colleagues used NTOF data to examine the circumstances around machine-related incidents, which were the "second leading cause of traumatic occupational fatalities between 1980 and 1989, account[ing] for 14,354 deaths, with a fatality rate of 1.61 per 100,000 workers" (Pratt 1996:70). The workers identified as being at the greatest risk of sustaining an occupational injury resulting in death due to a machinery related incident were in agriculture/forestry/fishing occupations, and mining and construction occupations between the years of the study (1980 and 1989). As for the type of machinery that is associated with the highest risk of fatal injury, tractors “had both the highest frequency and fatality rate” (Pratt 1996:77). Tractors posed a high risk of injury for all workers in the study but were especially high in older workers (over 65 years old).

The high numbers of deaths to farmers or farming related incidents deserve special attention in the study of occupational fatalities. In the 1980’s Murphy and colleagues found that about 46 deaths per 100,000 workers were occurring in the farming occupations by the NSC (Murphy 1990: 198). In that same year, the NIOSH reported 18.4 per 100,000 workers. This discrepancy is likely due to the “usual occupation” question on death certificates versus the NSC’s classification system. Often individuals working on farms are under the age of 16, or have other full time occupations, or experience as accidents that are hard to classify as a farming-related incident when. This study found there to be a 20 percent undercount in the NIOSH count of fatalities. They found that there are two main reasons that NIOSH death certificate data have such a vast discrepancy on agricultural fatalities rates between the two sources: first, the NIOSH uses census bureau data for the denominator when calculating their rate and the NSC uses data from the BLS data; and secondly, death certificates “do not differentiate between occupational and non-occupational work” (Murphy 1990:200). This means that death certificates may not capture deaths that occur to workers whose “usual occupation” is not in agriculture. These undercounts are relevant in any occupation or industry but are especially pertinent for agricultural fatalities because of the existence of seasonal work.

Another reason that agricultural fatalities deserve extra consideration is the presence of undocumented workers who do much of the most dangerous work on large farms throughout the United States. The work that is associated with the highest risk of injury is work that involves the use of heavy equipment; without adequate training and safety resources, accidents are more likely to happen. The undocumented population would be at an increased risk because of language barriers that prohibit proper training, and lack of training because these workers are not hired through any system that requires adequate training before work is performed. Compounding this potential effect is the lack of health insurance and proper health care which may escalate an occupational injury into an occupational fatality.

So through the diverse literature on occupational fatalities, one can see the trends and implications that injuries at work pose for workers. These trends show individuals sustaining occupational fatalities disproportionately due to race, gender, ethnicity and age. Most importantly, for this thesis, differences in occupational fatalities exist between occupations. Recent literature concentrating agricultural fatalities demonstrates the difficulty in measuring agricultural occupations and the dangerous machinery and other hazards related to the cause of death.

The previous findings will guide the hypotheses used in this thesis and described in the next chapter. Also in the next chapter is a discussion of the death certificate data used in the analyses and the methods of analyses, namely logistic regression.

CHAPTER III

DATA, METHODS AND HYPOTHESIS

In this chapter, information about the data to be used in this thesis is presented along with a description of the variables to be included in the analyses. Logistic regression will also be discussed in relation to its proposed use in the analyses.

Data

The data to be used in this thesis are death certificate data from the years 1998 and 1999. The death certificate data are available from the Center for Disease Control (CDC). The years 1998 and 1999 were used because these are the most recent years that include the occupational question "usual occupation," which is of obvious importance for the analyses that will be performed. Currently, the "usual occupation" question is no longer included on the death certificates in the United States, making the years 1998 and 1999 the most recent and last years that analyses like those in my thesis could be undertaken. Two years of death certificate data were merged into one data set so to include as many cases of occupational fatalities as possible. The data were first restricted by sex and age to include only males between the ages of twenty-five and fifty-five. After dropping cases from the data set with missing values on any of the variables, the data set includes 21,310 cases. Dropping all cases that had missing data for the 'injury at work' variables resulted in the loss of thirty-nine thousand cases alone. Also dropped from the sample were non-civilian deaths and deaths to individuals who were not employed since 1984. After these exclusions there is a total of 1,307 cases of occupational fatalities identified by the death certificates for both years.

One limitation of the death certificate data is that not every state includes information about the individual's occupation. While the death certificates are collected in all fifty of the states of the United States, the content on each state's death certificate varies from state to state. Only eighteen of the fifty states included usual occupation on the death certificate for both 1998 and 1999. The states including the 'usual occupation' on their death certificate are: Colorado, Georgia, Hawaii, Idaho, Indiana, Kansas, Kentucky, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, Rhode Island, South Carolina, Utah, Vermont, West Virginia and Wisconsin (NIOSH Surveillance Report 2002). This restricts my findings as generalizable to deaths occurring in these states.

NIOSH also uses death certificate data in their analyses of occupational fatalities. For the purposes of their analyses death certificate data "identify the largest number of data and are fairly comparable between all vital statistics reporting units…Studies have found that death certificates alone identify between 67 percent and 90 percent of all fatal work injuries among the various States (Marsh and Layne 2001:2)." Because of the types of fatalities that occur at work it can be difficult to always identify the fatality as the result of an occupational injury. This is especially the case with the top two causes of occupational fatalities: motor vehicle crashes and homicides. These deaths are more difficult to identify as an occupational fatality since they occur under circumstances that are not necessarily inherent to an individual's work duties. The National Association for Public Health Statistics and Information Systems (NAPSHIS) provides help on how the 'injury at work' question should be completed on the death certificate:

> "[E]xamples of injuries at work: Injury while working in vocational job training on premises…while on break or at lunch or in parking lot on job premises…while working for pay or compensation, including at home…while

> working as a volunteer law enforcement official, etc…while traveling on business, including to and from business contacts" (2005: 180).

These situations help the medical examiner or coroner classifies the injuries by the 'injury at work' variable that may not be easily identifiable. Also included in the NAPSHIS instructions are situations that do not constitute an injury at work. These are defined as follows:

> "Injury while engaged in personal recreational activity on job premises…while a visitor to job premises… [as a] homemaker at homemaking activities…working for self for no profit (mowing own yard, repairing roof, hobby)…student in school…commuting to or from work" (2005: 181).

These situations help demonstrate how difficult it can be to assess whether or not an injury occurred at work. Even with the shortcomings just identified, death certificates are still used in some capacity for most nationwide investigations of occupational fatalities.

In 1992 the death certificate "injury at work" question became standardized. This is thought to aid in the exclusion of false positives and the inclusion of false negatives (Marsh and Layne 2001:4). Multiple source surveillance systems are shown to provide the best counts of occupational fatalities, but problems arise with the comparability of these types of data and lack of data from all occupations and many states. In the case of this thesis, the use of death certificate data allowed a large number of occupational fatalities to be identified while still allowing the incorporation of important demographic characteristics.

"The number of deaths indicates the magnitude of a problem and fatality rates depict the risk faced by workers" (http://www.cdc.gov/niosh/NTOF2000/pdfs/ntof2fbc.pdf). The number of occupational fatalities found by using the 1998 and 1999 Death Certificate Data will, hopefully, accurately reflect the risk that a worker endures in that occupation. “The injury at work item, demographic variables and the cause of death data are coded from the death certificate by trained nosologists” (Cormack et al 2000:2). This helps ensure that the death certificate data demonstrate the actual risk the employee is under and that the cases with ‘injury at work’ identified are not false positives because the death certificates are being completed by trained professionals.

The National Association for Public Health Statistics and Information Systems (NAPSHIS) provides in depth instructions on how various questions should be answered on the death certificate. This set of instructions identifies that the only acceptable persons who should fill out the ‘injury at work’ question of a death certificates are a “medical examiner or coroner or a certifying physician (depending on state law)” (2005 p. 179). The instructions also state that the ‘injury at work’ question is to be filled out if the item “manner of death” is listed on the death certificate as either accident, suicide or homicide and/or there is an injury reported and the decedent is over fourteen years old (2005 p 179). One of the limitations of the ‘injury at work’ question, as used in this thesis, is that comparing the usual occupation with the injury at work variable does not discern whether or not the injury occurred in the usual occupation the decedent had at the time of the injury. The instructions from the NAPSHIS specifications instructions state that “an injury at work could occur at work regardless of whether the injury occurred in the course of the decedent’s ‘usual’ occupation” (2005 p.180). So even for the eighteen states that provide ‘usual occupation’ information, we cannot be certain that the ‘usual’ occupation is the occupation the decedent had at the time of the injury and subsequent death.

The usual occupation question was element of the death certificate that allowed the creation of the occupational status variable. There are several indices of occupational status that can be used to assess the level of status an individual is considered to be in for any given profession. For the purposes of this thesis the Nam-Terrie (known as Nam-Powers for previous years) occupational scores were used. These scores are “a valuable measure of socioeconomic status that uses education requirements and income rewards to objectively determine status” (Rogers, Hummer and Nam 2000:144). These scores are created by averaging information on the median years of education, and income for each occupation. Rogers and colleagues describe the Nam-Terrie (Powers) index as:

> A “measure of occupational status [based] on objective referents from census data that are continuously updated, rather than on special surveys or public perception studies. Because the [Nam-Terrie] index measures socioeconomic status rather than social desirability or prestige, [it] provides a hierarchical ranking of occupations, based on objective referents, [it] is normally distributed, ascertains the ability for occupations to provide resources for individual incumbents…” (Rogers, Hummer and Nam 2000:145).

Haug (1977) discusses the Nam-Powers index and several other occupational status indices from the United States and Europe. Haug describes the Nam-Powers index as an “average of [an] individual’s occupation, education and family income scores…and is thus roughly equivalent to an occupation’s averaged percentile rank in a status array” (Haug 1977:57). “It does enjoy concurrent validity with respect to its relationship with occupation skill requirement and rewards as operationalized by relative education and income" (Haug 1977:57). Another reason that the Nam-Terrie index was selected for use in this thesis is because it is updated each year to coincide with the changing occupation titles used in the census. Since the death certificate data from the NCHS uses the categories of the census in their coding of the occupation questions, the Nam-Terrie index allowed straightforward recoding of these categories into the occupational status scores that were used in the analyses.

For the purposes of this thesis I believe the death certificate data are sufficient. The standardization of the question "injury at work" helps ensure the reliability of the measures. Similarly the fact that a trained professional is completing the death certificate at time of death helps to ensure the correctness of the data. In the previous literature that was examined there were few analyses that used logistic regression to predict the likelihood of sustaining an injury at work. Analyses that were reviewed were either descriptive analyses or included methods like Poisson regression to estimate trends in fatal occupational injury rates over time (see Richardson et al 2004).

Due to the limitations that the data pose for the analyses in this thesis, restrictions were made beyond the data as just described. First, the data were limited to only individuals that are between the ages of twenty-five and fifty-five. As stated in the review of literature, in the United States 71 percent of worker fall within this age group (Sestito 2004: 3). The data were then restricted to only males. The exclusion of females from the data set was to done to further ensure a working population. Although women do constitute about 46 percent of the working population in the United States, the majority of occupational fatalities occur to males, 92 percent according to the 2002 NIOSH study. In fact, when females were dropped from the sample it only reduced the number of occupational fatalities by 123 instances and resulted in 7,765 instances being dropped from the sample. These restrictions reduced the overall number of cases but ensure as best as possible that the analysis will mainly focus on working individuals. Taking these reductions into account, this thesis can better assess occupational fatalities by ensuring that comparisons are made to the working population of the United States. This is because those who died from an occupational fatality were working at the time of their death; however there is no guarantee that those who did not die from an occupational fatality were working at the time of their death. But the restriction of the sample to males between the ages of 25 to 55 helps ensure that comparisons are made only to working individuals.

Dependent Variable

The dependent and independent variables were operationalized based on the death certificate data being used. Through the examination of previous literature, familiarity with the actual death certificate form has aided in the understanding of death certificate based studies. As imagined there are a limited number of questions included on the certificate, thereby restricting the types of analyses that can be done with death certificates. Included in the appendix, Figure A.1 is a copy of the standard death certificate form that is provided by the CDC and NIOSH. Also in the appendix, Figure A.2 is a sample of a death certificate from New Mexico. As earlier identified, New Mexico is one of the states that included the ‘usual occupation’ question on their death certificates for the years 1998 and 1999. Becoming familiar with these forms helps the description of how the variables were operationalized in this thesis.

The dependent variable used in this thesis is ‘injury’ a dummy variable compiled from the ‘injury at work’ variable from the death certificate data. On the death certificate the question of injury at work is answered as either yes (1), no (2) or unknown (98) and not applicable (99). This nominal level variable was collapsed into a dichotomous ‘dummy’ variable where a value of ‘1’ indicates a positive answer, ‘yes,’ on the original death certificate, and a value of ‘0’ indicates that the death was not the result of an injury at work. This dichotomous variable enables the use of the ‘injury at work’ variable as the dependent variable of a logistic regression.

Independent Variables

Also included in the analyses are several independent variables to help predict the likelihood of sustaining an occupational injury resulting in death. All but one of the independent variables included are measured at the individual level.

1. Occstat (occupational status)

This is an interval level variable ranging in value from 1 to 99, where a value of 1 indicates the lowest level of occupational status and 99 represents the highest level of occupational status.

2. South

This is a dummy variable where a value of 1 indicates that the decedent was a resident of a Southern state and a value of 0 indicates that the decedent was a resident of a non-Southern state. In this thesis Southern resident, are from either the South Atlantic (Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia and Florida), the East South Central (Kentucky, Tennessee, Alabama and Mississippi) or the West South Central (Arkansas, Louisiana, Oklahoma and Texas).

3. Black

This is a dummy variable where a value of 0 indicates that the decedent is non-black and 1 indicates that the decedent is black.

4. Hispanic

This is a dummy variable where a value of 0 indicates that the decedent is non-Hispanic, and a value of 1 that the decedent is Hispanic (of Mexican, Puerto Rican, Cuban, Central or South American, and “other” decent).

5. Married

This is a dummy variable where a value of 0 indicates that the decedent was not married at the time of his death (never married, widowed or divorced), and a value of 1 that the decedent was married at the time of his death.

6. Education

This is an interval level variable measuring years of education. The variable ranges from a value of 0 to a value of 17, where 0 means that the individual had no formal education and each increasing value indicates an additional year of formal education that the individual received. In preliminary analyses I treated education as a dummy variable where 1 was four or more years of college, and 0 was anything less than 4 years of college. This variable was changed to the interval variable years of education because I believed the equation could be better estimated using the full range of educational data.

Hypotheses

While there are available thorough descriptive analyses from the NIOSH and other government agencies using death certificate data by occupation, there has been no attempt to date to predict the likelihood that an occupational fatality will occur. Based on my examination of the previous literature on the subject of occupational fatalities, hypotheses were developed. Using logistic regression, the relationship between the incidence of occupational fatalities and occupational status categories will be studied. Independent variables measuring race, ethnicity, southern residence, marital status and years of education will also be included. Logistic regression will enable the prediction of the likelihood that an individual will sustain an occupational injury that results in death.

Based on the general hypotheses regarding occupational fatalities from the previous literature, more specific hypotheses were developed that address the research questions of this thesis. These hypotheses are:

1. Individuals in occupations that are categorized as lower on the occupational status scale will be more likely to sustain an occupational injury that results in death as compared to individuals that are in the occupations that are categorized as higher on the occupational status scale, controlling for the other x variables in the model.
2. Individuals who are identified as black will have a greater likelihood of sustaining an occupational fatality as compared to those identified as non-black individuals, all other things equal.
3. Individuals who are identified as Hispanic will be more likely to sustain an occupational fatality than those identified as non-Hispanics, controlling for all other x variables in the model.
4. Individuals who died in the Southern region of the United States will be more likely to sustain an occupational fatality than those who died in the non-Southern regions of the United States, all other things equal.
5. The more the years of education completed, the less likely the individual will be to sustain an occupational fatality, all other things equal.

Methods

The method of analysis to be used to test the hypotheses is logistic regression. Logistic regression was the best choice because it enables the prediction of the likelihood that an event will occur. The event being predicted is the likelihood that the individual will die from an occupational injury. The ‘injury at work’ question in the death certificate lends itself well to logistic regression because it is a dependent variable that is dichotomous. Logistic regression requires a dependent variable with a binary outcome, meaning that the dependent variable only has two options for an outcome. The two outcomes are (1) the individual died as a consequence of an injury at work or (0) the individual did not die due to an injury at work. One of the important functions of a logistic regression is its ability to predict the odds of an event occurring. These odds indicate when an event occurs relative to when an event does not occur (Long and Freese, 2003: 113). The use of odds to specify the relationship between the event occurring or not occurring allows the interpretation of an occupational event occurring to individuals that possess a certain demographic characteristic and those that do not.

In the next chapter of this thesis will review the descriptive analyses performed that help gain familiarity of the data in the sample that will be used in the logistic regression. The independent and dependent variables will be used in frequency distributions to show the percentage and number of occupational fatalities by the occupational status score and the other independent variables described in chapter III of this thesis. Using these independent variables, logistic regressions will also be performed to predict the likelihood of sustaining an occupational injury resulting in death. The logistic regression results will also be given in chapter IV. Chapter IV will conclude with a brief discussion of the results of the logistic regression. The findings and implications of the logistic regression will be discussed in further detail in the concluding chapter.

CHAPTER IV

DESCRIPTION OF DATA

Descriptive Results

As discussed in previous chapters, the data in the analyses of this thesis come from the Center for Disease Control’s death certificate data from 1998 and 1999. This first section will provide descriptive analyses of the sample derived from the CDC data that are used in this thesis. Also important to recall is that the data sample being used only includes males between the ages of twenty-five and fifty-five. Also excluded are non-civilian deaths.

These descriptive analyses in Table 4.1 show the distribution of the dependent and independent variables that are being used in the logistic regression. The description of the independent and independent variables will help clarify the relationship that will be examined later in the chapter. The independent variables that will be discussed will help understand the characteristics of the American worker that are hypothesized to be associated with occupational fatalities. Logistic regression results will follow the preliminary descriptive results. Logistic regression is the most appropriate form of analysis because the dependent variable ‘injury at work’ is dichotomous. The chapter will conclude with a discussion of the results in relation to the models that were estimated.

Table 4.1 Descriptive Results of Independent and Dependent Variables

Variable	N	Mean	Std Dev	Min	Max
Injury	20088	0.065	0.24	0	1
Occstat	20088	45.50	23.74	1	99
Black	20088	0.157	0.364	0	1
Hispanic	20088	0.076	0.266	0	1
Married	20088	0.439	0.496	0	1
South	20088	0.452	0.498	0	1
Education	20088	12.25	2.357	0	17
Age	20088	40.16	8.474	25	55

There are a total of 20,088 decedents in this sample, which consists only of males. The mean score on the occupational status score in 45.5, which on a scale of occupational status scores that range from 1 to 99, means that the average score on the occupational status scale is less than the middle of the range of scores. To give an idea of the meaning of this score, in the Nam-Powers scale from which the occupational status scores were created, the score of forty-five is the exact score for the occupations of athletes, interviewers, classified ad clerks, dental assistants, supervisors personal service occupations, supervisors, painters, paperhangers and plasterers, glaziers and lathe and turning machine operators. The average age in the sample is forty years and the mean years of education is twelve—a high school education. Regarding region, Southern residents total about 45 percent of the sample. In total there are 3,162 black males in the sample, about 16 percent of the total, and there are 1,534 Hispanic males which is almost 7 percent of the sample. The majority of the sample is white males, which based on previous literature is the racial/ethnic group with the highest rates of occupational fatalities compared to other ethnic and racial groups.

Table 4.2 Frequency Distribution of Occupational Status Scores (by Injury)

Occstat	No		Yes		Occstat	No		Yes	
	#	%	#	%		#	%	#	%
					50	276	1.38	15	1.15
1	23	0.11	0	0	**51**	24	0.12	4	0.31
2	0	0	0	0	**52**	112	0.56	9	0.69
3	55	0.27	0	0	**53**	203	1.01	11	0.84
4	0	0	0	0	**54**	33	0.16	1	0.08
5	9	0.04	0	0	**55**	418	2.09	9	0.69
6	0	0	0	0	**56**	8	0.04	0	0
7	221	1.1	17	1.3	**57**	7	0.03	0	0
8	327	1.63	4	0.31	**58**	133	0.66	4	0.31
9	62	0.31	3	0.23	**59**	19	0.09	1	0.08
10	54	0.27	6	0.46	**60**	111	0.55	8	0.61
11	13	0.06	0	0	**61**	63	0.31	2	0.15
12	52	0.26	0	0	**62**	122	0.61	6	0.46
13	56	0.28	1	0.08	**63**	545	2.72	55	4.21
14	45	0.22	1	0.08	**64**	134	0.67	10	0.77
15	315	1.57	24	1.84	**65**	309	1.54	35	2.68
16	755	3.77	52	3.98	**66**	554	2.77	41	3.14
17	0	0	0	0	**67**	19	0.09	0	0
18	46	0.23	1	0.08	**68**	41	0.2	0	0
19	19	0.09	1	0.08	**69**	60	0.3	5	0.38
20	65	0.32	9	0.69	**70**	108	0.54	11	0.84
21	58	0.29	0	0	**71**	133	0.66	5	0.38
22	1060	5.3	47	3.6	**72**	52	0.26	6	0.46
23	1415	7.07	89	6.81	**73**	173	0.86	7	0.54
24	3	0.01	1	0.08	**74**	57	0.28	6	0.46
25	66	0.33	2	0.15	**75**	75	0.37	5	0.38
26	116	0.58	3	0.23	**76**	19	0.09	0	0
27	334	1.67	10	0.77	**77**	109	0.54	6	0.46
28	396	1.98	8	0.61	**78**	179	0.89	10	0.77
29	24	0.12	2	0.15	**79**	7	0.03	1	0.08
30	203	1.01	9	0.69	**80**	192	0.96	5	0.38
31	112	0.56	8	0.61	**81**	57	0.28	5	0.38
32	430	2.15	14	1.07	**82**	227	1.13	34	2.6
33	77	0.38	4	0.31	**83**	73	0.36	0	0
34	705	3.52	30	2.3	**84**	101	0.5	1	0.08
35	224	1.12	10	0.77	**85**	107	0.53	3	0.23

Table 4.2 Continued

Occstat	No #	%	Yes #	%	Occstat	No #	%	Yes #	%
36	59	0.29	3	0.23	**86**	880	4.4	62	4.74
37	82	0.41	10	0.77	**87**	0	0	0	0
38	399	1.99	62	4.74	**88**	1	0	0	0
39	105	0.52	3	0.23	**89**	126	0.63	4	0.31
40	1836	9.18	271	20.73	**90**	38	0.19	2	0.15
41	1186	5.93	59	4.51	**91**	69	0.34	4	0.31
42	141	0.7	12	0.92	**92**	68	0.34	3	0.23
45	55	0.27	7	0.54	**95**	188	0.94	6	0.46
46	142	0.71	18	1.38	**96**	27	0.13	0	0
47	131	0.65	14	1.07	**97**	4	0.02	1	0.08
48	123	0.61	19	1.45	**98**	1	0	0	0
49	173	0.86	7	0.54	**99**	162	0.81	3	0.23
					Total	**18785**	**100**	**1303**	**100**

Table 4.2 shows the distribution of occupational fatalities according to scores on occupational status. It can be seen that throughout the occupational status scores, fatalities do not appear to occur equally. If there were no differences between occupational status and the number of occupational fatalities, there should be equal numbers of fatalities in each category. The occupational status category ‘40’ has the highest occurrence with 271 cases of occupational fatalities. However, this occupational status category also is the largest represented in the sample. In total, of the 20,088 decedents 2,107 are categorized into group ‘40’. The occupations that were categorized as having an occupational status score of ‘40’ are: duplicating machine operators, communications equipment operators, bank tellers, farm managers (except horticulture), carpenters, extruding and forming machine operators, photographic process machine operators, hand molding, casting and forming occupations, and truck drivers. These

occupations seem to support the literature which classifies farming occupations, occupations working with heavy machinery, carpentry and public utility workers as those at the highest risk. Also, the fact that truck drivers and bank tellers fall into this category supports the literature which shows homicides and motor vehicle accidents as the most frequent cause of death among all occupational fatalities. It is important to keep in mind that none of these findings are connected with the cause of death data. However, these preliminary descriptive findings do merit further investigation.

Table 4.3 (below) shows the frequency distribution of the other independent variables to be used in the logistic regression. These independent variables are education—which is an interval level variable measuring the years of education; South—where a value of one indicates the individual is from the Southern United States; married—where a value of one indicates that the individual was married at the time of death; black—where a value of one indicates the individual is black; and Hispanic—where a value of one indicates that the individual is Hispanic.

The highest numbers of individuals were in the twelve-year category of education. This category comprises 10,173 of the 21,310 decedents in the sample, which is almost 48 percent of the sample. Consequently, this is also the educational group that had the highest number of occupational fatalities. Of the 1,307 occupational fatalities in the sample, 672 or about 51 percent were in this category. In this sample there are 9,101 Southern individuals. However, of the 1,307 individuals that sustained an occupational fatality, the majority (58 percent) are non-Southern residents. The variable married indicates that the majority of the decedents in this sample were not married; about 95 percent were not married at the time of death. The married category however, does have the highest representation among the decedents in the sample that suffered an occupational fatality. Of the 1,307 cases of occupational fatalities, 841 were married. As will be seen later, this will have some interesting effects in the logistic regressions. The majority of the individuals in the sample were not black (only 3,290) or Hispanic (only 1,544 individuals), meaning that the majority of individuals in the sample were white.

Table 4.3 Frequency Distribution of Independent Variables (by Injury at Work)

	Injury at Work				
Education	**No #**	**%**	**Yes #**	**%**	**Raw Total**
0	25	0.13	5	0.38	30
1	5	0.03	0	0	5
2	18	0.10	2	0.15	20
3	39	0.21	6	0.46	45
4	53	0.28	3	0.23	56
5	51	0.27	5	0.38	56
6	242	1.29	23	1.77	265
7	146	0.78	3	0.23	149
8	643	2.64	31	2.38	527
9	643	3.42	50	3.84	693
10	1276	6.79	64	4.9	1340
11	1205	6.41	51	3.98	1256
12	8984	47.83	670	51.42	9654
13	892	4.75	79	6.06	971
14	1884	10.03	135	10.36	2019
15	451	2.40	33	2.53	484
16	1553	8.27	109	8.37	1662
17	822	4.38	34	2.61	856
Total	18785	100.00	1303	100	20088
South					
Non-southern	10238	54.5	758	58.17	10996
Southern	8547	45.5	545	41.83	9092
Total	18785	100	1303	100	21310
Marital Status					
Not Married	10800	57.49	463	35.53	11263
Married	7985	42.51	840	64.47	8825
Total	18785	100	1303	100	20088
Black					
Non-Black	15757	83.88	1169	89.72	16926
Black	3028	16.12	134	10.28	3162
Total	18785	100	1303	100	20088
Hispanic					
Non-Hispanic	17346	92.34	1208	92.71	18554
Hispanic	1439	7.66	95	7.29	1534
Total	18785	100	1303	100	20088

Table 4.4 Regression Results (Males, N=20088)

Injury	Coef.	Std Error	t	P>|t|
Occstat	4.84e-06	0.000	0.06	0.954
Black	-0.020	0.005	-4.15	0.000
Hispanic	-0.014	0.007	-2.07	0.038
Married	-0.054	0.004	15.19	0.000
South	-0.010	0.004	-2.95	0.003
Education	-0.002	0.009	-2.26	0.024
Age	-0.000	0.002	-0.21	0.832
Constant	0.075	0.013	5.89	0.000
F	45.78			
Prob>F	0			
R-squared	0.015			

These data contained in Table 4.4 present the findings from a regression run with 'injury' as the dependent variable and occupational status as the independent variable and black, Hispanic, married, south, years of education and age as the control variables. As can be seen, black, Hispanic, married, south and education all are statistically significant in this regression. Occupational status however, is not statistically significant, which may pose problems in the logistic regressions.

Table 4.5 Multicolinearity Test Tolerances

Variable	Tolerance
occstat	0.736
education	0.739
Hispanic	0.886
south	0.924
black	0.924
married	0.949
age	0.956

In order to guard against the presence of strong multicolinearity, tests are performed to show the degree to which the independent variables are interrelated. The results shown in Table 4.5 are the tolerance values of the independent variable. There is little multicolinearity in the variables. These data are appropriate for logistic regression modeling. The values in this table include all the independent variables that will appear in analyses. The tolerance values are all way above 0.35, a “rule of thumb” minimum tolerance value. All the tolerance values are above 0.77.

Logistic Regression Results

The next section of chapter IV presents the results of the logistic regression used to test the hypotheses. The models are performed with the independent variables previously discussed and with the use of ‘injury at work’ as the dependent variable. As previously discussed, logistic regression allows the prediction of a binary dependent variable, and is therefore the preferred method to test the hypotheses regarding occupational fatalities. The tables display the results of the tests of the model. The first tables will display the logit coefficients which are interpreted as the natural logarithms of the odds. Odds ratios will also be displayed and interpreted as the likelihood of an event occurring. In both cases the event that will be predicted is the probability that an individual will die as a result of an injury at work, as indicated on their death certificate.

Table 4.6 Logistic Regression Results Coefficients (Males)

Sociodemographic Characteristics	Predicting an Injury at Work Resulting in Death Coefficients
Occ Status	0.00008
	0.001
Black	-0.414**
	0.096
Hispanic	-0.241*
	0.118
Married	0.896***
	0.061
South	-0.176**
	0.06
Education	-0.0311**
	0.014
Age	-0.006
	0.0035
Constant	-2.599***
Pearson Chi-Squared	275.32***
Pseudo R-Squared	0.0285
Log Likelihood	-4686.43
N	20088
Degrees of Freedom	7

significant at .1 (*)
significant at .05 (**)
significant at .001 (***)

The results of this logistic regression seen in Table 4.6 indicate that many of the variables have a statistically significant relationship with sustaining an ‘injury at work’. All variables were significant with the exception of occupational status and age. Table 4.7 displays the odds ratios of the above coefficient which have a more intuitive interpretation than the logistic regression coefficients. An odds ratio is the anti-log of the coefficient and can be interpreted as the percent change in the odds ratio when 1 is subtracted from it an then multiplied by 100, i.e., (Odds Ratio – 1) * 100.

Table 4.7 Logistic Regression Results Odds Ratios (Males)

	Predicting an Injury at Work Resulting in Death
Sociodemographic Characteristics	**Odds ratios**
Occ Status	1.000
	0.001
Black	0.661**
	0.064
Hispanic	0.786*
	0.093
Married	2.450***
	0.149
South	0.838**
	0.051
Education	0.969**
	0.013
Age	0.999
	0.003
Pearson Chi-Squared	275.32
Pseudo R-Squared	0.0285
Log Likelihood	-4686.4326
N	20088
Degrees of Freedom	7

significant at .1 (*)
significant at .05 (**)
significant at .001 (***)

The regression results indicate that the hypotheses set forth in this thesis were supported in some cases. In the United States the risk of sustaining an occupational injury resulting in death decreases for individuals with more years of education. The results of the black and Southern variables, however, were contrary to the hypotheses. The results of the logistic regression show decreased risks of occupational fatalities for blacks and for those living in the South. Black decedents were .66 times as likely as non-blacks to sustain an occupational fatality. This means that black individuals were 33 percent less likely than non-blacks to suffer an occupational fatality. Southern decedents were about .84 times as likely to suffer an occupational fatality. This means that Southerners have about a 16 percent lower risk than non-Southerners of sustaining an occupational injury resulting in death. The married variable had the highest associated risk of occupational fatalities, which also was contrary to my hypothesis. Married individuals were 2.45 times as likely or 155 percent more likely to die from an occupational injury than non-married individuals. The Hispanic variable was found to be negatively associated in the model at the 0.1 significance level. This finding is also shows the opposite of the relationship that was hypothesized; it shows that Hispanics have a 22 percent lower risk than non-Hispanics of sustaining an occupational injury resulting in death. The results of the occupational status variable also did not support my hypothesis. The odds ratio of occupational status was 1.000082 meaning that one increase in occupational status was associated with 0.008% increase in the likelihood of sustaining an occupational fatality; this finding is not statistically significant.

In order to further investigate these relationships another logistic regression was estimated in which only married males between the ages of twenty-five and fifty-five, were used. Below, tables 4.8 and 4.9 displays the logistic regression results and odds ratios respectively. The findings are surprising. They will be reviewed below and further discussed in chapter V of this thesis.

Table 4.8 Logistic Regression Results Coefficients (Married Males)

	Predicting the Likelihood of Sustaining an Injury at Work Resulting in Death
Sociodemographic Characteristics	**Coefficients**
Occ Status	-0.001
	0.002
Black	-0.543**
	0.134
Hispanic	-0.053
	0.143
South	-0.181**
	0.076
Education	-0.004
	0.017
Age	0.002
	0.004
Constant	-2.12
Pearson Chi-Squared	28.45
Pseudo R-Squared	0.005
Log Likelihood	-2760.09
N	8825
Degrees of Freedom	6

significant at .1 (*)
significant at .05 (**)
significant at .001 (***)

The results from table 4.8 show that by restricting the sample to only married males between the ages of twenty-five and fifty-five, only the South and black variables are statistically significant. This restriction also reduces the sample to only 8,825 cases. Both South and black are still associated with a decreased risk of sustaining an occupational fatality. The occupational status scale and the education variable both lose their significance in the model containing only married males. This finding points to what may be considered the real predictor of occupational fatalities, finding out the true working population in the United States.

Table 4.9 Logistic Regression Results Odds Ratios (Married Males)

	Predicting the Likelihood of Sustaining an Injury at Work Resulting in Death
Sociodemographic Characteristics	**Odds Ratios**
Occ Status	0.999
	0.001
Black	0.581**
	0.078
Hispanic	0.948
	0.136
South	0.834**
	0.063
Education	0.996
	0.017
Age	1.002
	0.005
Constant	-2.12
Pearson Chi-Squared	28.45
Pseudo R-Squared	0.005
Log Likelihood	-2760.0959
N	8825
Degrees of Freedom	6

significant at .1 (*)
significant at .05 (**)
significant at .001 (***)

Table 4.9 shows the odds ratios for the logistic regression. As already stated, only the variables black and South are statistically significant and the relationships are opposite of those predicted in the hypotheses. The odds ratio for black of 0.58 means that black individuals are 42 percent less likely than non-black individuals, to sustain an occupational injury resulting in death. Southern individuals are 0.83 times as likely (17 percent less likely) than non-Southerners to sustain an occupational fatality resulting in death.

These regression results show that the hypotheses set forth were not supported. Relationships were found contrary to the hypotheses and some relationships were found to not be statistically significant. The next chapter of this thesis will discuss these findings and the future potential and possible direction of this and similar studies.

CHAPTER V

CONCLUSIONS AND IMPLICATIONS

Results of Hypothesis Testing

Previous research has found that variables used in analyses undertaken in this thesis do indeed affect the number and rate of occupational fatalities sustained in the United States and in other countries. But, the analyses in this thesis produced many contradictory results to those of previous literature discussed in earlier chapters. This final chapter will discuss the findings of the logistic regression equations that were estimated in chapter IV. The results did not fully support the hypotheses. The alternative results will be discussed as well as possible explanations for the outcomes that were found. This chapter will conclude with a discussion of possible directions for the study of occupational fatalities in the future.

The main hypothesis of this thesis concerned the relationship between an individual's occupational status and the likelihood of sustaining an occupational fatality. As described in previous chapters, the occupational status score was hypothesized to be negatively associated with the likelihood of sustaining an occupational injury resulting in death. The hypothesized negative association was expected because occupational scores measure the status of occupations. Therefore, the higher the individual ranked on this index, the higher status the job is and the less likely the person would be to sustain an occupational injury. However, the findings of the logistic regression do not support this hypothesis. According to the logistic regression, the occupational status variable has an odds ratio of 1.000, which was not statistically significant. This finding is in the opposite direction as hypothesized.

This finding may be due to the distribution of the scores in the sample. As we can see below in Figure 4.1, there is a non-normal distribution of occupations in this sample.

Occupations are more prominent in the first half of the distribution and the largest number of occupations is concentrated in the categories forty and forty-one. This may have an effect on the regression results.

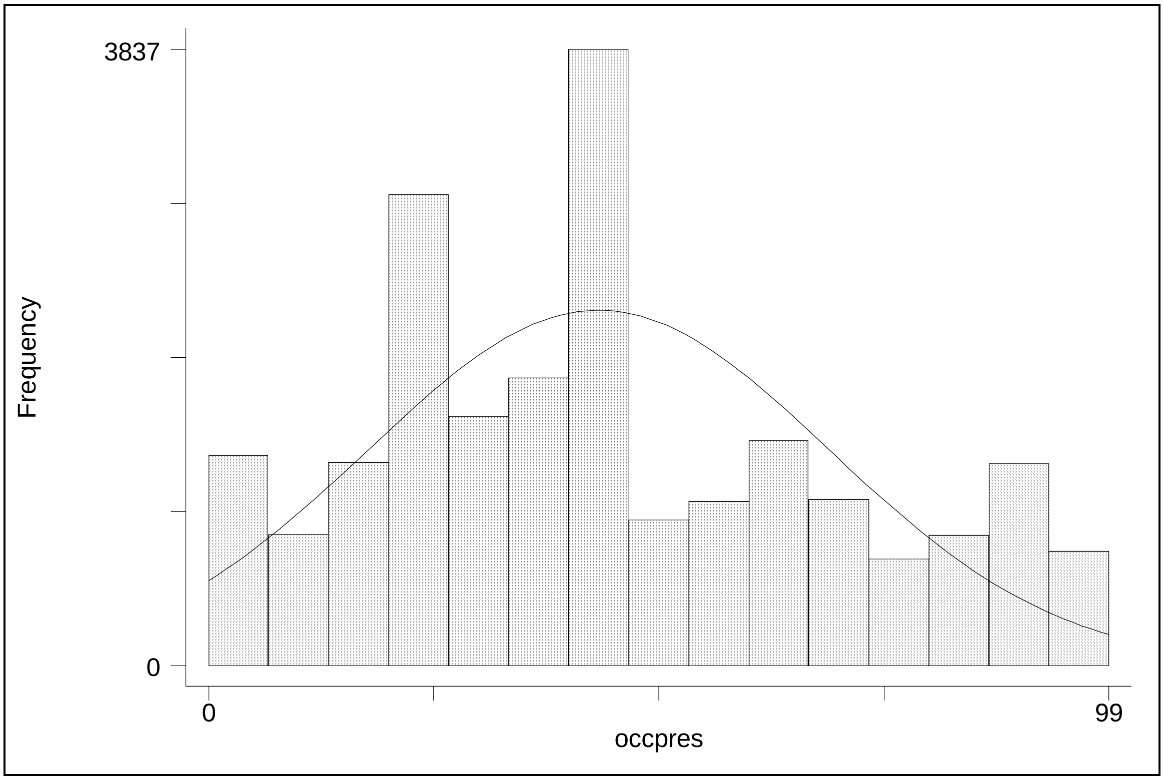

Figure 5.1: Distribution of Occupational Status Scores

It is also possible that occupational status is not the correct way to assess whether or not an individual is exposed to the risk of an occupational fatality. As discussed in chapter III, the occupational status scores are compiled using a scale that incorporates not only the occupation but also the education and income of individuals in that occupation. While these may be an accurate portrayal of an occupation's status, the scores may not grasp the population of at-risk occupations. As previously discussed, the amount of risk that an individual has in an occupation may well result in increased pay to the individual. Increased risk may also mean higher education, such as associates or bachelor's degrees that pertain to job skills and training. These occupations may not be singled out as being "dangerous" if factors such as pay and education are incorporated into the scale. Future studies may concentrate on one aspect of occupation, i.e., pay or education and skill level, in order to grasp the at risk population among American employees.

The results of this thesis were not consistent with some of the previous literature on occupational fatalities. In previous analyses that I performed before writing this thesis, I indeed found a relationship between occupational status and occupational fatalities. But I used occupational data based on broad categories rather than specific occupations. I used six occupational categories as dummy variables in a logistic regression (the highest status occupational dummy variable was the reference category). The same dependent variable, injury at work, was used in the logistic regression as well as the variables black, Hispanic, south, married and education. The results of the logistic regression found increased likelihoods of occupational fatalities in the farming, craft and labor occupations (the management occupational category was used as a reference).

The significant findings in these preliminary logistic regressions may indicate that in the study of occupational fatalities broader categories of occupation may be a better way for assessing the risk of sustaining a fatal work injury than the specific occupational status variable used in this thesis. Future studies would benefit from using this less specific type of measure, especially when using death certificate data that have so many restrictions to the number of cases.

An important issue to remember is that the "usual occupation" question that was the basis for the occupational status score is filled out by the decedent's next of kin at their time of death. This approach to data collection makes mistakes on the occupational response item very likely. The question of occupation is a difficult one to answer, even when the person providing the information is the incumbent. When the usual occupation question has to be answered by an outside individual, answers are like to vary even more so. It is possible that even the decedent's close family and friends may not have a clear grasp of what his or her usual occupation was at the time of death.

This can present problems for the creation of an occupational status score that relies on the accuracy of the usual occupation question. If the responses to the occupation question are incorrect, than the index misrepresents the individual, and the connection to involvement in a fatal work injury may not arise. Further studies of this type should take this methodological into account and try to develop a different way to measure the individual's occupation that is less prone to misreporting.

In the logistic regression results shown in table 4.7, we see that the only variable that performed as hypothesized was education. This variable was measured as years of education and is significant at the 0.05 level. With each additional year of education an individual received, he or she can expect to reduce his or her likelihood of sustaining an occupational fatality resulting in death by 4 percent. This coincides with previous research on occupational fatalities and mortality in general which show increased life expectancy with additional years of education. This finding with regards to occupational fatalities is likely due to the less 'hands on' jobs that individuals with higher education are likely to have. As described in the literature review, the majority of occupational fatalities occur as a result of motor vehicle accidents and homicides. Also contributing to the number of occupational fatalities in the United States are machine related accidents, falls and electrocutions. These causes of death show an element of involvement in the industry that occurs in jobs likely to be held by individuals in lower status jobs. Even in industries that involve these kinds of equipment that are associated with accidents, individuals with higher education would be more likely to be managers or executives and thus not involved in the means of production or transporting goods. However, increased education is not likely to completely reduce the number of occupational fatalities since regardless of degree these jobs will still be performed. Higher education is only a solution at the individual level and is not expected to help at a policy level.

The variables black and Hispanic were both shown to be significant in the logistic regression, but the effects of these variables were opposite of the hypotheses. These two variables were both expected to be positively associated with the likelihood of dying from an occupational fatality. However, being identified as black decreased the individuals' likelihood of sustaining an occupational fatality by 33 percent. Similarly, being identified as Hispanic decreased the likelihood by 22 percent. Previous literature had mixed findings on the occurrence of occupational fatalities for racial and ethnic minorities. Studies found that Hispanic and black individuals were likely to sustain occupational fatalities, but these findings were thought to be unique to certain parts of the country and/or certain industries. Descriptive results from the NIOSH found more whites than minorities as falling victim to occupational injuries and fatalities. This finding is likely due to the greater numbers of whites in the workforce compared to black and Hispanic individuals. These decreased likelihoods could also be due to the restricted number of states for which that the data are available. Since the only Southern states that have "usual occupation" information on the death certificate are Georgia, Kentucky, North and South Carolina and West Virginia, the sample may not provide a representative sample of Southern states where income, education and occupation inequalities are more prevalent.

Due to the sample restrictions of the death certificate data, my data only included small numbers of minority workers. The states that were included were not among those with large minority populations or are not typical of southern states. For example, most of the southern states that were included—Georgia, Kentucky, North Carolina, South Carolina and West Virginia—tend to have larger white populations compared to other southern states and some of these do not have large populations of blacks or Hispanics. In order to deal with the selectivity of the sample, in future research additional logistic regression should be estimated that would be restricted to white married males between the ages of 25 and 55. This might help create a better study population that is less susceptible to the differences between minorities in different parts of the country.

This leads to the last independent variable that had a significant finding in the logistic regression, namely South. As described above, only five Southern states were included in the sample. Although previous literature shows that Southerners are more likely to sustain an occupational fatality, the results of this thesis show that persons from Southern states had a decreased the likelihood of 16 percent. This finding could also be due to the states that were included in the sample. These states may not have represented the number of occupational fatalities that occur in the Southern. This decreased finding may also represent a changing dynamic of American industry where not all low status jobs are concentrated in one area of the United States. We need data for all fifty states and for several time periods to test this speculation; this is something that cannot be done with death certificate data alone.

The most interesting findings of the logistic regression occurred when the sample was restricted only to married males. This restriction was implements in order to help understand the large effect the marital status variable was having in the logistic regression. As seen in chapter IV, individuals married at the time of death were 155 percent more likely than non-married individuals to sustain an occupational fatality. Recall that the non-married individuals include those who were widowed, divorced and separated or single (never married) at their time of death. This increase was not only a large effect, but was statistically significant at the 0.001 level, making it the variable with the highest level of statistical significance in the regression.

In sample containing only married individuals, the variables that were found to be statistically significant in the first regression, namely occupational status, Hispanic, and education, were no longer significant. This means that the effect of marriage on these traits is no longer evident once individuals with non-married statuses at the time of their death are removed from the sample. As was seen in table 4.9, after the sample is restricted to married males, the only variables that maintain their significance are the black and Southern variables. In the regression of only married males, black individuals were 42 percent less likely than non-blacks to sustain an occupational injury resulting in death. Compare this to the results from the unrestricted sample (provided in table 4.7) in which black individuals had a decreased risk of only 33 percent compared to non-black individuals and we can see that the restriction makes a difference for the race of the worker. The only other variable that maintained significance is the Southern residence variable. In the married males sample, Southern residents were found to experience a 17 percent decreased likelihood of sustaining an occupational fatality compared to non-Southern residents. This finding is the same as the finding in the sample that included married and non-married males. Southern residents were shown experience a decreased likelihood of 17 percent compared to non-Southern residents.

Implications and Directions for Further Research

Herbert and Landrigan (2000) identify that while in the United States 65,000 workers die each year because of occupational fatalities, worldwide 1.1 million workers die each year. This "surpasses the number of deaths from road accidents and war." (541). These staggering worldwide numbers show the grave impact that occupational fatalities play around the world.

The problem of occupational fatalities is a problem that needs attention not only in the United States but also worldwide. Unfortunately, many other countries do not have the same kinds of regulations and policies regarding occupational safety and health that protect employees in the United States. Although occupational fatalities still occur in the United States, special measures have been taken by employers to help ensure that the risk to the worker is limited. Many times the steps that an employer takes to prolong the health and life of their workers are the direct result of government policy that requires such action. Not following these guidelines and necessary precautions can mean fines or even being shut down. However, worldwide these same types of measure may not even exist in some countries or industries. When looking at the overall number of occupational fatalities suffered in the United States in which safe practices are mandatory, the gravity of employee safety globally becomes even more apparent.

Also important to consider is the difficultly in measuring occupational fatalities, a fact that many scholars have demonstrated in their studies. When considering the difficulty in counting and measuring occupational fatalities in the United States, one can imagine the increased difficulty that would arise in developing countries. It is possible that the 1.1 million occupational fatalities that Herbert and Landrigan (2000) cite is a gross underestimate of the worldwide numbers of occupational fatalities occurring every year.

The fact that different racial and ethnic groups tend to sustain occupational fatalities differently shows important information about these workers and their risks. The high likelihood of Hispanic workers to sustain occupational fatalities is of special of concern. This increased likelihood seems to show that Hispanic workers have an unequal stratification in high risk occupations. Also the literature suggests that these workers may be illegal immigrants that may fear to report injuries and illnesses and may not have the same access to health care and employee rights as other workers (Herbert and Landrigan 2000:3). Although many immigrant workers may work illegally, they still should have rights to comparable health care and benefits as non-immigrant workers. I believe that the findings of the logistic regression show that special attention should be paid to these high risk workers.

The occupational fatality literature expresses the need for better ways to identify occupational fatalities. Azaroff and Levenstein (2002) find that United States Bureau of Labor Statistics surveys significantly underestimate the incidence of work-related injuries and illnesses. Although significant improvements have been made to the measurement of occupational fatalities, the issue of underestimation still needs to be addressed. Perhaps a combination of death certificate and surveillance data could be used in further analyses predicting the likelihood of sustaining an occupational fatality.

Another way to test some of the hypotheses set forth in earlier chapters would look at occupational fatalities among specific occupations, rather than among individual persons. In this thesis I examined the risk of a fatality occurring to an individual. In contrast I could examine the risk of a fatality among occupations. Characteristics would then be gathered as independent variables for the occupations and comparisons would be made among occupations rather than among individuals.

This would involve matching up the number of individuals in a given occupation from a data source like the Current Population Survey for the years of the death certificate data, namely 1998 and 1999. This would establish the number of individuals in an occupation and provide a denominator for the calculation of the rate of occupational fatalities in that occupation. The numerator would be the number of fatalities in that occupation for the available years.

In order to perform this type of analysis, a much larger number of occupational fatalities would have to be identified since the numerator would encompass a representative sample of the U.S. population. To obtain the larger numbers of occupational fatalities a different data source would need to be used other than or in addition to, the death certificates. This would leave the sample with a high number of "zeros" which would be industries in which no fatalities occurred, making a logistic regression impossible to perform. In this case, a Poisson regression would be better able to account for the large number of zeros.

Another way to deal with the idea of the occupation question would be to develop a better way of obtaining data on job and work. In this thesis, the occupational status score was not found to be significant; this was surprising considering previous literature showing a clear connection between occupation and fatal work injuries. Putting aside the problems with the measurement of "usual occupation" on the death certificate, it is possible that the variable of occupational status does not grasp the amount of risk an individual is under.

In future studies the inclusion of a measure of job risk would be helpful to better understand the connection between occupation and fatal injuries. Incorporating issues like the types of machinery that an individual uses (if any), the amount of driving an occupation requires, and other indicators of the risky duties a job involves, may be a better measure of the danger of an occupation. Also important would be to take into account the amount of training received and precautions that are taken at a company or within an industry to ensure a worker's health and well-being. So, a measure of at-risk behavior within an occupation might be more important to consider when looking at occupational fatalities, rather than occupational status scores that rely on measures of education and income.

The study of occupational fatalities can have implications for economic and political studies. "The magnitude of value-of-life estimates is of considerable policy importance…U.S. federal agencies have used labor market estimates of the value of statistical life to assess the benefits of health, safety and environmental regulations. These benefit values are critical inputs to the policy because the benefits from reducing risk to life are often the dominate benefit component, and the magnitude of these benefits is consequential given the increased reliance on benefit-cost tests for policy assessment (Viscusi 2004:2)." So, by studying the risk factors associated with occupational fatalities, changes can be made to national, state and local policies that affect the changes to the health, safety and environmental regulations. These policies should affect the labor market and the practices of hiring in various industries. When occupational fatalities are given the attention that they deserve within an industry, measures may well be taken to help prevent them.

Studies about occupational fatalities have implications that reach many aspects of society. Using death certificate data in itself is an eye opening experience when one thinks about every case not as an individual respondent but as an actual person who lost his or her life. Although dying is a consequence of human life, occupational fatalities represent non-natural deaths that in most cases could be avoided. Some individuals and some occupations are at higher risks of dying from an occupational injury. Efforts can be made in every industry to reduce the risks that workers are under everyday at work. Training programs could help workers become more familiar with their work and their responsibilities. Also training should include how to “troubleshoot” problems if they arise. Dangerous circumstances cannot be avoided in all cases, but if the workers know how to deal with the dangerous situations should they arise, live may be able to be spared. Safety equipment should be replaced often and should be the best equipment available in that field of work.

In further research a better measure of educational attainment to measure education’s impact on occupational fatalities would be helpful. With more and more individuals obtaining higher and advanced degrees before entering the workforce, the dynamic that education plays in placement in certain industries is sure to have differing effects through time. Also of interest would be a study of the work conditions to which workers are exposed in the various occupations. Specifically, one would study the working conditions in the high risk occupations and the ways these can be reduced. This may be studied by looking at the occurrence of occupational fatalities by the cause of death data that are available on the NCHS death certificate data.

Another example of working conditions that need further attention is the length of work day. In research for this thesis I found out that in my father’s occupation, individuals worked twelve hour shifts in which they would be on for twelve hours and off for twelve hours during which he would be on call. The injury that he suffered actually occurred during his twelve hours that he was on call. An ability to measure the length of work day is an important factor regarding the frequency of occupational injuries. Clearly the topic of occupational injuries is a very important one that affects persons involved in all aspects of the workforce.

Considering the research for this thesis, I began to understand the magnitude that the issue of occupational fatalities is all around the world. From personal experience I know that losing a loved one to an occupational fatality is difficult as losing the person to any other cause of death. But in many ways it can be more difficult because the family and friends left behind have no warning of the impending death. My father went to work everyday for years and returned home healthy and unharmed. It only took one work day among thousands of work days to end his life. If there were any means that could have prevented his accident I know that my family and I would hope that those steps were taken. I suspect that this is how the families and friends of other decedents feel.

REFERENCES

United States Census Bureau, Population Division (2006-06-20). 2005 Population Estimates. Retrieved on 1/26/2007.

Azaroff, Lenore S., Charles Levenstein and David H. Wegman. 2002. "Occupational Injury and Illness Surveillance: Conceptual Filters Explain Underreporting." *American Journal of Public Health.* 92(9):1421-1429.

Bailer, A., N.A. Stayner, L.D. Reed and S.J. Gilbert. 1998. "Trends in Rates of Occupational Fatal Injuries in the United States: 1983-1992." *Occupational Environmental Medicine.* 55: 485-490.

Baillargeon, Jacques, Gregg Wilkinson, Laura Rudkin and Gwen Baillargeon. 1998. "Characteristics of the Healthy Worker Effect: A Comparison of Male and Female Occupational Cohorts." *Journal of Occupational and Environmental Medicine*. 40(4): 368-373.

Christenson, Bruce A. and Nan Johnson. 1995. "Educational Inequality in Adult Mortality: An Assessment with Death Certificate Data from Michigan." *Demography.* 32(2):215-229.

Cormack, Richard M., Chang, Yue-Fang and Gordon Smith. 2000. "Estimating deaths from industrial injury by capture-recapture: A cautionary tale." International *Journal of Epidemiology.* 29(6):1053-1060.

Dembe, Allard E., Judith A. Savageau, Benjamin C. Amick and Steven M. Banks. 2005. "Racial and Ethnic Variations in Office-Based Medical Care for Work-Related Injuries and Illnesses." *Journal of the National Medical Association Thorofare*. 97(4):498-507.

Haug, M.R. (1977). "Measurement in Social Stratification." *Annual Review of Sociology*. 3: 51-77.

Herbert, Robin, and Phillip Landrigan. 2000. "Work-related Death: A Continuing Epidemic." *American Journal of Public Health.* 90(4):541-546.

Hummer, Robert A., Richard G. Rogers and Isaac W. Eberstein W. 1998. "Sociodemographic Differentials in Adult Mortality: A Review of Analytic Approaches." *Population and Development Review.* 24(3):553-578.

Johnson, Norman J., Paul D. Sorlie and Eric Backlund. 1999. "The Impact of Specific Occupation on Mortality in the U.S. National Longitudinal Mortality Study." *Demography.* 36(3):355-367.

Li, C.Y. and F.C. Sung. 1999. "A Review of the Healthy Worker Effect in Occupational Epidemiology." *Occupational Medicine*. 49(4): 225-229.

Loomis, Dana and David Richardson. 1998. "Race and the Risk of Fatal Injury at Work." *American Journal of Public Health*. 88(1):40-45.

Marmot, Michael. 2001. "Inequalities in Health." *The New England Journal of Medicine.* 345(2): 134-137.

Marmot, Michael G., M. Kogevinas and M.A. Elston. 1987. "Social/Economic Status and Disease." *Annual Review of Public Health*. 8:111-135.

Marsh, Suzanne M and Larry A. Layne. 2001. "Fatal Injuries to Workers in the United States, 1980-1995." Department of Health and Human Services: Center for Disease Control, National Institute for Occupational Health and Safety. Retrieved on 4/10/2007 (http://www.cdc.gov/niosh/docs/2001-129/2001129state.html).

Martinello, Felice and Ronald Meng. 1992. "Workplace Risks and the Value of Hazard Avoidance." *The Canadian Journal of Economics*. 25(2):333-345.

Moore, David E. and Mark D. Hayward. 1990. "Occupational Careers and Mortality of Elderly Men. *Demography*. 27(1):31-53.

Murphy. D.J., Barbara L. Seltzer and Charles E. Yesalis. 1990. "Comparison of Two Methodologies to Measure Agricultural Occupational Fatalities." *American Journal of Public Health.* 80(2): 198-201.

Park, Robert M. 2002. "Hazard Identification in Occupational Injury: Reflections on Standard Epidemiological Methods." *International Journal of Occupational and Environmental Health.* 8(4):354-363.

Pratt, S., Suzanne Kisner and James Helmkamp. 1996. "Machinery Related Occupational Fatalities in the United States, 1980 to 1989." *Journal of Occupational and Environmental Medicine.* 38(1)70-77.

Preston, S.H. 1977. "Mortality Trends." *Annual Review of Sociology*. 3:163-178.

Preston S.H. 1996. "Population Studies of Mortality." *Population Studies.* 50(3):525-526.

Richardson, David B., Dana Loomis, James Bena and John A. Bailer. 2004. "Fatal Occupational Injury Rates in Southern and Non-Southern States, by Race and Hispanic Ethnicity." *American Journal of Public Health*. 94(10):1756-1762.

Richardson, David and Dana Loomis. 1997. "Trends in Fatal Occupational Injuries and Industrial Restructuring in North Carolina in the 1980's." *American Journal of Public Health.* 87(6):1041-1044.

Rogers, Richard G., Robert A. Hummer and Charles B. Nam. 2000. *Living and Dying in the USA: Behavioral, Health, and Social Differences of Adult Mortality*. San Diego, CA. Academic Press.

Russell, J and Carol Conroy. 1991. “Representativeness of Death Identified through the Injury at Work Item on the Death Certificate: Implications for Surveillance.” *American Journal of Public Health*. 81(12) 1613-1619.

Sestito, J.P., Alan R. Lunsford, Anne C. Hamilton and Roger Rosa. 2004. “Worker Health Chartbook.” Department of Health and Human Services; Centers for Disease Control, National Institute for Occupational Safety and Health.

Viscusi, W Kip. 2004. “The Value of Life: Estimates with Risks by Occupation and Industry.” *Economic Inquiry*. Discussion Paper 422.

APPENDIX

U.S. STANDARD CERTIFICATE OF DEATH

LOCAL FILE NO. STATE FILE NO.

NAME OF DECEDENT ___________
For use by physician or institution

To Be Completed/Verified By: FUNERAL DIRECTOR

1. DECEDENT'S LEGAL NAME (Include AKA's if any) (First, Middle, Last)
2. SEX
3. SOCIAL SECURITY NUMBER

4a. AGE-Last Birthday (Years)
4b. UNDER 1 YEAR: Months / Days
4c. UNDER 1 DAY: Hours / Minutes
5. DATE OF BIRTH (Mo/Day/Yr)
6. BIRTHPLACE (City and State or Foreign Country)

7a. RESIDENCE-STATE
7b. COUNTY
7c. CITY OR TOWN

7d. STREET AND NUMBER
7e. APT. NO.
7f. ZIP CODE
7g. INSIDE CITY LIMITS? □ Yes □ No

8. EVER IN US ARMED FORCES? □ Yes □ No
9. MARITAL STATUS AT TIME OF DEATH □ Married □ Married, but separated □ Widowed □ Divorced □ Never Married □ Unknown
10. SURVIVING SPOUSE'S NAME (If wife, give name prior to first marriage)

11. FATHER'S NAME (First, Middle, Last)
12. MOTHER'S NAME PRIOR TO FIRST MARRIAGE (First, Middle, Last)

13a. INFORMANT'S NAME
13b. RELATIONSHIP TO DECEDENT
13c. MAILING ADDRESS (Street and Number, City, State, Zip Code)

14. PLACE OF DEATH (Check only one: see instructions)
IF DEATH OCCURRED IN A HOSPITAL: □ Inpatient □ Emergency Room/Outpatient □ Dead on Arrival
IF DEATH OCCURRED SOMEWHERE OTHER THAN A HOSPITAL: □ Hospice facility □ Nursing home/Long term care facility □ Decedent's home □ Other (Specify):

15. FACILITY NAME (If not institution, give street & number)
16. CITY OR TOWN, STATE, AND ZIP CODE
17. COUNTY OF DEATH

18. METHOD OF DISPOSITION: □ Burial □ Cremation □ Donation □ Entombment □ Removal from State □ Other (Specify):___________
19. PLACE OF DISPOSITION (Name of cemetery, crematory, other place)

20. LOCATION-CITY, TOWN, AND STATE
21. NAME AND COMPLETE ADDRESS OF FUNERAL FACILITY

22. SIGNATURE OF FUNERAL SERVICE LICENSEE OR OTHER AGENT
23. LICENSE NUMBER (Of Licensee)

To Be Completed By: MEDICAL CERTIFIER

ITEMS 24-28 MUST BE COMPLETED BY PERSON WHO PRONOUNCES OR CERTIFIES DEATH
24. DATE PRONOUNCED DEAD (Mo/Day/Yr)
25. TIME PRONOUNCED DEAD

26. SIGNATURE OF PERSON PRONOUNCING DEATH (Only when applicable)
27. LICENSE NUMBER
28. DATE SIGNED (Mo/Day/Yr)

29. ACTUAL OR PRESUMED DATE OF DEATH (Mo/Day/Yr) (Spell Month)
30. ACTUAL OR PRESUMED TIME OF DEATH
31. WAS MEDICAL EXAMINER OR CORONER CONTACTED? □ Yes □ No

CAUSE OF DEATH (See instructions and examples)

32. PART I. Enter the chain of events--diseases, injuries, or complications--that directly caused the death. DO NOT enter terminal events such as cardiac arrest, respiratory arrest, or ventricular fibrillation without showing the etiology. DO NOT ABBREVIATE. Enter only one cause on a line. Add additional lines if necessary.

Approximate interval: Onset to death

IMMEDIATE CAUSE (Final disease or condition ---------> resulting in death) a.___________
Due to (or as a consequence of):
Sequentially list conditions, if any, leading to the cause listed on line a. Enter the UNDERLYING CAUSE (disease or injury that initiated the events resulting in death) LAST b.___________
Due to (or as a consequence of):
c.___________
Due to (or as a consequence of):
d.___________

PART II. Enter other significant conditions contributing to death but not resulting in the underlying cause given in PART I.
33. WAS AN AUTOPSY PERFORMED? □ Yes □ No
34. WERE AUTOPSY FINDINGS AVAILABLE TO COMPLETE THE CAUSE OF DEATH? □ Yes □ No

35. DID TOBACCO USE CONTRIBUTE TO DEATH? □ Yes □ Probably □ No □ Unknown
36. IF FEMALE: □ Not pregnant within past year □ Pregnant at time of death □ Not pregnant, but pregnant within 42 days of death □ Not pregnant, but pregnant 43 days to 1 year before death □ Unknown if pregnant within the past year
37. MANNER OF DEATH □ Natural □ Homicide □ Accident □ Pending Investigation □ Suicide □ Could not be determined

38. DATE OF INJURY (Mo/Day/Yr) (Spell Month)
39. TIME OF INJURY
40. PLACE OF INJURY (e.g., Decedent's home; construction site; restaurant; wooded area)
41. INJURY AT WORK? □ Yes □ No

42. LOCATION OF INJURY: State: City or Town:
Street & Number: Apartment No.: Zip Code:

43. DESCRIBE HOW INJURY OCCURRED:
44. IF TRANSPORTATION INJURY, SPECIFY: □ Driver/Operator □ Passenger □ Pedestrian □ Other (Specify)

45. CERTIFIER (Check only one):
□ Certifying physician-To the best of my knowledge, death occurred due to the cause(s) and manner stated.
□ Pronouncing & Certifying physician-To the best of my knowledge, death occurred at the time, date, and place, and due to the cause(s) and manner stated.
□ Medical Examiner/Coroner-On the basis of examination, and/or investigation, in my opinion, death occurred at the time, date, and place, and due to the cause(s) and manner stated.
Signature of certifier:___________

46. NAME, ADDRESS, AND ZIP CODE OF PERSON COMPLETING CAUSE OF DEATH (Item 32)

47. TITLE OF CERTIFIER
48. LICENSE NUMBER
49. DATE CERTIFIED (Mo/Day/Yr)
50. FOR REGISTRAR ONLY- DATE FILED (Mo/Day/Yr)

To Be Completed By: FUNERAL DIRECTOR

51. DECEDENT'S EDUCATION-Check the box that best describes the highest degree or level of school completed at the time of death.
□ 8th grade or less
□ 9th - 12th grade; no diploma
□ High school graduate or GED completed
□ Some college credit, but no degree
□ Associate degree (e.g., AA, AS)
□ Bachelor's degree (e.g., BA, AB, BS)
□ Master's degree (e.g., MA, MS, MEng, MEd, MSW, MBA)
□ Doctorate (e.g., PhD, EdD) or Professional degree (e.g., MD, DDS, DVM, LLB, JD)

52. DECEDENT OF HISPANIC ORIGIN? Check the box that best describes whether the decedent is Spanish/Hispanic/Latino. Check the "No" box if decedent is not Spanish/Hispanic/Latino.
□ No, not Spanish/Hispanic/Latino
□ Yes, Mexican, Mexican American, Chicano
□ Yes, Puerto Rican
□ Yes, Cuban
□ Yes, other Spanish/Hispanic/Latino (Specify) ___________

53. DECEDENT'S RACE (Check one or more races to indicate what the decedent considered himself or herself to be)
□ White
□ Black or African American
□ American Indian or Alaska Native (Name of the enrolled or principal tribe) ___________
□ Asian Indian
□ Chinese
□ Filipino
□ Japanese
□ Korean
□ Vietnamese
□ Other Asian (Specify)___________
□ Native Hawaiian
□ Guamanian or Chamorro
□ Samoan
□ Other Pacific Islander (Specify)___________
□ Other (Specify)___________

54. DECEDENT'S USUAL OCCUPATION (Indicate type of work done during most of working life. DO NOT USE RETIRED).

55. KIND OF BUSINESS/INDUSTRY

REV. 11/2003

Figure A.1 U.S. Standard Death Certificate

United States of America - State of New Mexico - New Mexico Vital Records and Health Statistics.

CERTIFICATE OF DEATH - Certified by Medical Investigator ☐ Certified by Physician ☐

(NOTE: If death is due to accident, homicide, trauma, or unknown causes, refer case to Medical Investigator)

County of Death | City, Town, Location

DECEASED

1. DECEDENT - NAME First Middle Last
2. SEX
3. DATE OF DEATH (mo, day, yr)
4. DATE OF BIRTH (mo, day, yr)
5a. AGE - last birthday
5b. UNDER 1 YEAR MOS. DAYS
5c. UNDER 1 DAY HOURS MINS.
6a. RACE - Specify White, Black, Native American, etc.
6b. IF NATIVE AMERICAN, Specify Tribal Affiliation (e.g. Zia, Jicarilla, Navajo, etc.)
6c. DECEDENT HISPANIC? ☐ NO ☐ Yes Specify: Spanish ☐ Mexican ☐ Cuban ☐ Puerto Rican ☐ Other ☐ Specify
7. EDUCATION OF DECEDENT - Indicate highest grade completed 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 + UNK
8a. PLACE OF DEATH - Name of hospital or other facility (if neither, give street and number or location)
8b. HOSPITAL ☐ Inpatient ☐ ER/Outpatient ☐ DOA; OTHER ☐ Nursing Home ☐ Residence ☐ Other (Specify)
9. STATE OR COUNTRY OF BIRTH
10. CITIZEN OF WHAT COUNTRY
11. MARRIED, NEVER MARRIED, WIDOWED, DIVORCED - Specify
12. SURVIVING SPOUSE (If wife, give birth name)
13. WAS DECEDENT EVER IN U.S. ARMED FORCES? ☐ YES ☐ NO
14. SOCIAL SECURITY NUMBER
15a. USUAL OCCUPATION (Kind of work done during most of working life, even if retired)
15b. KIND OF BUSINESS OR INDUSTRY
16a. RESIDENCE - State
16b. County
16c. City, Town or Location
16d. INSIDE CITY LIMITS? ☐ YES ☐ NO
16e. STREET AND NUMBER OR LOCATION
16f. ZIP CODE

PARENTS

17. FATHER - NAME First Middle Last
18. MOTHER - BIRTH NAME First Middle Last

19a. INFORMANT - NAME (Type or print)
19b. MAILING ADDRESS Street/RFD No. City/Town State Zip

DISPOSITION

20a. METHOD OF DISPOSITION ☐ Burial ☐ Cremation ☐ Removal from State ☐ Donation ☐ Entombment ☐ Other (Specify)
20b. CEMETERY/CREMATORY - Name
20c. LOCATION City/Town State
21a. FUNERAL SERVICE LICENSEE or PERSON ACTING AS SUCH - Signature
21b. LICENSE NUMBER
21c. FACILITY - NAME
21d. FACILITY - ADDRESS Street/RFD No. City/Town State

CERTIFICATION

22a. **CERTIFIER'S SIGNATURE** - On the basis of examination and/or investigation, in my opinion death occurred at the time, date and place and due to the cause(s) stated. ☐ Office of Medical Investigator ☐ Tribal/Military Authority ☐ Certified Physician
22b. TYPE/PRINT NAME ADDRESS
22c. DATE SIGNED (mo, day, yr)
22d. HOUR OF DEATH
22e. PRONOUNCED DEAD (mo, day, yr)
22f. PRONOUNCED DEAD (hour)
22g. MANNER OF DEATH ☐ NATURAL ☐ ACCIDENT ☐ SUICIDE ☐ HOMICIDE ☐ UNDETERMINED
23a. DATE FILED AT NMVRHS (mo, day, yr)
23b. STATE REGISTRAR'S SIGNATURE

CAUSE OF DEATH

24a. WAS AN AUTOPSY PERFORMED? ☐ YES ☐ NO
24b. If yes, were findings considered in determining cause of death? ☐ YES ☐ NO
24c. LOCATION WHERE AUTOPSY WAS PERFORMED (CITY, STATE)
25a. WAS RECENT SURGICAL PROCEDURE PERFORMED? ☐ YES ☐ NO
25b. IF YES, SPECIFY TYPE OF PROCEDURE
25c. DATE OF PROCEDURE
26a. WAS DECEDENT PREGNANT WITHIN LAST 6 WEEKS? ☐ YES ☐ NO
26b. If yes, estimated length of pregnancy
27a. DESCRIBE HOW INJURY OCCURRED (COMPLETE FOR ACCIDENT, SUICIDE, HOMICIDE, UNDETERMINED)
27b. HOUR OF INJURY
27c. DATE OF INJURY - (mo, day, yr)
27d. INJURY AT WORK ☐ YES ☐ NO
27e. PLACE OF INJURY - Specify home, farm, street, etc.
27f. LOCATION Street/RFD No. City/Town State

28. PART I. Enter the diseases, injuries or complications which caused the death. Do not enter the mode of dying, such as cardiac or respiratory arrest, shock, or heart failure. List only one cause per each line. — Approximate interval between onset and death

IMMEDIATE CAUSE (Final disease or condition resulting in death.) a. DUE TO (OR AS A CONSEQUENCE OF):

Sequentially list conditions, if any, leading to immediate cause. Enter UNDERLYING CAUSE (Disease or injury which initiated events resulting in death) LAST b. DUE TO (OR AS A CONSEQUENCE OF): c. DUE TO (OR AS A CONSEQUENCE OF): d.

PART II. Other significant conditions contributing to death but not resulting in the underlying cause given in Part I.

TYPE OR PRINT CLEARLY — PLEASE PRESS FIRMLY - MULTIPLE COPIES BEING MADE

O____ R____ ICDA

SAMPLE

SHADED AREAS FOR MEDICAL INVESTIGATOR - LEGAL OFFICER USE ONLY

NMVRHS 904 REV. 3/98

NEW MEXICO VITAL RECORDS AND HEALTH STATISTICS

Figure A.2 New Mexico Death Certificate

VITA

Rachel Lynn Traut received her Bachelor of Arts degree in sociology from University of Texas at San Antonio in 2004. She entered the Sociology program at Texas A&M University in September 2005, and she received her Master of Science degree in May 2007. Her research interests include demography, especially migration, and quantitative methods.

Ms. Traut may be reached at the Department of Sociology, Mail Stop 4351, Texas A&M University, College Station, Texas, 77843-4351.