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Descriptive Analysis of U.S. Air Force Occupational Injuries and Illnesses

Kenneth Mackenthun
Wright State University - Main Campus

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Abstract

Background: Occupational health is a concern in the workplace environment. Cases of occupational illness or injury could lead to lost workdays, a lower quality of life, chronic pain, and sometimes death. Air Force personnel perform unique functions that could have negative effects on their health.

Purpose: Identify the most common occupational illnesses and injuries among active duty United States Air Force (U.S.A.F.) personnel, determine rates of occupational illnesses and injuries in the Air Force by rank, and compare rates across Major Commands (MAJCOMS).

Methods: A literature review was conducted on select occupational illnesses and injuries. A descriptive data analysis was performed at the United States Air Force School of Aerospace Medicine on Wright-Patterson, Air Force Base using a pre-existing data set provided by the U.S.A.F.

Results: Among occupational illnesses, hearing loss was the most common occupational illness and handling objects was the greatest cause of occupational injury in the Air Force from 2006-2010. Enlisted personnel are at a greater risk of occupational illnesses and injuries compared to officers. Among MAJCOMs, Air Force Special Operations Command had the highest rate of occupational illness and Pacific Air Forces had the highest rate of occupational injury.

Conclusion: These results could be used to plan prevention programs for occupational health. No single illness or cause of injury should be ignored. However, greater focus could be tailored towards the occupational illnesses and injuries that are the most burdensome, those at most risk, and locations with the most occupational illness and injury.

Keywords: Hearing loss, enlisted, officer, Major Command, work prevention

Descriptive Analysis of U.S. Air Force Occupational Injuries and Illnesses

Bernardino Ramazzini, known as The Father of Occupational Medicine, observed workers during the 1600s. His observations included bakers who became bowlegged, tailors who developed a bent body posture, printers that developed eye diseases after frequently focusing on the black letters, and female weavers who suffered from a miscarriage due to the fatigue on their body (Glass, Stones, & Franco, 2001). Today, workplace hazards are a daily exposure for the nearly 63% of American adults who are in the labor force (Mui & Jayakumar, 2013). Workplace injuries can result in lost production, lost wages, medical expenses, and disability compensation. These consequences can negatively affect business at the local, state, and national level. During 2007 in the United States (U.S.), there were 5,600 fatal injuries and up to 8,559,000 nonfatal injuries at a cost of $6 billion for fatal injuries and $186 billion for nonfatal injuries (Leigh, 2011). The U.S. Congress passed the Occupational Safety and Health Act of 1970 (OSHAct) to protect the health of working men and women by assuring safe working conditions. Furthermore, Congress encourages companies and personnel to increase occupational safety in the work environment (Occupational Safety and Health Administration [OSHA], n.d.b).

From 1993-2002, the U.S. Department of Labor, Bureau of Labor Statistics (BLS) Survey of Occupational Injuries and Illnesses reported that the biggest cause of lost workdays was overexertion. Overexertion can result from a repetitive physical effort involving lifting, wielding, turning, pushing, pulling, and carrying. Not only does overexertion cause acute pain, but it can lead to chronic problems, like carpal tunnel syndrome (OSHA, n.d.c). Back injuries, most likely a result from overexertion, were the most frequently reported cause of lost-workday injuries (Kemp, Burnham, Copley, & Shim, 2010).

Active duty United States Air Force (USAF) personnel perform a variety of jobs. Tasks include equipment maintenance, aircraft-related upkeep, and handling heavy objects. The responsibilities of Air Force personnel put them at risk of occupational injury and illness, which leads to lost workdays and production. Certain career fields in the U.S.A.F. may have a higher risk of injuries than other career fields. Within the Air Force, there are different Major Commands (MAJCOMS) with a unique Air Force mission. A MAJCOM is the highest level of a command below Headquarters Air Force. Currently, there are ten Air Force MAJCOMs (Table 1). Based on specialized operations of a location, some USAF MAJCOMs, as well as bases, may have a higher prevalence of noise pollution due to aircraft operations.

Table 1

Active Duty Air Force Major Commands

Air Force Major Commands
1. Air Combat Command
2. Air Education and Training Command
3. Air Force Global Strike Command
4. Air Force Material Command
5. Air Force Space Command
6. Air Force Special Operations Command
7. Air Mobility Command
8. Pacific Air Forces
9. United States Africa Command
10. United States Air Forces in Europe

Source: Air Force Historical Research Agency, n.d.

The U.S.A.F. School of Aerospace Medicine Epidemiology Consult Division has collected data from 2006-2010 recording occupational health illnesses and injuries among active duty personnel. This data set would be analyzed to determine: 1) the most common occupational illnesses and injuries among U.S.A.F. active duty personnel; 2) rates of occupational illness and injury by rank (Table 2); 3) U.S.A.F. MAJCOMs that report the highest rates of occupational illness and injuries.

Table 2

Air Force Ranks and Pay Grades

Air Force Rank and Pay Grade			
Enlisted Rank	**Pay Grade**	**Officer Rank**	**Pay Grade**
Airman Basic	E-1	Second Lieutenant	O-1
Airman	E-2	First Lieutenant	O-2
Airman First Class	E-3	Captain	O-3
Senior Airman	E-4	Major	O-4
Staff Sergeant	E-5	Lieutenant Colonel	O-5
Technical Sergeant	E-6	Colonel	O-6
Master Sergeant	E-7	Brigadier General	O-7
Senior Master Sergeant	E-8	Major General	O-8
Chief Master Sergeant	E-9	Lieutenant General	O-9
		General	O-10

Source: United States Air Force, n.d.

Purpose Statement

The purpose of this study is to identify the most common occupational illnesses and injuries, determine rates of occupational illnesses and injuries in the U.S.A.F. by rank, and compare rates across all MAJCOMs

Literature Review

Occupational Health Injuries and Illnesses Background and Statistics

According to the BLS, as of July 2014, there were 117,113,000 Americans working in the private sector alone. Since 2006, the average weekly work hours of the American private sector employee has remained between 33.8 and 34.7 hours (Bureau of Labor Statistics [BLS], n.d.). Occupational injuries are a threat to American workers. The consequences of a work-related injury include death, lost work days, job transfer, restricted work activity, expensive medical treatment, and long-term rehabilitation (Lax & Klein, 2008). In 1970, the Occupational Safety and Health Act (OSHAct) was passed to protect workers from death or serious injury in a workplace environment. The OSHAct required employers to be responsible for ensuring a safe work environment, maintaining meaningful workplace standards, and protecting employees from

harmful exposures. Under the OSHAct, workers have the right to request that the Occupational Safety and Health Administration (OSHA) inspects their workplace, receive information about hazards and prevention, and get copies of test results to determine workplace hazards. The OSHAct led to the creation of the OSHA. OHSA covers private sector workers and local, state, and federal government workers. OSHA defines an occupational injury as a wound or bodily damage that occurs from an event in a work setting. An occupational illness results in a condition or worsens a pre-existing condition (OSHA, n.d.c).

The Occupational Injury and Illness Classification System (OIICS) was created by the BLS as a simple way to code workplace injuries. The OIICS has four main coding structures (Table 3). These coding structures help to classify conditions of occupational health.

Table 3

Occupational Injury and Illness Classification System: Major Coding Structures

Occupational Injury and Illness Classification System Coding Structures	**Example**
1. Event or Exposure	Vehicle accident
2. Source and Secondary Source of Illness or Injury	Government truck
3. Nature of Injury or Illness	Fracture
4. Part of Body Affected	Left leg

Source: Northwood, Sygnatur, & Windau, 2012

The event is the way the illness or injury occurred. The source and secondary source of the injury identifies the objects, equipment, substances, and other causes responsible for an injury or illness. The nature of an injury or illness is the principle physical features or indicators. Nature can be further broken down by traumatic injuries or disorders and diseases resulting from longer exposure. The part of the body affected is arranged from the head down to the feet (Northwood, Sygnatur, & Windau, 2012).

With the exception of 2011, the reported rate of occupational illnesses and injuries has trended downward over the last decade. According to the 2012 Survey of Occupational Injuries

and Illnesses, the private industry reported close to three million nonfatal workplace injuries and illnesses (Incidence Rate: 3.4 cases per 100 full-time workers). The 2012 incidence rate was lower than the 2011 rate (3.5 cases per 100 full-time workers). No private sector industry had an upward trend in the rate of occupational injuries and illnesses over the last decade. State estimates of rates of occupational illnesses and injuries are available for forty-two states. By state, private sector injury and illness rates were highest in Maine with 5.6 cases per 100 workers and lowest in Louisiana with 2.3 cases per 100 workers (Figure 1). Among public sector workers, an estimated 792,700 injuries and illnesses reported. Most reported occupational injuries and illnesses occurred among local government workers (6.1 cases per 100 full-time workers). The rate for state government workers was 4.4 cases per 100 full-time workers (BLS, 2013a).

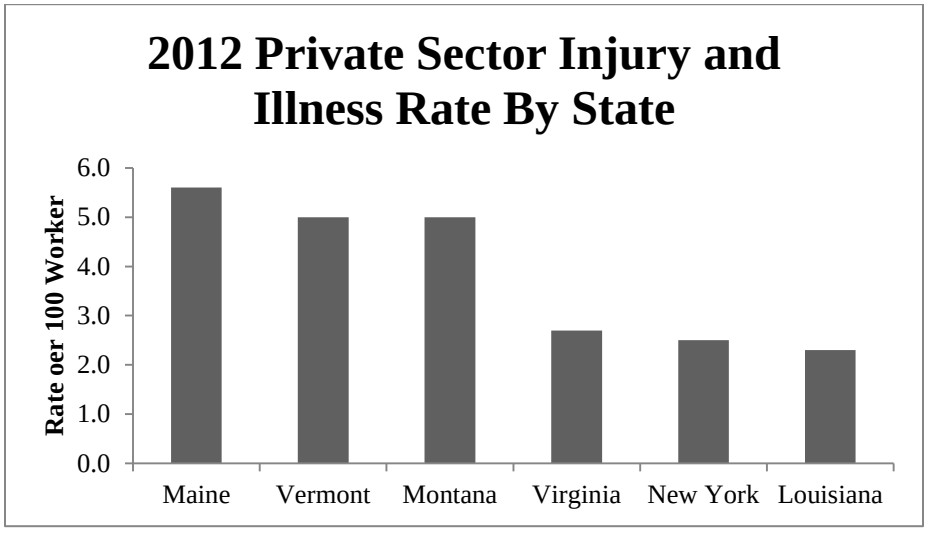


Figure 1: Three states with the highest and lowest occupational injury and illness rates in the private sector for 2012 (BLS, 2013a).

In 2012, sprains, strains, and tears were the most common injury in the United States. They accounted for 38% of the total occupational injury cases leading to days away from work. About 63% of these cases resulted from overexertion and bodily reaction. Falls, slips, and trips

accounted for 23% of occupational injury cases. Men suffered 61% of all injuries and illnesses. On average, men also required ten days away from work after an injury, while women, on average, required seven days away from work. About 39% of days-away-from-work cases occurred among workers known to be white, 12% were known to be Hispanic workers, and 8% were known to be African American workers. Race was not reported for 39% of the days away from work. For private industry workers, workers with fewer than 3 months of service had 8.9% of injuries. Workers with more than 5 years of experience accounted for 42.9% of workplace injuries (BLS, 2013b). In 2013, there were 4,405 fatal injuries; 3,929 of the fatal injuries occurred in the private sector and 476 of the fatal injuries occurred to government workers (BLS, 2014).

Active duty military personnel perform a variety of risky jobs. Biological, chemical, and physical exposures present an occupation health hazard to military personnel. Military personnel exposures can be categorized by the industrial tasks at military installations, by the exposures related to combat and training operations, or by environmental exposures in the air, soil, and water. In 1984, a U.S. Army survey reported that there were 95 eye injuries each year at Fort Campbell located on the Kentucky-Tennessee border. This resulted in a loss of 89,000 soldier hours. About half of these injuries could have been prevented if the soldier had been wearing proper eye protection. Based on incidents like Fort Campbell, leaders across all branches of the military realize that occupational injuries are a significant health issue and that their personnel are valuable assets. Military personnel should be protected from harmful occupational exposures in all workplace environments (Gaydos, 2011). However, there may be times when occupational safety may become second in priority to the responsibilities of the mission being performed.

Illnesses and Injuries

The following literature review will focus on common occupational illnesses and injuries. The occupational illness section will comprise of hearing loss, thermal illnesses, chemical sources, musculoskeletal disorder.

Hearing Loss

Hearing loss is the third leading chronic health problem after hypertension and arthritis (Walling & Dickson, 2012). Hearing loss affects at least twenty-eight million Americans. As the baby-boomer generation ages, the prevalence of hearing loss in Americans is expected to trend higher. Regular speech occurs between 500-3,000 hertz (Hz) at 45-60 decibels (dB). Once people turn 60, hearing could decrease by 1 dB every year. Hearing loss of 25 dB or greater affects 37% of adults between the ages of 61-70 and over 80% of adults older than 85 years old (Walling & Dickson, 2012). According to the National Institute of Occupational Safety and Health (NIOSH), hearing loss is one of the most common occupational illnesses. Occupational noise-induced hearing loss (ONIHL) is a result of excessive workplace noise exposure. About 37% of all adult hearing loss is caused by excessive noise exposure (Kurmis & Apps, 2007). ONIHL is an important occupational health hazard that typically does not have a cure, but is preventable (Kurmis & Apps, 2007).

Hearing loss greatly impacts quality of life. Those with hearing loss are more likely to experience anger, depression, anxiety, social isolation, and loneliness (Kooser, 2013). Likewise, hearing loss is associated with higher risk of falls for Americans older than forty (Kooser, 2013). Depending on the type of hearing loss, a worker may lose as much as $30,000 in annual income (Kooser, 2013). In the U.S., hearing loss is estimated to cost $122 billion annually in lost wages. A majority of these costs are not from expenses on direct health care and hearing aids, but from

lost earnings and productivity (Jennings & Shaw, 2008). There is conflicting evidence regarding future trends of hearing loss. While some reports suggest that hearing loss will increase in prevalence, one report suggested that hearing loss will be less of a burden now than it was 40 years ago (Thurston, 2013). This could reflect improvements from the use earplugs and earmuffs, surveillance to identify and control workplace noise, and increased prevention tailored towards hearing loss (Thurston, 2013).

A high proportion of military personnel are vulnerable to hearing loss because of their consistent exposure to excessive noise associated with aircraft, combat arms, heavy vehicles, and heavy machinery. A study among military personnel found those who work in combat arms, are males, or are enlisted were more likely to suffer from hearing loss compared to military personnel in noncombat arms positions, females, and officers (Cason, 2012). In a separate study, the Centers for Disease, Control, and Prevention (CDC) analyzed data from the 2010 Annual Social and Economic Supplement (ASEC) to the Current Population Survey (CPS) comparing hearing loss in veterans and nonveterans. In 2010, 8.9% of Americans 17 years or older were veterans. The prevalence of severe hearing impairment (SHI) was 10.4% for veterans and 2.5% for nonveterans. The prevalence of hearing loss for veterans who served after 2001 was 3.9%. Male veterans (10.9%) had a higher prevalence of SHI compared to female veterans (4.0%). Veteran females had a significantly higher prevalence compared to nonveteran males and females (Groenewold, Tak, & Masterson, 2011).

Thermal Injuries

Heat exposure poses a serious risk to workers (Centers for Disease Control and Prevention [CDC], n.d.a). Between 2012-2013, there were 20 cases of heat illness or death in the U.S. Heat exposure was the cause of death for 13 of these cases. Most of the employees

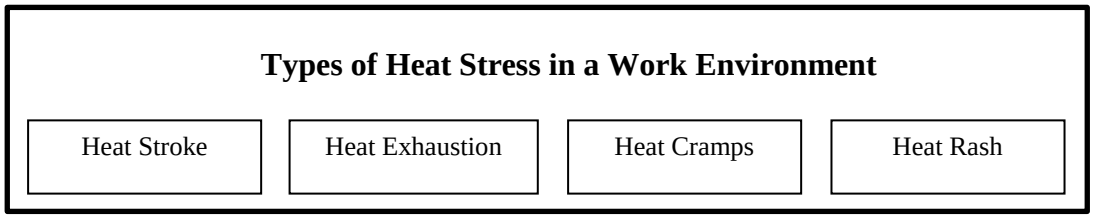
were outside exposed to high temperatures performing moderate to heavy work. Four deaths occurred as the employees just started their new jobs. Heat illness prevention was found to be nonexistent or incomplete at these workplaces. No attempt was made to acclimate new workers to a hot environment (Arbury et al., 2014). Workers exposed to high temperatures are at risk of heat stress. Heat stress can lead to heat stroke, heat exhaustion, heat cramps, and heat rashes. Contact with high temperature surfaces can lead to burns. Working outdoors increases the risk of heat stress. Firefighters, farmers, factory workers, and construction workers are at a greater risk for heat stress compared to employees in an indoor work environment (CDC, n.d.a). Risk factors include increasing age (sixty-five and older), overweight or obesity, and existing chronic illnesses (CDC, n.d.a).

To be prepared for managing heat stress, employers and employees should be knowledgeable about the types of heat stress that occurs in the work environment (Table 4). Each type of heat stress has its own degree of seriousness, symptoms, and treatment. Heat stroke is the most serious disorder related to heat (CDC, n.d.a). During heat stroke, there is a rapid increase in body temperature and the body cannot cool itself down. Body temperatures rise above 106 degrees Fahrenheit. If emergency treatment is not applied quickly, death or permanent disability can occur. Symptoms of heat stroke include high body temperature, chills, hallucinations, and dizziness. Too much perspiration can lead to heat exhaustion, as a response to losing too much water and salt. Signs of heat exhaustion include heavy sweating, fatigue, muscle cramps, and dizziness. Heat cramps affects workers performing vigorous actions. Sweating results in lower salt and moisture levels. A decrease in salt levels can lead to muscle cramps. Symptoms include muscle pain or spasms. A heat rash is a rash on the skin that occurs from too much sweating in hot temperatures. Signs of a heat rash include clusters of pimples or

small blisters (CDC, n.d.a). Military personnel are exposed to warm climates during deployment assignments that put them at risk of thermal injuries. Personnel stationed at cold climate locations may not be acclimated to hot climates during a deployment or permanent location change to a warm climate location.

Table 4

Types of Heat Stress in a Work Environment from Most to Least Severe



Source: CDC, n.d.a.

Chemical Injuries

Chemical and toxic substances pose serious health hazards to workers. Chemicals could cause irritation, adverse reproductive health effects, effect the immune and endocrine system, and be toxic and carcinogenic. OSHA requires manufacturers to assess the hazards of their chemical products, label their products, and distribute safety sheets for customers (OSHA, n.d.a). Employers must provide labels and safety data sheets for employees. Employers are required to train employees how to handle chemicals properly, which includes hazards of chemicals used and ways to protect themselves (OSHA, n.d.a). All chemicals, no matter how toxic, need to be handled with care (Mannan, O'Connor, & Keren, 2009).

Chemical eye injuries, which include chemical burns and conjunctivitis, result after exposure to corrosive substances in products like cleaners and detergents. The incidence of burns to the eye has been reported as 10.7 per 100,000 in the U.S. population (Blackburn, Levitan, MacLennan, Oswley, & McGwin Jr., 2012). Chemical eye injuries could lead to

damage to the cornea, ocular surface epithelium, or anterior segment. Other chemicals may result in injury to the eyelids and lashes, or conjunctivitis. The most common agents include detergents, adhesives, bleach, plaster, ammonia, antipersonnel sprays, and solvents/paints (Blackburn et al., 2012). The severity depends on factors such as the pH concentration of the chemical and the duration of chemical contact with the ocular surface. Alkali chemical burns tend to be more common and more severe than acid or other agents. Chemical injuries to the eye often require immediate treatment because of the possibility of permanent damage and vision loss (Gelston, 2013). Symptoms of a chemical eye injury include decreased vision, eye pain, tearing, and redness (Gelston, 2013).

Musculoskeletal Illness and Injuries

Musculoskeletal disorders (MSD) are injuries to muscles, nerves, tendons, joints, cartilage, or spinal discs (CDC, n.d.c). Work-related musculoskeletal disorders (WMSDs) occur under two conditions: the work environment and performance of the work has a significant contribution to the disorder and/or the disorder is worsened or lasts longer because of settings in the workplace. Certain work conditions increase the risk of MSDs. This includes regularly picking up heavy objects, overhead work, continuous forceful actions, and daily unnatural body positions (CDC, n.d.c). MSDs lead to absenteeism, increased health care costs, and lost productivity, which results in a high cost to employers (CDC, n.d.c). The Institute of Medicine estimates that the economic burden of WMSDs is between $45-54 billion each year (CDC, n.d.c). MSDs can lead to as much as two weeks of restricted work. Since 1981, medical discharges in the military have increased, mostly due to an increase in MSDs (Yancosek, Roy, & Erickson, 2012).

MSDs are reported as the main cause of all medical encounters across the US military (Zambraski & Yancosek, 2012). The Armed Forces Health Surveillance Center (AFHSC), which maintains the Defense Medical Epidemiology Database, reported that MSDs, which accounted for 30% of medical encounters, were the greatest cause of medical encounters of deployed and non-deployed service members in 2010. Over a period from 1980-2002, MSDs were responsible for 70% of discharges in the United States Army (Zambraski & Yancosek, 2012). In a three year period from 2004-2007, 34,006 personnel were medically evacuated from Iraq or Afghanistan (Zambraski & Yancosek, 2012). Of the 34,006 personnel, MSDs (24%) were the most common cause of evacuation (Zambraski & Yancosek, 2012). Injuries to Air Force personnel caused by carrying or lifting heavy objects, especially aircraft components and loaded boxes, were a leading cause of lost workdays. Recreational sports, including basketball, softball, and flag football were in the top ten leading causes of lost workdays for Air Force active duty personnel (Kemp et al., 2010). Risk factors for musculoskeletal injuries include older age, being of female sex, participation in sports, carrying heavy objects, walking long distances, and standing for extended periods of time (Yancosek et al., 2012).

Methods

Study Participants

Active duty Air Force occupational illness and injury safety data were obtained by the United States Air Force School of Medicine/Epidemiology Consult Division (USAFSAM/PHR) branch at Wright-Patterson, Air Force Base from 2006-2010. All active duty Air Force personnel who had an occupational illness or injury were included in this data set, regardless of demographic background. There were 893 records consisting of 870 distinct individuals in the Safety-Illness data. There were 7,824 records consisting of 7,555 individuals in the Safety-

Injury data. All participants were over the age of 18. Participants were further analyzed by rank category (officer vs. enlisted), rank, assigned MAJCOM, age, and sex.

The proportion of higher ranking individuals within the enlisted and officer ranks was smaller compared to lower ranking enlisted personnel and officers. Therefore, to protect the identity of an individual, Senior Master Sergeant and Chief Master Sergeant were grouped together in the safety illness and injury data set and labeled "Senior Master Sergeant". Similarly, Colonel, Brigadier General, Major General, Lieutenant General, and General were grouped together in the safety illness and injury data set and labeled "Colonel". Individuals whose rank could not be identified for security purposes were classified into the category "Unknown." For the MAJCOM analysis, individuals who were not assigned to an existing MAJCOM were grouped into the category "Other."

Data Analysis

The Institutional Review Board at Wright-Patterson Air Force Base determined the study was exempt and this was determination was accepted by the Wright State University (Appendix A). Relevant occupational health literature was obtained from PubMed and Ebsco host. Data analysis was performed at United States Air Force School of Medicine (USAFSAM) on Wright-Patterson Air Force Base, Ohio. Analysis was performed using Statistical Analysis Software (SAS) Enterprise Guide 5.1 and Microsoft Excel.

Occupational illness and injury rate per 100,000 were calculated for age and sex. Individuals were grouped into five-year age groups, starting with age 18-22 and ending with 53 and older. Occupational illness and injury rate per 100,000 were obtained for occupational illnesses and injuries across the Air Force and were further broken down by rank category, rank, and MAJCOM. For each year from 2006-2010, the population at the end of September was

totaled and used as the denominator when calculating rates. The relative risk ratio for occupational illness and injury in enlisted versus officer was calculated with the 95% confidence interval, and the p-value was reported.

Results

Table 5 includes rates per 100,000 for occupational illness and injury by age and sex.

Table 5

Demographic Rate per 100,000 for Occupational Illness and Injury

Demographic Characteristic	Illness: Rate per 100,000	Injury: Rate per 100,000
Age (years)	-	-
18-22	42.01	818.79
23-27	38.72	604.13
28-32	51.86	388.60
33-37	62.73	255.66
38-42	68.38	155.71
43-47	115.95	132.68
48-52	104.92	91.24
53+	119.33	119.33
Sex	-	-
Male	58.51	491.30
Female	35.27	396.95

Figure 2 shows the rate per 100,000 for the most common occupational illnesses in the Air Force among active duty personnel from 2006-2010. The rate per 100,000 was calculated by dividing the total number of cases for each illness by the total U.S.A.F. active duty population from 2006-2010, which was 1,654,572.

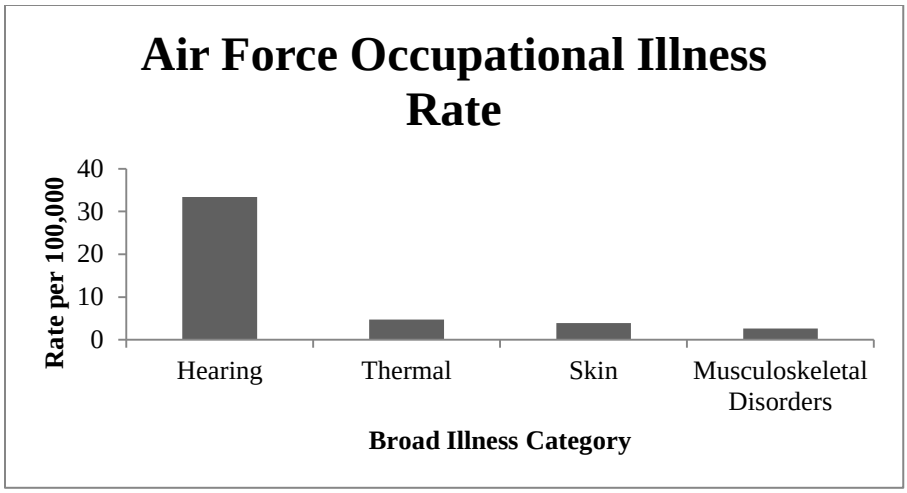


Figure 2. Air Force occupational illness rate per 100,000 from 2006-2010.

Figure 3 shows the rate per 100,000 for the most common occupational injuries in the Air Force among active duty personnel from 2006-2010. The rate per 100,000 was calculated by dividing the total number of cases for each injury by the total active duty population from 2006-2010, which was 1,654,572. Objects include lifting, carrying, and/or moving objects including, but not limited to, aircraft parts, boxes, and office furniture. Falls include any reported fall that is not associated with running for aerobic training. Animate forces are injuries caused by living sources, such as dog bits.

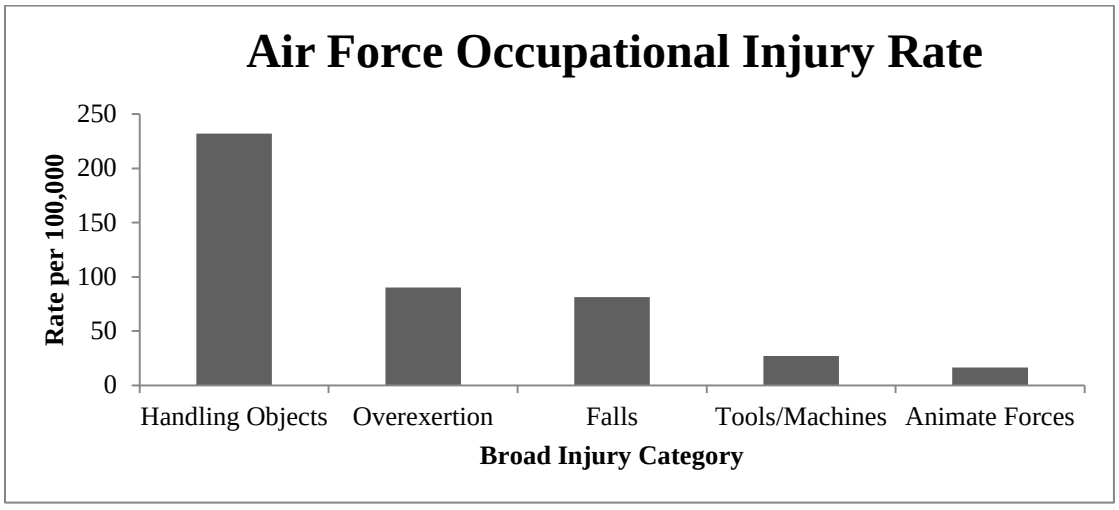


Figure 3. Air Force occupational injury rate per 100,000 from 2006-2010.

Table 6 shows the rate per 100,000 and relative risk ratio of occupational illness and injury in enlisted ranks compared to officer ranks; with 95% confidence interval and p-value. Enlisted personnel were at a 1.47 times higher risk to experience an occupational illness compared to officers. Enlisted personnel were at a 3.73 times higher risk to experience an occupational injury compared to officers.

Table 6

Relative Risk Ratio for Occupational Illness and Injury for Rank Category

Occupational Health and Rank Category: Rate per 100,000 & Relative Risk					
	Enlisted Rate per 100,000	**Officer Rate per 100,000**	**Relative Risk**	**95% Confidence Interval**	**p-Value**
Illness	57.71	39.19	1.47	1.22-1.77	<0.0001
Injury	554.64	148.69	3.73	3.41-4.08	<0.0001

Figure 4 shows the occupational illness rate per 100,000 by enlisted pay grade. To calculate the rate per 100,000, the total number of illness cases for each rank was divided by the total population from 2006-2010 for that specific rank. The category “unknown” was assigned to enlisted personnel whose rank could not be identified for confidentiality purposes.

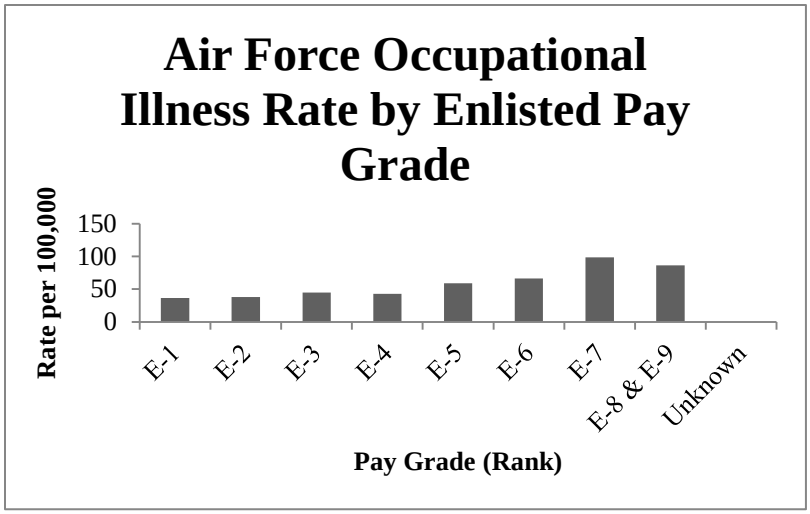


Figure 4: Air Force occupational illness rate per 100,000 by enlisted rank.

Figure 5 shows the occupational illness rate per 100,000 by officer pay grade. To calculate the rate per 100,000, the total number of illness cases for each rank was divided by the total population from 2006-2010 for that specific rank. The category "unknown" was assigned to officers whose rank could not be identified for confidentiality purposes.

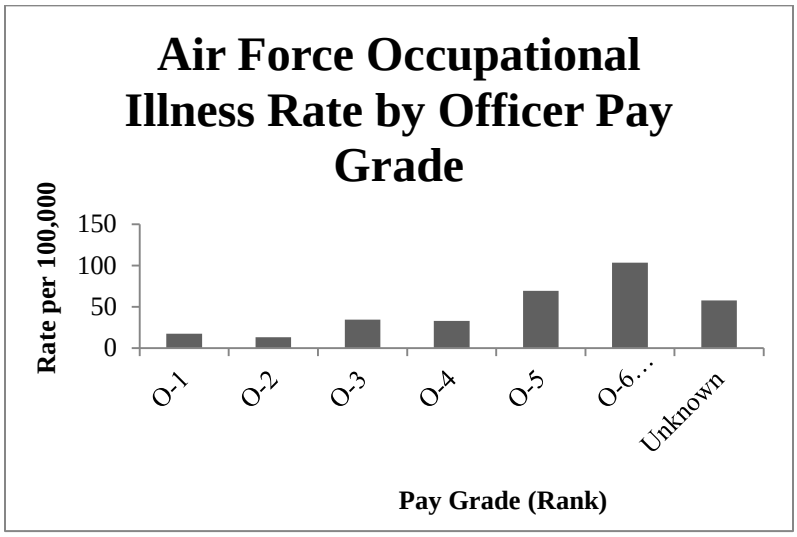


Figure 5: Air Force occupational illness rate per 100,000 by officer rank.

Figure 6 shows the occupational injury rate per 100,000 by enlisted pay grade. To calculate the rate per 100,000, the total number of illness cases for each rank was divided by the total population from 2006-2010 for that specific rank. The category "unknown" was assigned to enlisted personnel whose rank could not be identified for security purposes.

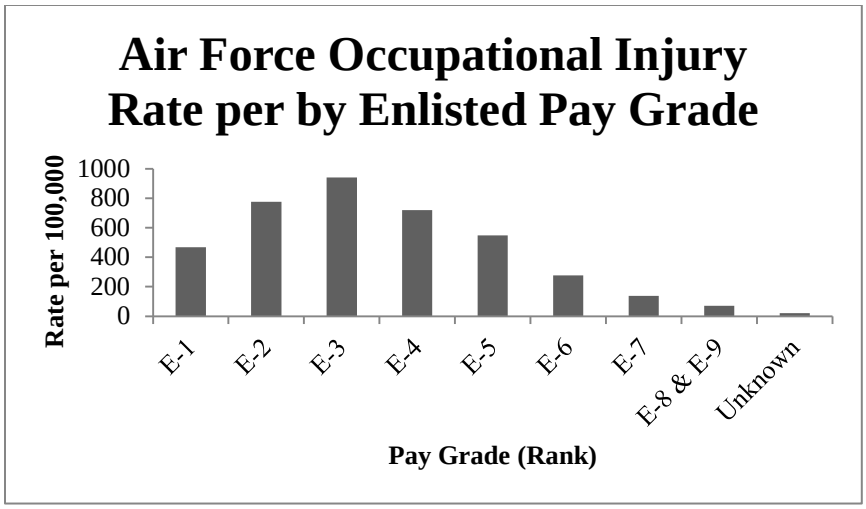


Figure 6: Air Force occupational injury rate per 100,000 by enlisted rank.

Figure 7 shows the occupational injury rate per 100,000 by officer pay grade. To calculate the rate per 100,000, the total number of illness cases for each rank was divided by the total population from 2006-2010 for that specific rank. The category "unknown" was assigned to officers whose rank could not be identified for security purposes.

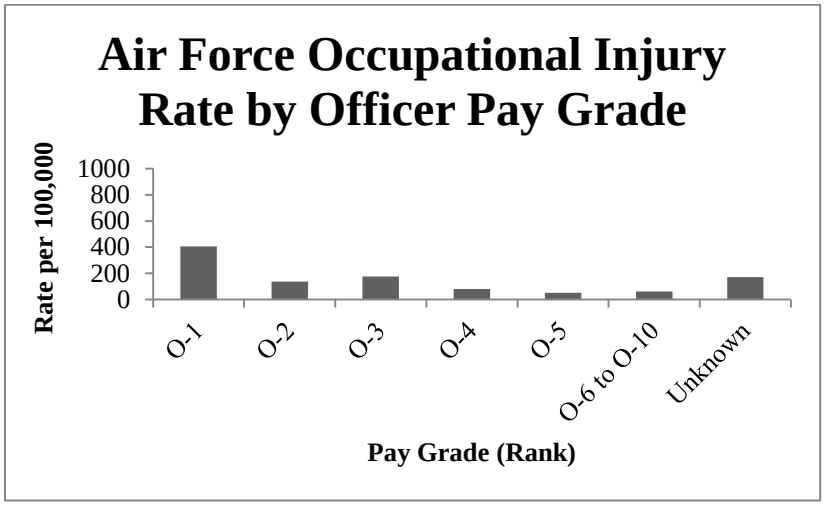


Figure 7: Air Force occupational injury rate per 100,000 by officer rank.

Table 7 shows the occupational illness and injury rate per 100,000 by MAJCOM. To calculate the rate per 100,000 for each MAJCOM, the total number of occupational illness or injury cases in each MAJCOM was divided by the total population for that MAJCOM from

2006-2010. Active duty personnel who were not assigned to one of the nine commands were included in the category "other." Personnel at United States Africa Command were groups into their own category. Air Force Reserve Command was omitted due to its reserve (non-active duty) status. MAJCOMs are presented in alphabetical order.

Table 7

Air Force Occupational Illness Rate per 100,000 by Major Command

Occupational Illness & Injury Rate per 100,000 by Major Command		
Major Command	**Illness Rate per 100,000**	**Injury Rate per 100,000**
Air Combat Command	66.03	532.98
Air Education and Training Command	56.04	525.59
Air Force Global Strike Command	79.33	624.72
Air Force Material Command	73.14	325.29
Air Force Space Command	19.12	554.53
Air Force Special Operations Command	136.60	363.62
Air Mobility Command	54.63	580.15
Pacific Air Forces	46.36	659.84
United States Africa Command	N/A	397.61
United States Air Forces in Europe	48.80	510.00
Other	22.90	103.29

Discussion

This analysis examined the most common occupational illnesses and injuries in the Air Force from 2006-2010 by rate across the Air Force, by rank, and by Major Command. The results show that as age went up, so did the occupational illness rate. By contrast, the occupational injury rate was higher for younger populations. The age group with the highest occupational illness rate was 53+ years old and the age group with the lowest rate was 23-27 years old. The age group with the highest occupational injury rate was 18-22 years old and the

age group with the lowest rate was 48-52 years old. The rate of occupational illness and injury was higher in males compared to females.

From 2006-2010, hearing loss had the highest rate of occupational illness among active duty personnel across the Air Force. The high rate of hearing loss compared to other occupational injuries could be caused by the Air Force's mission with aircraft. Hearing loss is an illness that is cumulative and does not improve over time. Increasing exposure to aircraft could lead to a greater burden of hearing loss. The second highest rate of occupational illness was thermal injuries. Lifting, carrying, or handling heavy objects was the greatest cause of occupational injury in the Air Force from 2006-2010, followed by overexertion.

When comparing enlisted personnel and officers, enlisted personnel had higher rates of occupational illness and injury than officers. Based on relative risk ratios, enlisted personnel are at a higher risk of occupational illness or injury than officers. Higher ranking enlisted personnel and officers have higher rates of occupational illnesses, while lower ranking enlisted personnel and officers higher rates of occupational injuries.

Across MAJCOMs, Air Force Special Operations Command, Air Force Global Strike Command, and Air Force Material Command had the highest rates of occupational illness. Pacific Air Forces, Air Force Global Strike Command, and Air Mobility Command had the highest rates of occupational injury. Each MAJCOM has certain bases under its command. Bases within MAJCOMs with the highest rates of occupational illness and injury could be targeted for prevention purposes.

Limitations include determining a denominator for rate calculations. People are constantly entering or leaving the Air Force, getting promoted, moving from the enlisted rank structure to the officer rank structure, and moving across MAJCOMs within a given year. There

are also sudden rises and drops in the number of employed Air Force personnel based on the federal budget. Another limitation includes withholding the rank of individuals whose rank could not be identified when calculating rates. The occupational safety data set only included individuals who were diagnosed with an occupational illness or injury. Individuals who had an occupational illness or injury that was never diagnosed would not have been included in the occupational safety data set.

Although there is an association between enlisted rank and higher rates of occupational illness and injury, being of an enlisted rank is not necessarily the cause of higher rates. Further analysis can look into what career fields (AFSCs) have the highest rates of occupational illnesses and injuries among enlisted personnel. Occupational illnesses or injuries can be further explored by looking at specific causes for younger, lower ranking enlisted personnel and officers versus older, higher ranking enlisted personnel and officers. Hearing loss could be further explored by analyzing the age group, rank, and base location that is most affected by this illness. MAJCOMs can be further analyzing by looking into specific bases that are under a MAJCOM with a high occupational illness or injury rate. 2006-2010 data could be compared with more current data to see any changes in trends for occupational illnesses and injuries. The burden of occupational illnesses and injuries could be analyzed in terms other than prevalence, like cost of prevention, lost workdays, ease of preventability, or how an occupational illness or injury affects mission performance.

Prevention

If prioritizing on the basis of prevalence, prevention of occupational illnesses in the Air Force should be heavily focused towards hearing loss. The nature of the Air Force makes this difficult. Many tasks performed by the Air Force are associated with aircraft. Removing

hazardous noise from aircraft is not an option. In addition to using noise reduction headsets and earplugs, techniques could be explored and implemented to decrease an individual's exposure to higher decibel sources. Although hearing loss is the greatest cause of occupational illness in the Air Force, other occupational illnesses should not be ignored. Air Force personnel at risk need to be aware of the dangers of heat stress, musculoskeletal injuries, neurological illnesses, as well as other occupational illnesses.

Recent prevalence of injury, illness, and death from workplace hazards is substantially lower than the prevalence in the early 20th century (Howard & Hearl, 2012). However, they have not been eliminated. New strategies are being implemented to further reduce the toll of workplace hazards. NIOSH has been conducting research on work organization and stress, workplace violence, and emerging hazards like nanotechnologies. OSHA implemented a Severe Violate Enforce Program (SVEP) in 2010. The SVEP focuses OSHA enforcement resources on uncooperative employers that ignore their responsibilities under the law and continue to put workers at risk. OSHA also increased fines for employers that do not meet OSHA standards. The maximum penalty for a willful violation is $70,000. Employers and employees can ask NIOSH for a health hazard evaluation to learn about any health hazards in the workplace environment. Following the evaluation, NIOSH will recommend actions to decrease hazards and prevent occupational injuries and illnesses (Howard & Hearl, 2012).

The NIOSH recommends 85 decibels as acceptable occupational noise exposure for less than eight hours. To prevent hearing loss, the NIOSH recommends removing hazardous noise from an environment when possible (i.e., engineering controls). Hearing protection should be used when noise cannot be controlled or eliminated. According to the CDC, there are eight components to a successful hearing loss program (Table 8) (CDC, n.d.b).

Table 8

Eight Components of a Successful Hearing Loss Program

Components to a Successful Hearing Loss Program
1. Noise Exposure Monitoring
2. Engineering and Administrative Controls
3. Audiometric Evaluation
4. Hearing Protection Devices
5. Education and Motivation
6. Record Keeping
7. Program Evaluation
8. Program Auditing

Source: CDC, n.d.b.

Military services have worked together with the Veteran's Health Administration to develop Comprehensive Action Plans for dealing with musculoskeletal symptoms related to war and providing programs that lower injury rates, reduce pain, and improve performance. The United States Army Medical Command has created three initiatives aimed at decreasing the effect of MSDs. These are the Pain Management Task Force, the Musculoskeletal Action Plan, and Musculoskeletal Action Teams. The Pain Management Task Force provides recommendations for a comprehensive pain management strategy. The Musculoskeletal Action Plan focuses on preventing injuries, early detection, and management, rehabilitation, and reintegration of personnel. The Musculoskeletal Action Teams consist of physical therapists, physical therapy assistants, and athletic trainers (Yancosek et al., 2012). The military has realized that not all musculoskeletal injuries can be prevented because of the dangerous and demanding nature of military operations. Prevention strategies have been tailored towards training and operational methods. Military personnel must be highly trained to be prepared physically and mentally for the strenuous demands of their work. Twenty percent of noncombat MSIs occur from sports injuries (Zambraski & Yancosek, 2012). Another strategy is to place

restrictions on recreational activities. However, this could be at the expense of morale building activities (Zambraski & Yancosek, 2012).

To protect from heat stress, OSHA recommends that employers modify work schedules. Managers should implement break periods in shaded or cooled areas where workers can hydrate and cool down. Workers should drink plenty of fluids throughout the day. For workers new to heat, workload should slowly be increased to allow them to acclimate to working in the heat. Clothing should be a light color, lightweight, and loosely fit to provide cooling. If a worker suffers from heat stress, the supervisor should be notified and 911 should be contacted. If a heat stroke is suspected, 911 should be called immediately. The worker should be moved to a cooler area and someone should remain with the worker until help arrives. Outer clothing should be removed and the worker should be fanned and applied with mist (OSHA, 2014).

The management of an organization plays an important role preventing occupational injuries. Supervisors and managers who value workplace safety can influence the choices workers make and encourage them to participate in safety-reacted actions. Supervisors and managers should develop professional relationships with their employees. Employees faced with high job demands but low control and support from management are at a greater risk of occupational injury. A study found that management safety perception is important in motivating employees to provide support in the workplace (Kiani & Khodabakhsh, 2014). Employees who are in a work environment that values safety are more likely to realize that their own personal safety is important and will not rush their job tasks while risking injury. Employees faced with work pressure face job stress and perform work tasks rapidly, increasing the risk of injury (Kiani & Khodabakhsh, 2014).

Conclusion

This descriptive analysis assessed rates of occupational illness and injury from 2006-2010 and calculates rates across U.S.A.F. rank and MAJCOM. Using these rates, prevention programs for occupational illnesses and injuries could be focused on individuals who are most prone to this burden and need it the most. Based on prevalence, prevention programs for occupational illnesses should focus on hearing loss and those who work around aircraft. Prevention programs geared towards occupational injuries should focus on educating younger and/or lower ranking personnel on injury prevention. Using MAJCOM data, prevention programs could be focused on bases whose primary mission puts personnel at risk of an occupational illness or injury.

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Appendix A – IRB Exemption Letters

DEPARTMENT OF THE AIR FORCE
AIR FORCE RESEARCH LABORATORY
WRIGHT-PATTERSON AIR FORCE BASE OHIO 45433

MEMORANDUM FOR USAFSAM/RHR (LT KENNETH MACKENTHUN)

FROM: 711 HPW/IR (AFRL IRB)

SUBJECT: IRB Determination of Not Human Use Research

1. The AFRL IRB has reviewed your study FWR20150009N, entitled "Descriptive Analysis if Air Force Occupational Injuries/Illnesses," and found that it does not constitute human use research for the following reason:
    a. Per 32 CFR 219.102 (d), research is a "systematic investigation designed to develop or contribute to generalizable knowledge."
    b. Per 32 CFR 219.102 (f), Human subject means a living individual about whom an investigator (whether professional or student) conducting research obtains
        i. Data through intervention or interaction with the individual, or
        ii. Identifiable private information.
2. The purpose of this study is to analyze prevalence and incidence trends of occupational injuries and illnesses for United States Air Force Active Duty personnel, determine rates of occupational injuries by career field, identify the most common occupational injuries, and compare rates across all Major Commands. The data set being used is preexisting and de-identified. This is not a systematic investigation, nor will it develop or contribute to generalizable knowledge. As such, this activity is not considered human subject research, and it does not fall under the purview of the IRB.
3. As a reminder, this determination pertains only to the Federal, DoD, and Air Force regulations that govern the use of human subjects in research. It does not constitute final approval to conduct the test, or serve as a safety or technical review board approval, which should be pursued separately, if necessary (note, AFRLI 61-103 v.2). If changes occur to this project which may affect the facts on which this determination is made, please contact the IRB Office immediately for a new determination.
4. For questions or concerns, please contact the EDO official, Lt Haley Wilson at haley.wilson.1@us.af.mil or (937) 986-5437.

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DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USAF, cn=WILSON.HALEY.PACE.1385305580
Date: 2014.11.04 17:13:31 -05'00'

HALEY P. WILSON, 2 LT, BS, EDO
Exempt Determination Official, AFRL IRB

Office of Research and Sponsored Programs
201J University Hall
3640 Col. Glenn Hwy.
Dayton, OH 45435-0001
(937) 775-2425
(937) 775-3781 (FAX)
e-mail: rsp@wright.edu

DATE: March 12, 2015

TO: Kenneth Mackenthun, PI, Graduate Student
Community Health
Nalia Khalil, Ph.D., Faculty Advisor

FROM: Jodi Blacklidge
Program Facilitator, IRB-WSU

SUBJECT: SC# 5819
'Descriptive Analysis of Air Force Occupational Injuries/Illnesses'

The above-listed project does not meet the Federal definition for human subjects research, specifically "a systematic investigation designed to contribute to generalizable knowledge". Therefore, the project does not require approval from the Wright State University Institutional Review Board.

If you have any questions or require additional information, please contact me at 775-3974.

Best wishes for a successful project.

Appendix B – List of Competencies Used in CE

Tier 1 Core Public Health Competencies

Domain #1: Analytic/Assessment Skills
Describes factors affecting the health of a community (e.g., equity, income, education, environment)
Identifies quantitative and qualitative data and information (e.g., vital statistics, electronic health records, transportation patterns, unemployment rates, community input, health equity impact assessments) that can be used for assessing the health of a community
Applies ethical principles in accessing, collecting, analyzing, using, maintaining, and disseminating data and information
Selects valid and reliable data
Selects comparable data (e.g., data being age-adjusted to the same year, data variables across datasets having similar definitions)
Identifies gaps in data
Describes how evidence (e.g., data, findings reported in peer-reviewed literature) is used in decision making
Domain #2: Policy Development/Program Planning Skills
Identifies current trends (e.g., health, fiscal, social, political, environmental) affecting the health of a community
Gathers information that can inform options for policies, programs, and services (e.g., secondhand smoking policies, data use policies, HR policies, immunization programs, food safety programs
Describes implications of policies, programs, and services
Applies strategies for continuous quality improvement
Domain #3: Communication Skills
Communicates in writing and orally with linguistic and cultural proficiency (e.g., using age-appropriate materials, incorporating images)
Conveys data and information to professionals and the public using a variety of approaches (e.g., reports, presentations, email, letters)
Facilitates communication among individuals, groups, and organizations
Domain #4: Cultural Competency Skills
Describes the concept of diversity as it applies to individuals and populations (e.g., language, culture, values, socioeconomic status, geography, education, race, gender, age, ethnicity, sexual orientation, profession, religious affiliation, mental and physical abilities, historical experiences)
Addresses the diversity of individuals and populations when implementing policies, programs, and services that affect the health of a community
Describes the effects of policies, programs, and services on different populations in a community
Domain #5: Community Dimensions of Practice Skills
Describes the programs and services provided by governmental and non-governmental organizations to improve the health of a community
Suggests relationships that may be needed to improve health in a community
Provides input for developing, implementing, evaluating, and improving policies, programs, and services
Domain #6: Public Health Sciences Skills
Retrieves evidence (e.g., research findings, case reports, community surveys) from print and electronic sources (e.g., PubMed, Journal of Public Health Management and Practice, Morbidity and Mortality Weekly Report, The World Health Report) to support decision making
Recognizes limitations of evidence (e.g., validity, reliability, sample size, bias, generalizability)
Describes evidence used in developing, implementing, evaluating, and improving policies, programs, and services
Domain #8: Leadership and Systems Thinking Skills
Contributes to development of a vision for a healthy community (e.g., emphasis on prevention, health equity for all, excellence and innovation)
Describes ways to improve individual and program performance

Global Health Concentration Competencies
Identify strategies that strengthen community capabilities for overcoming barriers to health and well-being