Comparative Analysis of Work-Related Injuries and Illnesses in Industrial Locations in the United States Between 2007-2011

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Comparative Analysis of Work-Related Injuries and Illnesses in Industrial Locations in the United States Between 2007-2011

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ABSTRACT

BACKGROUND:

This study analyzed 10 different types injuries and illnesses. Specifically, amputation of finger, burns 3rd degree of the hand, falls on same level, fracture of upper limbs, heat stress, laceration of the upper limbs, machine accidents, overexertion, sprains/strains, and struck by or against an object. The objective of the study is to discover if age, race, or gender factor in the hospitalization outcomes of the aforementioned injuries and illnesses. An additional objective is to explore whether region, day of incident (weekday or weekend), length of stay, social economics, and total medical charges in the presence of these specific work-related injuries and illnesses are impacting factors.

METHOD:

Data was available by the Healthcare Cost and Utilization Project (HCUP) sponsored by the Agency for Health Care Policy and Research[1]. The National Inpatient Sample (NIS) data in years 2007 through 2011 was assessed and downloaded from HCUP. A total of over 15 million patients aged 18-64 and who did not die when admitted to the hospital in the United States between years 2007 through 2011 (5 years). The data provided patient demographics such as: age, gender, race, insurance type, and income. The Statistical Package for the Social Sciences (SPSS) version 26 was serviced to analyze the data of the study, and all outcomes with a p-value less than 0.05 were found to be significant. Frequencies and multiple linear regression were the appropriate statistical tests to determine the predictors of the study outcomes.

RESULTS:

White older aged males (31 to 64 years) have the highest frequency of injury and illness. The 76th to 100th percentile income level had the highest frequency of injury and illness. Majority of injuries and illnesses occurred in the South region. The regression model discovered that indicator of sex is they key variable in the amount of time spent in the hospital and the total amount of hospital charges. Falls from same level injury, had 70,226 patients, which is 49% of the total population of all 10 injuries and illnesses investigated. In addition, older aged White females (31 to 64 years) were the highest frequency of patients for falls from same level.

CONCLUSION:

Older White males in the 76th to 100th percentile income have the highest risk of injury and illness in the workplace. Preventative measures should improve work-related injuries and illnesses; especially for older ages, provide knowledge through specific training to prevent complacency and help workers to be more aware of risks associated with their age, gender, income, and job duties.

ACKNOWLEDMENT

First, and most of all, I would like to thank Dr. Shankar Srinivasan for his expertise, assistance, guidance, and patience throughout the process of writing this dissertation. Without your help this dissertation would not have been possible. I would also like to thank my advisory committee member Dr. Dinesh Mital for his guidance and advise through progression of the research. Lastly, I would like to acknowledge and thank Dr. Riddhi Vyas, for her valuable teaching, feedback, and comments on my dissertation.

This research was only possible with the guidance and support of these essential team members who have kept me on track, stayed on me to finish, and to push me throughout this entire process.

DEDICATION

I want to dedicate this major accomplishment to my wife Farrah, daughter Aryah, son Keyon, brother Roy III, twin sisters Felicia and Theresa, sister Nova, dad Roy Jr. and mom Rosemarie Brown. Also, I want to thank the Education Opportunity Fund (EOF) Program of Rutgers University, specifically the School of Engineering, Dr. Dean Brown.

I've learned this saying as it has crossed my thoughts and dreams.

"Just stop comparing about what other people have done, just finish"

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CHAPTER I

INTRODUCTION

1.1 Background of Work-related Injuries and Illnesses

What is a work-related injury? And how do work-related injuries and illnesses impact our society in terms of economic, psychological, and socially? An **injury** or **illness** is considered by the Occupational Safety and Health Administration (OSHA) to be work-related if an event or exposure in the work environment either caused or contributed to the resulting condition or significantly aggravated a pre-existing condition[3]. A **Recordable**, which is OSHA definition on how to define an event that result in the following: Death, Loss of consciousness, Days away from work, Restricted work activity or job transfer, Medical treatment (beyond first aid), or significant work-related injuries or illnesses that are diagnosed by a physician or other licensed health care professional. These include any work-related case involving cancer, chronic irreversible disease, a fractured or cracked bone, or a punctured eardrum[3]. Additional criteria that can result in a Recordable case include: any needlestick injury or cut from a sharp object that is contaminated with another person's blood or other potentially infectious material. Any case requiring an employee to be medically removed under the requirements of an OSHA health standard. Tuberculosis infection as evidenced by a positive skin test or diagnosis by a physician or other licensed health care professional after exposure to a known case of active tuberculosis. An employee's hearing test (audiogram) reveals that the employee has experienced a Standard Threshold Shift (STS) in hearing in one or both ears (averaged at 2000, 3000, and 4000 Hz) and if the employee's total hearing level is 25 decibels (dB) or more above the audiometric zero (also averaged at 2000, 3000, and 4000 Hz) in the same ear(s) as the STS[3].

1.2 Historical Background of Work-related injuries and illnesses

Richard Nixon was the 37th president of the United States, serving from 1969 until 1974 who was the founder of the Occupational Health and Safety Administration (OSHA) on April 28th, 1971. OSHA is part of the Department of Labor and considered a sector within the executive branch of the Federal government. Of the three branches of the government, the executive branch is responsible for the enforcement of laws as enacted by Congress, the legislative branch. OSHA was formed due to the rising injury and death rates on the job. Known initially as the OSH Act, the "Safety Bill of Rights," to assure safe and healthful working conditions for working men and women; by authorizing enforcement of the standards developed under the Act; by assisting and encouraging the States in their efforts to assure safe and healthful working conditions; by providing for research, information, education, and training in the field of occupational safety and health; and for other purposes[2].

Since the establishment of OSH Act, fatality and injury rates have dropped remarkably. Although accurate statistics were not kept at the time the establishment of OSHA, it is estimated that in 1970 around 14,000 workers were killed on the job. That number fell to approximately 4,340 in 2009. At the same time, U.S. employment has almost doubled and now includes over 130 million workers at more than 7.2 million worksites. Also, the rate of reported serious workplace injuries and illnesses has declined from 11 per 100 workers in 1972 to 3.6 per 100 workers in 2009[2]. OSHA safety and health standards, including those for trenching, machine guarding, asbestos, benzene, lead, and Bloodborne pathogens, which prevented countless work-related injuries, illnesses and deaths[2].

The OSHA Recordable Incident Rate is a mathematical calculation that describes the number of employees per 100 full-time employees that have been involved in a Recordable injury or illness.

Figure 1

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CALCULATIONS

OSHA Recordable Incident Rate

The OSHA Recordable Incident Rate (or Incident Rate) is calculated by multiplying the number of recordable cases by 200,000, and then dividing that number by the number of labor hours at the company.

$$IR = \frac{\text{Number of OSHA Recordable Cases X 200,000}}{\text{Number of Employee labor hours worked}}$$

Rate Calculation Example - a company has 17 full-time employees and 3 part-time employees that each work 20 hours per week. This equates to 28,400 labor hours each year. If the company experienced 2 recordable injuries, then the formula works like this:

$$IR = \frac{2 \text{ x } 200{,}000}{28{,}400} \qquad IR = \frac{400{,}000}{28{,}400} \qquad IR = 14.08$$

What is now known is that for every 100 employees, 14.08 employees have been involved in a recordable injury or illness. Please note that smaller companies that experience recordable incidents will most likely have high incident rates, or the incident rates will fluctuate significantly from year to year. This is because of the small number of employees (and hence the lower number of labor hours worked) at the company. Calculations are more meaningful at larger companies that have a higher labor hour count.

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The most recent data available from the U.S. Bureau of Labor Statistics reports as of 2018 there were a Total Recordable cases of 2,834,500, cases involving days away from work, 900,400, median days away from work was 8, cases involving sprains, strains, and tears 308,630, cases involving injuries to the back 142,230, and cases involving falls, slips, and trips 240,160[3].

1.3 The 10 Injuries and Illnesses Defined

1.3.1 Amputation of Finger

A work-related amputation was defined as the loss of a protruding body part involving bone loss due to a traumatic incident with evidence of work-relatedness[4]. Amputations can consist of body parts in upper and lower limbs, but in this study amputation of finger was specifically identified and analyzed.

1.3.2 Burns 3rd Degree of the Hand

An occupational burn injury is defined as injuries (usually to the skin) resulting from either thermal or radiant energy[2]. A reported 29% of all hospital treated burns are work-related[5]. There can be various locations of occupational burn injuries, but this study specifically analyzed burns of the third degree of the unspecified hand.

1.3.3 Falls on Same Level

Slips, trips, and falls are among the highest rate of work-related injury in the workforce[6]. This event can cause back injuries, strains and sprains, contusions, and fractures[2]. An example of falls to the same level consist of platforms and stairways slippery from water and grease, an employee tripping over boxes, electrical cords, equipment, or debris. Moreover, the flooring could be uneven or have uncovered holes that can cause an employee to trip.

1.3.4 Fracture of Upper Limbs

Among construction and manufacturing workers, fractures were reported to be the most common work-related non-fatal injury[7]. Work-related fractures affect various body parts, and they vary by occupation, industry, and sources of data[7]. The upper limbs were analyzed, because one study based on emergency department data showed the most frequent anatomic site was the upper limb area[8].

1.3.5 Heat Stress

Thermal environment can directly affect worker's occupational health and safety, and act as a contributing factor to injury and illness[9]. Specifically, heat illness that is brought about by the combination of hot weather and physical activity is known to occur during military training, physical labor, organized team sports and amateur sporting events[10]. Severe heat illness, in particular, heat stroke may cause irreversible acute damage to the heart, lungs, kidneys and liver, which could lead to cardiovascular disease (CVD), ischemic heart disease (IHD), chronic liver, and or renal failure and is known to cause damage to tissue of the heart, kidneys, and liver[9].

1.3.6 Laceration of Upper Limbs

Acute traumatic hand injuries, which include lacerations, crushes, and fractures, are common at work. The National Electronic Injury Surveillance System reported that the fingers and hand were the most frequent anatomic sites injured at work and treated in the hospital emergency departments[11]. When a wound is torn of soft tissue and usually irregular, jagged, and can be contaminated with bacteria and debris from the object that caused the cut is a laceration. The cut/puncture nature of injury category includes lacerations. Amputations cases, including finger-tip lacerations, are classified separately from lacerations and are captured in amputation of finger[12].

1.3.7 Machinery Accidents

Industrialization, while providing benefits to communities, also leads to serious problems in the life of working people. Some of the leading problems of the work environment are produced by occupational accidents[13]. A machine is defined as an assembly fitted with or intended to be fitted with a drive system consisting of linked parts or components at least one of which moves, and which are joined together for a specific application. Machines contain hazards of different nature and exposure to those hazards can result in injuries or deaths[14].

1.3.8 Overexertion

From 1992–2010, musculoskeletal disorders (MSDs) accounted for 29–35% of all occupational injuries and illnesses involving days away from work in the United States[15]. Cumulative trauma disorders, repetitive motion injuries or disorders, repetitive stress injuries, musculoskeletal disorders, and ergonomic injuries are a number of ailments that result from overexertion[16].

1.3.9 Sprains and Strains

Sprains and strains are the most prevalent type of nonfatal occupational injury involving days away from work in the United States in 2003 that contributed to more than 40% of the 1.3 million injuries and illnesses in the private industry[17]. Sprains/Strain injuries are defined as acute traumatic injuries to muscles, tendons, ligaments, and joints that result from sudden wrenching, twisting, stretching, and/or ripping[18].

1.3.10 Struck By or Against Object

Contact with an object or piece of equipment, largely struck by an object, are the most common injury event overall in construction, followed by bodily reaction and exertion injuries and falls[19]. For example, injuries include some of the more damaging construction events including collapsing cranes and trenches, as well as more minor events such as worker hitting a thumb with a hammer. Also, a struck by event can include objects being dropped from above and debris flying into a worker’s eye[19].

1.4 Goals and Objectives

The main objectives of this study are to determine the following:

1) Whether there is a significant association between age and race and amputation of finger.

2) Whether there is a significant association between age and race and third degree burns of the hand.

3) Whether there is a significant association between age and race and fall on same level.

4) Whether there is a significant association between age and race and fracture of upper limbs.

5) Whether there is a significant association between age and race and heat stress.

6) Whether there is a significant association between age and race and laceration of upper limbs.

7) Whether there is a significant association between age and race and machine accidents.

8) Whether there is a significant association between age and race and overexertion.

9) Whether there is a significant association between age and race and sprains/strains.

10) Whether there is a significant association between age and race and struck by or against an object.

11) Whether there are predictors for length of stay for amputation of finger in older patients.

12) Whether there are predictors for length of stay for third degree burns of the hand in older patients.

13) Whether there are predictors for length of stay for fall on same level in older patients.

14) Whether there are predictors for length of stay for fracture of upper limbs in older patients.

15) Whether there are predictors for length of stay for heat stress in older patients.

16) Whether there are predictors for length of stay for laceration of upper limbs in older patients.

17) Whether there are predictors for length of stay for machine accidents in older patients.

18) Whether there are predictors for length of stay for overexertion in older patients.

19) Whether there are predictors for length of stay for sprains/strains in older patients.

20) Whether there are predictors for length of stay for struck by or against an object in older patients.

21) Whether there are predictors for total charges in patients who are Black and Latino with amputation of finger.

22) Whether there are predictors for total charges in patients who are Black and Latino with third degree burns of the hand.

23) Whether there are predictors for total charges in patients who are Black and Latino with fall on same level.

24) Whether there are predictors for total charges in patients who are Black and Latino with fracture of upper limbs.

25) Whether there are predictors for total charges in patients who are Black and Latino with heat stress.

26) Whether there are predictors for total charges in patients who are Black and Latino with laceration of upper limbs.

27) Whether there are predictors for total charges in patients who are Black and Latino with machine accidents.

28) Whether there are predictors for total charges in patients who are Black and Latino with overexertion.

29) Whether there are predictors for total charges in patients who are Black and Latino with sprains/strains.

30) Whether there are predictors for total charges in patients who are Black and Latino with struck by or against an object.

31) Whether there are predictors for day of injury or illness in patients who are Black and Latino with amputation of finger.

32) Whether there are predictors for day of injury or illness in patients who are Black and Latino with third degree burns of the hand.

33) Whether there are predictors for day of injury or illness in patients who are Black and Latino with fall on same level.

34) Whether there are predictors for day of injury or illness in patients who are Black and Latino with fracture of upper limbs.

35) Whether there are predictors for day of injury or illness in patients who are Black and Latino with heat stress.

36) Whether there are predictors for day of injury or illness in patients who are Black and Latino with laceration of upper limbs.

37) Whether there are predictors for day of injury or illness in patients who are Black and Latino with machine accidents.

38) Whether there are predictors for day of injury or illness in patients who are Black and Latino with overexertion.

39) Whether there are predictors for day of injury or illness in patients who are Black and Latino with sprains/strains.

40) Whether there are predictors for day of injury or illness in patients who are Black and Latino with struck by or against an object.

41) Whether there are predictors for region of injury or illness in patients who are Black and Latino with amputation of finger.

42) Whether there are predictors for region of injury or illness in patients who are Black and Latino with third degree burns of the hand.

43) Whether there are predictors for region of injury or illness in patients who are Black and Latino with fall on same level.

44) Whether there are predictors for region of injury or illness in patients who are Black and Latino with fracture of upper limbs.

45) Whether there are predictors for region of injury or illness in patients who are Black and Latino with heat stress.

46) Whether there are predictors for region of injury or illness in patients who are Black and Latino with laceration of upper limbs.

47) Whether there are predictors for region of injury or illness in patients who are Black and Latino with machine accidents.

48) Whether there are predictors for region of injury or illness in patients who are Black and Latino with overexertion.

49) Whether there are predictors for region of injury or illness in patients who are Black and Latino with sprains/strains.

50) Whether there are predictors for region of injury or illness in patients who are Black and Latino with struck by or against an object.

51) Whether there are predictors for economic status with injury or illness in patients who are Black and Latino with amputation of finger.

52) Whether there are predictors for economic status with injury or illness in patients who are Black and Latino with third degree burns of the hand.

53) Whether there are predictors for economic status with injury or illness in patients who are Black and Latino with fall on same level.

54) Whether there are predictors for economic status with injury or illness in patients who are Black and Latino with fracture of upper limbs.

55) Whether there are predictors for economic status with injury or illness in patients who are Black and Latino with heat stress.

56) Whether there are predictors for economic status with injury or illness in patients who are Black and Latino with laceration of upper limbs.

57) Whether there are predictors for economic status with injury or illness in patients who are Black and Latino with machine accidents.

58) Whether there are predictors for economic status with injury or illness in patients who are Black and Latino with overexertion.

59) Whether there are predictors for economic status with injury or illness in patients who are Black and Latino with sprains/strains.

60) Whether there are predictors for economic status with injury or illness in patients who are Black and Latino with struck by or against an object.

1.5 Research Hypotheses

Hypothesis 1: There is a significant association between age and race and amputation of finger.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 2: There is a significant association between age and race and third degree burns of the hand.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 3: There is a significant association between age and race and fall on same level.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 4: There is a significant association between age and race and fracture upper limbs.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 5: There is a significant association between age and race and heat stress.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 6: There is a significant association between age and race and laceration of upper limbs

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 7: There is a significant association between age and race and machine accidents.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 8: There is a significant association between age and race and overexertion.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 9: There is a significant association between age and race and sprains/strains.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 10: There is a significant association between age and race and struck by or against an object.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 11: There are significant predictors for length of stay for amputation of finger in older patients.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 12: There are significant predictors for length of stay for third degree burns of the hand in older patients.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 13: There are significant predictors for length of stay for fall on same level in older patients.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 14: There are significant predictors for length of stay for fracture upper limbs in older patients.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 15: There are significant predictors for length of stay for heat stress in older patients.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 16: There are significant predictors for length of stay for laceration of upper limbs in older patients.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 17: There are significant predictors for length of stay for machine accidents in older patients.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 18: There are significant predictors for length of stay for overexertion in older patients.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 19: There are significant predictors for length of stay for sprains/strains in older patients.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 20: There are significant predictors for length of stay for struck by or against an object in older patients.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 21: There are significant predictors for total charges in patients who are Black and Latino with amputation of finger.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 22 There are significant predictors for total charges in patients who are Black and Latino with third degree burns of the hand.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 23: There are significant predictors for total charges in patients who are Black and Latino with fall on same level.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 24: There are significant predictors for total charges in patients who are Black and Latino with fracture upper limbs.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 25: There are significant predictors for total charges in patients who are Black and Latino with heat stress.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 26: There are significant predictors for total charges in patients who are Black and Latino with laceration of upper limbs.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 27: There are significant predictors for total charges in patients who are Black and Latino with machine accidents.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 28: There are significant predictors for total charges in patients who are Black and Latino with overexertion.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 29: There are significant predictors for total charges in patients who are Black and Latino with sprains/strains.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 30: There are significant predictors for total charges in patients who are Black and Latino with struck by or against an object.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 31: There are significant predictors for day of injury or illness in patients who are Black and Latino with amputation of finger.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 32: There are significant predictors for day of injury or illness in patients who are Black and Latino with third degree burns of the hand.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 33: There are significant predictors for day of injury or illness in patients who are Black and Latino with fall on same level.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 34: There are significant predictors for day of injury or illness in patients who are Black and Latino with fracture upper limbs.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 35: There are significant predictors for day of injury or illness in patients who are Black and Latino with heat stress.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 36: There are significant predictors for day of injury or illness in patients who are Black and Latino with laceration of upper limbs.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 37: There are significant predictors for day of injury or illness in patients who are Black and Latino with machine accidents.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 38: There are significant predictors for day of injury or illness in patients who are Black and Latino with overexertion.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 39: There are significant predictors for day of injury or illness in patients who are Black and Latino with sprains/strains.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 40: There are significant predictors for day of injury or illness in patients who are Black and Latino with struck by or against an object.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 41: There are significant predictors for region of injury or illness in patients who are Black and Latino with amputation of finger.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 42: There are significant predictors for region of injury or illness in patients who are Black and Latino with third degree burns of the hand.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 43: There are significant predictors for region of injury or illness in patients who are Black and Latino with fall on same level.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 44: There are significant predictors for region of injury or illness in patients who are Black and Latino with fracture upper limbs.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 45: There are significant predictors for region of injury or illness in patients who are Black and Latino with heat stress.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 46: There are significant predictors for region of injury or illness in patients who are Black and Latino with laceration of upper limbs.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 47: There are significant predictors for region of injury or illness in patients who are Black and Latino with machine accidents.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 48: There are significant predictors for region of injury or illness in patients who are Black and Latino with overexertion.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 49: There are significant predictors for region of injury or illness in patients who are Black and Latino with sprains/strains.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 50: There are significant predictors for region of injury or illness in patients who are Black and Latino with struck by or against an object.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 51: There are significant predictors for economic status with injury or illness in patients who are Black and Latino with amputation of finger.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 52: There are significant predictors for economic status with injury or illness in patients who are Black and Latino with third degree burns of the hand.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 53: There are significant predictors for economic status with injury or illness in patients who are Black and Latino with fall on same level.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 54: There are significant predictors for economic status with injury or illness in patients who are Black and Latino with fracture upper limbs.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 55: There are significant predictors for economic status with injury or illness in patients who are Black and Latino with heat stress.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 56: There are significant predictors for economic status with injury or illness in patients who are Black and Latino with laceration of upper limbs.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 57: There are significant predictors for economic status with injury or illness in patients who are Black and Latino with machine accidents.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 58: There are significant predictors for economic status with injury or illness in patients who are Black and Latino with overexertion.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 59: There are significant predictors for economic status with injury or illness in patients who are Black and Latino with sprains/strains.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

Hypothesis 60: There are significant predictors for economic status with injury or illness in patients who are Black and Latino with struck by or against an object.

Null Hypothesis: H0 = H1

Alternative Hypothesis: H0 ≠ H1

1.6 Statement of the Problem

The major volume of literature to research work-related injuries and illnesses outcomes in the United States have been centralized to analyze the injury and illness in the general population, and not incorporate younger age, gender, and ethnicity/race[20].

Literature that discussed ethnicity/race in considering Blacks and Latinos and work-related injuries and illnesses is very limited. Are younger adults or minorities (Blacks and Latinos) more susceptible to have a work-related injury compared to the general population? And if so, are there underlying factors such as: education, income level, or working experience that contribute to these results.

1.7 **Importance of the Study**

Therefore, the study aims to conduct a new large scale nationally representative data of working population ages 18-64 among gender and race/ethnic groups with specific work-related injuries and illnesses to understand the differences in outcomes and to prevent future Recordable incidents.

We also aim to test if there are differences in income, region, hospital location, and day (weekday or weekend) are primary factors in reducing work-related injuries and illnesses.

Finally, assessing which injury or illness is prominent and most costly in the United States between 2007-2011 compared to the BLS 2018 and NCCI 2020 outcomes.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

Workplace injuries in the USA cause hardships for both employers and employees, with both indirect and direct cost estimated to be about $155.5 billion per year[21]. Approximately 1,800,000 injuries caused at least 1 day of time loss from work that resulted in 110 million days of time loss[22]. Working adults between 20 through 64 years of age account for approximately one-third of all injuries and about one-six of all deaths that occur at work[23]. This chapter reviews the causes, types, costs, risk factors, and demographics for work-related injuries and illnesses.

2.2 Causes of Work-related Injuries and Illnesses

2.2.1 Alcohol and Drug Abuse

In the United States, national surveys reveal that among employed adults (ages 18-49) who work full-time, approximately 78% have used alcohol, 9% have used marijuana, and 5% have used other illicit drugs during the preceding 12 months[24]. This survey encompasses all aspects of daily life that applies to before, during, and after working hours. Moreover, alcohol misuse can harm people other than the drinker, and can have negative consequences for society as a whole[25]. For example, alcohol and drug use can decrease worker productivity, increase unintentional injuries, and aggression and violence against others[25]. The total employment-related cost of alcohol and drug abuse due to lowered productivity and employability in 1992 was estimated to be $80.9 billion ($66.7 billion due to alcohol abuse and $14.2 billion due to drug abuse)[24].

2.2.2 Carelessness

Carelessness is the failure to give sufficient attention to avoiding harm. A lack of concern or an indifference for the consequences of the action due to inattention[26]. In Western Turkey, surveys were provided to work-related eye injury (WREI) patients totaling 948 over a 2-year period where their responses were broken into three groups. One group was worker-related causes, second group was workplace-related causes, and third group was both. "Carelessness" and "hurrying up" were the most commonly reported causes of WREIs from the patients' point of view among 'worker-related causes' (21.4% and 16.1%, respectively)[27]. When a worker is in a rush he or she may forget to wear the proper personal protective equipment correctly i.e. safety goggles and safety shields when welding, drilling, or cutting. The study showed lack of protective measures (goggles etc.) ranked the highest among workplace-related causes (18.7%)[27]. It goes hand in hand with rushing a job to be completed and being careless when it comes to following the proper protocols that include work instruction and wearing the correct personal protective equipment (PPE).

2.2.3 Education

Miseducation can generate work-related injury. You can either not have the education to fully understand the job and task at hand, i.e. learning a trade in plumbing, electrician, or welder. Or you can be overeducated in an example of a college graduate in chemistry trying to work as a mechanic. Moreover, a cross-sectional data from the 2003 and 2005 Canadian Community Health Surveys (n=64,462) were used to examine the relationship between having an educational level that is incongruent with occupational skills requirements and the risk of sustaining a work injury[28]. The study defining education-to-job mismatch as the status when worker's level and/or type of education does not correspond to the requirements of their job[28]. It was found that 1 out of 4 workers between ages 25-54 years of age were over-educated and resulted in an increased risk of work injury and repetitive motion injuries.

2.2.4 Environmental

There are various health and safety concerns when it comes to the environment and how the environment can affect employees while working. Working outside with ambient temperatures that can have high or very low temperatures effect workers' health and safety. Also, being exposed to loud sounds over time or sudden high impact sounds can cause noise-induced hearing injury[29]. In addition, any chemical exposure through either inhalation, ingestion, injection, or skin absorption. An example of inhalation carpenters being exposed to number of substances that can increase risk for lung disorders. Exposures include dusts such as silica, asbestos, wood, cement, dusts from drywall finishing and other mineral dusts[30].

2.2.5 Equipment Failure

Equipment can fail from the lack of maintenance, faulty system, manufactured error, improper use, without safety devices, or overexerting the limits of the machine. Also, in terms to damage to equipment and materials and especially those that result in injuries[31]. An example of damaged equipment or materials are straps for a crane where the straps are damaged due to weather and usage and can fail when lifting or lowering an object.

2.2.6 Ergonomics

In Greek, "Ergo" means work and, "Nomos", means natural laws or systems. Ergonomics, therefore, is an applied science concerned with designing products and procedures for maximum efficiency and safety[32]. Ergonomics consists of good practices, staff training, equipment design, instrument design, workplace changes, and balance and exercise.

Incorrect body postures can cause pain and injury when reaching, lifting, or any repetitive motion.

2.2.7 Experience

There are various aspects of experience when it comes to working and one can take experience as a length of service on the job for several years. In this literature review, I'm accounting for experience as workers who are permanent versus workers who are temporarily hired to do a task. Temporary help agencies hire employees and assign them to client organizations to support or supplement the existing work force when needed because of employee absences, temporary skills shortages, seasonal workloads, or special projects[33]. Moreover, temporary workers are the considered inexperience and permanent employees are experience. A study by Judy Morris found the frequency rate for all reported injuries to be two to three times higher for temporary employees than for permanent employees performing the same task over a 6 year analysis of the injury frequencies of the temporary and permanent employee population in manufacturing jobs at a medium size Midwestern plastics products manufacturing worksite[33].

2.2.8 Lack of Supervision/Management

Both studies in Vredenburg 2002 and Tadesse et al, 2007 agree that preventative measures concerning functional occupational health and safety programs are essential to safeguard the health and safety condition of workforce in small and medium scale industries[34]. First and foremost, the health and safety of the employee must be the priority for the employer in reducing injuries and illnesses. Vredenburg declared that "when organizations take proactive measures to protect their employees, the company derives a financial benefit in reduced lost time and workers compensation expenses"[35].

2.2.9 Lack of Training

The U.S. Bureau of Labor Statistics (BLS) indicates that U.S. employers spend a considerable amount of time and resources on both formal and informal training including safety training. A national survey found establishments with 50 or more employees paid $7.7 billion to in-house training staff and $5.5 billion to outside trainers in 1994[36]. Sanders found that employees working for Grafton's Winchester facility who provided physical restraints for approximately 75 children and 43 adults on a given day in both the day school and the residential program reduced expenses by 93% from client induced employee injuries by implementing four-component training program to almost eliminate the use of physical restraints[37].

2.2.10 Mental Illness

Psychological injury can be defined into three types: physical-mental, mental-physical, and mental-mental. Physical-mental involves the development of negative psychological response following a physical injury. For example, employees developing posttraumatic stress symptoms following an occupational injury. Secondly, mental-physical includes stress symptoms precedes the development of physical symptoms or injury. Mental-mental is characterized by the development of psychological symptoms following recognized stressful conditions at work. There are two forms of stressful conditions, acute and chronic. Acute symptoms following exposure to known psychologically traumatic event and chronic symptoms are cumulative effect of exposure to lower grade work stressors[38].

2.2.11 Natural Disaster

Natural disasters are geological or meteorological phenomena that precipitate a breakdown in the relationship between humans and their environment or constitute a serious and sudden event (or a slow even, as in a drought) on such a scale that a stricken community requires extraordinary efforts to cope[39]. Even though natural disasters are destructive and generally cause structural damage, their mortality and morbidity effects are variable. The disaster cycle can be differentiated into five main phases, extending from one disaster to the next. The phases are: the warming phase indicating the possible occurrence of a catastrophe and the threat period during which the disaster is impending, the impact phase when the disaster strikes, the emergency phase when rescue, treatment, and salvage activities commence, the rehabilitation phase when essential services are provided on a temporary basis, and lastly the reconstruction phase when a permanent return to normalcy is achieved[40]. Work-related injuries most likely would occur during the impact and emergency phases where the onset of the disaster takes place while an employee is on duty working or if rescue personnel such as fire fighters get hurt during the emergency phase.

2.2.12 Negligence

The failure to exercise that degree of care that, in the circumstances law requires for the protection of other persons or those interests of other persons that may be injuriously affected by the want of such care[26]. There are two forms of negligence in the workforce, one is the employer's negligence and the other is worker negligence. Reed Tool Co. vs Copelin Texas 1985 defined negligence when an employer will be held liable if he consciously desired to cause injury, or if he knew with substantial certainty that the injury would occur[41]. For example, if an employer knew that the maintenance of their trucks was behind and out of specs for health and safety but continued to allow employees to drive such trucks and that employee was injured due to those malfunctions. The study Rahmai et al, 2013 concluded that the lack of protective equipment and worker's negligence are the main causes of accidents in western regions of the Tehran and Alborz Electricity Distribution company at 30% and 21%, respectively[42].

2.2.13 Personal Protective Equipment (PPE)

Personal protective equipment, commonly referred to as "PPE", is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. Personal protective equipment may include items such as gloves, safety glasses and shoes, earplugs or muffs, hard hats, respirators, or coveralls, vests and full body suits[2]. Lombardi et al, 2005 found foreign body and burns injuries in welders accounting for 71.7% and 22.2%, respectively. Whereas the use of PPE (for example, safety goggles, mask, helmets) was mention only 14.7% of all welders' claims, of which 20.6% reported donning or removing their PPE and 7.0% reported not wearing PPE at all[43].

2.2.14 Workplace Violence

Workplace violence is a major health and safety problem. An average of 20 workers are murdered each week in the United States[44]. In addition, each year, nearly 1 million individuals become victims of violent crime, while working or on duty. While there is emerging literature pertinent to work-related homicides, there is a serious deficiency in the knowledge of non-fatal work-related violence, as well as risk factors for both fatal and non-fatal events[45]. Notwithstanding the costs of violence to employees, the cost of customer violence to employers has been estimated at around 62 million a year, excluding compensation costs, and the costs associated with poor staff morale, poor business image, recruitment and staff turnover problems and high absenteeism[46].

2.2.15 Work Schedule and Overtime

Work scheduling variables such as work-rest schedules, weekly duration of work, shift work, and extended periods of overtime presumably relate to worker fatigue, hazards exposures, cumulative trauma, and other health outcomes. Much of the research on the relation between workhours and health has focused on shift work[47]. Caruso et al, 2006 found that long work hours negatively impact workers' health by increasing exposure to occupational hazards and reducing time for recovery[48]. Dembe et al, 2005 concluded that job schedules with long working hours are not riskier merely because they are concentrated in inherently hazardous industries or occupations, or because people working long hours spend more total time "as risk" for a work injury. Strategies to prevent work injuries should consider changes in scheduling practices, job redesign, and health protection programmers for people working in jobs involving overtime and extended hours[49].

2.3 Types of Work-related injuries and Illnesses

The Bureau of Labor Statistics' (BLS) 2010 study of the most common occupational illnesses in the U.S. that required days away from work are the following below.[50]

2.3.1 Sprains, Strains, and Tears

A rate of 46.9 out of every 10,000 work-related injuries and illnesses incidents occurred from sprains, strains and tears. Sprain of the shoulders required more time away from work than any other body part[3]. Marshall et al, 2004 provided injury questionnaires for 215 Commercial fishers in eastern North Carolina where 83 reported that they had suffered an injury event in the previous 12 months. The highest injuries reported were penetrating wounds to the hand/wrist/digits from marine animals at 47% and strains/sprains at 24% to the back while moving heavy objects[51]. Kelsh et al, 2008 found that older electric utility workers over the age of 50 had more than a fourfold increased risk of sustaining a severe shoulder sprain [OR=4.49 (1.89-10.67)] and a fivefold increased risk of missing work from that injury [OR=5.00 (1.96-12.75]), compared to workers age 40 and younger[17].

2.3.2 Musculoskeletal Disorders

A rate of 34.3 out of every 10,000 work-related injuries and illnesses incidents occurred from musculoskeletal disorders where involving the back, rotator cuff, carpel tunnel was most prevalent[3]. Musculoskeletal disorders (MSDs) are soft-tissue injuries caused by sudden or sustained exposure to repetitive motion, force, vibration, and awkward positions. These disorders can affect the muscles, nerves, tendons, joints and cartilage in your upper and lower limbs, neck and lower back[44]. The most frequently reported musculoskeletal disorders in farms and farm workers were located in the lower back (50% and 43%, respectively) and the shoulders (47% and 43%, respectively)[52]. In the study Koehoorn et al, found 93% of injury claims from 1,581 hospital workers resulted from musculoskeletal diagnosis, which involved sprains, strains, acute musculoskeletal injuries such as fractures, dislocations, and contusions[53]. Gold et al. found 31% of the 820 automobile manufacturing worker injuries were an upper extremity disorder symptom[54]. Moreover, musculoskeletal disorder injuries have a high impact on all overall injuries in different industries.

2.3.3 Overexertion

A rate of 27 out of every 10,000 work-related injuries and illnesses incidents occurred from Overexertion[3]. Overexertion accounted for a significant portion (over 1/3) of injuries to firefighters, typically involved injuries to the back, and was associated with significantly higher costs than other types of injuries[55]. During the two-year period 1985-1986, the most common occupational accidents among nurses' aides in Sweden were over-exertion accidents of 5,647 cases and of those cases 84% occurred during lifting[56]. In the literature review, overexertion of the back was the most common body part for injury.

2.3.4 General Soreness and Pain

A rate of 13.3 out of every 10,000 work-related injuries and illnesses incidents occurred from general soreness and pain[3]. Pain-related anxiety is clearly a complex construct, and is likely influenced by a number of cognitive, overt behavior, and physiological events[57]. Preliminary evidence for this statement was provided by McCraken et al, 1996, who found that individual facets of pain-related anxiety (escape/avoidance behaviors, physiological arousal, cognitive symptoms) influence the experience of chronic pain in different, and very specific ways[57]. Vowels et al, study provided a 4 to 6-week treatment program for patients with work-related injuries sustained while performing repetitive or strenuous lifting, bending, or twisting activities that manifested chronic pain of at least 3 months duration. To conclude, the treatment program indicated decreases in fear-avoidance beliefs for work-related activities that were potentially harmful or resulted in further injury. Patients with chronic pain had significant improvements in actual physical capabilities during work activities[57].

2.3.5 Bruises and Contusions

A rate of 9.9 out of every 10,000 work-related injuries and illnesses incidents occurred from bruises and contusions[3]. A bruise, or contusion, is caused when blood vessels are damaged or broken as the result of a blow to the skin (struck against something or hitting yourself with a tool)[26]. Lipscomb et al, 2003 provided surveillance of 902 union residential drywall carpenters from 1999–2001 and found 54.8% of all the injury cases involved struck by or against an object[58]. In types of contact injuries treated in the U.S. emergency departments among workers in the construction industry from 1998-2005 estimated 791,500 cases were struck by object or equipment at 46% of all total types of contact injuries[58]. In the literature review, the construction industry has the highest percentage of total injuries by type where struck by or against an object was the leading cause of injury.

2.3.6 Cuts, Lacerations, and Punctures

A rate of 9.1 out of every 10,000 work-related injuries and illnesses incidents occurred from cuts, lacerations, and punctures[3]. Hands accounted for 40 percent of those cases, the most among upper extremities. Cuts and lacerations resulted in more cases of job transfer or restriction than days away from work in crop production and transportation equipment manufacturing[3].

2.3.7 Fractures

A rate of 8.5 out of every 10,000 work-related injuries and illnesses incidents occurred from Fractures[3]. In 2015, fractures accounted for just 9% of all total nonfatal occupational injuries and illnesses cases for total private, state, and local government, but had the highest median days away from work at 31 days[3]. A reported 3 to 4 million working days are lost each year as a result of hand injuries. Of all upper extremity injuries, fractures account for over one half of the hospitalizations and days spent in a hospital[59].

2.3.8 Multiple Injuries and Disorders

A rate of 5.7 out of every 10,000 work-related injuries and illnesses incidents occurred from multiple injuries and disorders[3]. Multiple trauma means having several serious injuries from an incident in a fall, an attack, or a crash. The injuries could cause severe bleeding or break large bones. They might include damage to the brain or to organs such as the lungs or spleen[26]. Injuries at work comprise a substantial part of the injury burden, accounting for nearly half of all injuries in some age groups[60]. A serious injury can result in multiple injuries and disorders. OSHA defines a serious injury or illness when any injury or illness occurs in a place of employment or in connection with any employment which requires inpatient hospitalization for a period in excess of 24 hours for other than medical observation or in which an employee suffers a loss of any member of the body or suffers any serious degree of permanent disfigurement[2]. Heat stress, machinery accidents, and slips, trips, and falls are all examples of serious injuries and illnesses that can cause multiple injuries and disorders.

2.3.9 Back Pain

A rate of 4.0 out of every 10,000 work-related injuries and illnesses incidents occurred from back pain. Back pain, also known as backache, is pain felt in the back[3]. Common underlying mechanisms include degenerative or traumatic changes to the discs and facets joints, which can then cause secondary pain in the muscles, and nerves, and referred pain to the bones, joints and extremities[26].

Work-related low back pain is a common, disabling condition that frequently compromises ability to Work. In the United States, it is estimated that almost 5% of all workers are affected with work-related low back pain each year, resulting in more than 100 million lost workdays and direct costs almost $9 billion[61].

2.3.10 Heat Burns and Scalds

A rate of 1.6 out of every 10,000 work-related injuries and illnesses incidents occurred from heat burns and scalds[3]. While the rate of injury for burns are relatively low compared to other occupational injuries, they are generally more serious injuries and result in higher loss of productivity. Moreover, work days lost for occupational burns are much higher compared to other injuries of similar severity. Additionally, there is a high cost of rehabilitation associated with occupational burns due to long recovery periods and complicated morbidity[62].

2.4 Costs of Work-related Injuries and Illnesses

The costs of occupational injuries and illnesses can be divided into three broad categories: direct costs, indirect costs, and quality-of-life costs. Direct costs include payments for hospital, physician, and allied health services, rehabilitation, nursing homes care, home health care, medical equipment, medicine, burial costs, insurance administrative costs for medical claims, mental health treatment, police, fire, emergency transport, coroner services, and property damage. Indirect costs refer to the employee's productivity and wages lost. Also, including employer productivity losses, which include recruiting and training replacements for the injured workers. In addition, administrative costs, which include workers' compensation programs. Lastly, quality-of-life costs refer to value attributed to pain and suffering by the injured employee and their family[63]. In 1992 the United States had approximately 6,500 job-related deaths from injury, 13.2 million nonfatal injuries, 60,300 deaths from disease, and 862,200 illnesses are estimated to occur annually in the civilian American workforce. The total direct costs were $65 billion and indirect costs $106 billion[64]. Apart from this, the costs associated with pain and suffering associated with home care, family members, and the injured employee was not accounted into these estimates. Overexertion injuries and disorders, such as low back pain, tendonitis, and carpel tunnel syndrome, are the leading cause of work-related disabilities and Worker's Compensation costs in the United States and other industrialized nations[65].

2.5 Age, Gender, and Race

2.5.1 Age

The US Bureau of Labor Statistics has projected that, between 1995 and 2005, the number of workers ≥55 will increase at an annual rate of 2.5%, while the number of workers ≥25-54 will increase only 1.1% per year[66]. An American Association of Retired Persons (AARP) survey found that about 80% of a national sample of adults aged 33-52 expect to work past retirement age[67]. Social Security's full-benefit retirement age is increasing gradually because of legislation passed by Congress in 1983. Traditionally, the full benefit age was 65, and early retirement benefits were first available at age 62, with a permanent reduction to 80 percent of the full benefit amount[68]. Pransky et al. analyzed records of all work injuries reported to the New Hampshire Department of Labor between mid-November 2000 through the end of March 2002. The study compared work-related injuries of older adults (age 55≥) versus younger adults (age 54≤) and found that majority of workers who return to their jobs after an occupational injury have no age-related difference in functioning. In fact, lost time in older workers appeared to be more content and suffer fewer residual symptoms than younger workers. Thus, those over age 55 and who are still working have an advantage due to longer workplace attachment, job satisfaction, and post-injury employer response-factors[69].

2.5.2 Gender

In the last few decades females have joined the workforce and there have been dramatic increases since 1962 where females just accounted for 34% of the labor force compared to 2008 at 48% of the labor force[70]. Islam et al. analyzed incident rates among West Virginia Workers Compensation claimants that occurred between July 1st, 1994 to June 30th, 1995 by total number of female and male workers in each specific industry class and concluded that overall injury/illness rates were significantly lower in females than males (5.5 vs. 11.5 per 100 employees). The only exceptions were from the service and agricultural sectors[71]. Also, Saleh et al study found workers' compensation claim rates for university employees in 1997 were 1.36-fold higher for women than men. Women had significantly higher rates of claims for pain, sprains, bruises, burns, concussion, and inhalation injury; with lower rates of cuts, ligament injury, and jammed joints[72]. Studies have shown it depends on the industry and specific types of injuries and illnesses to conclude if gender difference is significant when it comes to injury and illness rates.

2.5.3 Race

Racial inequality is an important and enduring characteristic of United States, society, and both earnings and health status measures indicate that Black Americans hold a position decidedly worse than that of their White counterparts[73]. In 1999 almost 12% of the population (32.3 million people) lived at or below the official poverty level; of these, some 6.8 million were classified as "working poor" people and 64% of the working poor were full-time workers. Of the working poor by race, Blacks were 13.6%, Latinos were 10.7%, and Whites were 4.3%. Occupations with high proportions of workers in poverty include seasonal industries such as: forestry, fishing, and farming; and operators, fabricators, and laborers[74].

The United States Census 2000 tallied Blacks or African-Americans are 12.9% of the total United States population[75]. Yet average Black worker is found to be in an occupation 37 to 52 percent more likely to result in a serious injury or illness than the occupation of the average White worker, and this overrepresentation in hazardous jobs hold strong even after controlling for differences in education and on-the-job experience[76]. Workers of color generally are underrepresented in professional categories and overrepresented in blue-collar and service jobs, especially in certain occupations. For example, in 1996 Blacks were 50% of all garbage collectors, 33% of elevator operators, and 33% of nursing aides and orderlies. Similarly, Latinos were 75% miscellaneous woodworkers, 68% of farm product graders and sorters, 37% of farmworkers, and 34% of fabric machine operators. Compared to a profession such as a dental hygienist that is 97% White[77]. Moreover, Blacks and Latinos workers have jobs with higher injury risk on average compared to Whites and these factors contribute to Blacks and Latinos having a higher injury rate.

2.6 Injury and Illness Risk Factors

How do you define risks and what factors effect work-related injury and illness outcomes? The National Research Council defines risk factors for workplace injuries and illnesses as the probability an employee is exposed to physical and chemical hazards, personal characteristics and behavior, work organization and psychosocial demands, social, economic, and cultural context[78]. A hazard is something that can cause harm such as: electricity, chemicals, working up a ladder, noise, and heat. A risk is the chance, high or low, that any hazard will actually cause someone harm[26]. For example, working with a heat treat machine is very hazardous, because of the high temperatures that are generated, which can cause heat stress and burns. Risk factors such as: working age adults in a specific age range, the size of the company, high school setting, university setting, in manufacturing, at hospitals, and in farming will be explored below.

2.6.1 Working Age Adults

Dembe et al, used 12,686 participants from the National Longitudinal Survey of Youth (NLSY) who were between 14 to 22 years of age and were initially surveyed in 1979. Follow-up interviews with the NLSY were conducted annually from 1979 through 1994 and then biannually from 1996 until 1998. This study used responses from the 1998 NLSY surveys of the remaining 8,399 participants who were working adults aged 33 through 41 from the original interviewees in 1979 to analyze questions answered in reference to incidents of work-related injury or illness[79]. The top three reported work-related injuries and illnesses were musculoskeletal disorders (31.9%), body part affected in back and spine (20.3%), and body part affect in hands, wrists, and fingers (23.2%). Individuals with exposure to several potentially hazardous job activities were found to have an increased risk of reporting a work-related injury or illness after controlling for gender, region, occupation, and industry. Risk of injury was increased with physical effort on the job (OR=2.25, CI:1.81-2.81), lifting or carrying more than 10 pounds (OR=1.90, CI:1.42-2.55), using stair and inclines (OR=1.28, CI:1.01-1.62), kneeling or crouching (OR=1.89, CI:1.37-2.60), reaching (OR=1.41, CI:1.01-1.97), and hearing special sounds (OR=1.67, CI:1.32-2.10)[79]. In conclusion, the self-perceived level of total physical effort in a job was found to be more strongly related to the reporting of a work-related injury or illness than were exposures to specific activities such as lifting of heavy weights, reaching, kneeling, or crouching.

2.6.2 Size of the Company

Firm size is one of the factors that are significantly related to safety[80], and the rate of work-environment accidents in small enterprises is higher than that in large firms[81]. Accident prevention is often more difficult in smaller size companies compared to larger ones due to limited resources. Specifically, smaller companies are unable to hire staff who will be allocated to health and safety activities and are often unable to identify occupational hazards and manage regulations[82]. Also, risk of injury is higher in smaller companies due to limited health and safety resources in PPE, machine guarding and signage, supervision, and best practices in sorting, organizing, and keeping areas clean[83]. Buyukekmekci 2002 found that more than 70% of occupational accidents occurred in enterprises with 50 employees or less[84]. Thus, smaller size companies pose a higher risk of injury or illness than larger companies.

2.6.3 High School Setting

Over the past three decades, students in many countries have increased the time they dedicate to working during the school year[85]. There has been a great debate over whether student employment during the school year has advantages such as: financial aid toward a postsecondary education, work experience, increased sense of responsibility, and higher self-esteem; or negative effects, such as increased alcohol, tobacco, and drug use, lack of experience, increased rates of dropping out of school, and decreased overall attainment[86]. Moreover, adolescents and young adults aged 12 to 25 years old have been identified as a population at high-risk for problems related to sleepiness. The combination of insufficient sleep and excessive sleepiness puts students at risk for cognitive and emotional difficulties, low academic performances, and injuries[87]. Furthermore, young workers in most industrialized countries are known to have higher rates of workplace injuries than older workers[88]. Laberge et al, 2011 observed adolescence aged 17-18 who worked during the school year to have higher psychological distress, poorer health perception, greater sleep debt, and higher exposure to physical work factors associated with higher levels of acute fatigue[89].

2.6.4 University Setting

Work-related injuries and illnesses among university students have higher risk for injury than the general adult population due to their younger age and lack of experience or training[90] . Factors such as: poor working conditions and stress and fatigue from balancing academics and work increases their risk for injury[91]. OU et al, 2012 surveyed 476 student employees and found an incident rate of injury at 32 per 100 student employees. The high prevalence and incidence rate of injuries were a product of inexperience at work and lack of standard work practices. In addition, student employees who had greater exposure to workplace hazards and heavy workload were associated with a greater risk for injury. Specifically, the student employees experienced a greater risk for strains/sprains (OR=1.25, CI:0.91-1.71), cuts/lacerations (OR=1.83, CI:1.35-2.47), and bruises/contusions (OR=1.26, CI:0.94-1.68)[92].

2.6.5 Manufacturing Industry

As the industry attempts to meet the demands for increasing production and short product cycle time, working aged adults face long working hours, fast pace management, and less leisure time away from work to meet the consumers needs[93]. This fast pace in manufacturing can lead to vital exhaustion. Vital exhaustion is characterized by a combination of fatigue, lack of energy, loss of libido, feeling of hopelessness, and increased irritability[94]. This ultimately can lead to work burnout, which can cause increase absenteeism, reduced job performance, and an increased risk of psychosomatic or psychiatric disorders[95]. Schnorpfeil et al, 2002 study analyzed 537 airplane manufacturing employees' questionnaires concerning vital exhaustion and found excessive workload (OR=7.5, CI:2.4-23), adverse physical work conditions (OR=6.9, CI:2.2-21), adverse co-worker behavior (OR=4.8, CI:1.4-16), and social support by co-workers (OR=0.34, CI:0.13-0.99) to be the factors of vital exhaustion. In conclusion, factors such as physical work conditions, workload, and absence or presence of social support by co-workers is associated with exhaustion, which leads to a higher risk of injury and illness[96].

2.6.6 Hospital Setting

Nearly 1 in 10 U.S. workers are employed in the healthcare field. Work-related injuries and illnesses among this group increased 130% between 1983 and 1993[97]. One of the most prevalent healthcare injuries is low back injury, which accounts for 24% of all work-related injuries and 31% of total compensation costs[98]. Thomas et al, 2006 study indicated that work-related injuries among the Central Arkansas Veterans Healthcare System (CAVHS) employees who worked between 1997 through 2002 had increased with age and was more often by women than men. Also, work-related injuries were greater among maintenance and custodial staff than direct caregivers and clerical staff. In addition, the study found part-time staff had less of an occurrence of work-related injuries compared to full-time staff and incidence increased with workers who had a higher Body Mass Index (BMI)[99].

2.6.7 Farming

Agriculture fatality and injury rates rank high among general industry and is one of the most hazardous industries. Fatal injury rates have ranged from 11.5 to 30.6 fatalities per 100,000 workers, and nonfatal injury rates have ranged from 3.5 to 16 injuries per 100 workers annually[100]. Types of farming injuries range from sprains/strains, fractures, lacerations, lifting, operating machinery, and handling livestock. Jadhav et al, 2015 meta-analyses for the eight selected risk factors included: (1) Gender, (2) Work time (Full-time vs. Part-time), (3) Worker Status (Owner/Operator vs Hired Worker), (4) Regular Medication Use, (5) Prior Injury, (6) Health Problems, (7) Stress or Depression, and (8) Hearing Loss. All eight risk factors were found to have statistical significance, where study Nogalski et al, 2007 for gender (OR=1.27, CI:1.06-1.51), Carruth et al, 2002 for full-time farming (OR=3.10, CI:1.52-6.30), Broucke et al, 2011 for owner/operator vs hired worker (OR=1.64, CI:1.13-2.38), Sprince et al, 2003 for regular medication use (OR=1.80, CI:1.01-3.17), Erkal et al, 2009 for history of prior injury (OR=3.80, CI:2.36-6.20), Day et al, 2009 for having health problems (OR=0.65, CI:0.45-0.92), Park et al, 2001 for having stress/depression (OR=1.86, CI:1.60-2.16), and Sprince et al, 2007 for having hearing loss (OR=1.98, CI=1.02-3.80)[101].

2.7 Research Gap

The major volume of literature to research work-related injuries and illnesses outcomes in the United States have been centralized to analyze injury and illness and not incorporating younger age, gender, and ethnicity/race[102]. Only one other literature used NIS data sets to analyze the ICD-9 codes for work-related injuries and illnesses[103]. Also, many researchers used cross-sectional surveys to analyze injuries and illnesses outcomes not actual injury and illness datasets. In addition, there was limited research that analyzed Blacks and Latinos who were impacted by work-related injuries and illnesses. Patient outcomes, such as duration of hospital stay and total cost, were not mentioned in previous studies relating to any type of injury and illness. Finally, there are no studies involving the predictors of injury and illness, length of stay, total costs, day, and region for inpatients.

2.8 Summary

Work-related injuries and illnesses are an economic, social, health, safety, and environmental burden to the United States and globally. There are many risk factors for injury and illness, but limited research on the predictors of such events. In general, the literature is more reactive to the loses in financial, socioeconomic, and capital to quantify what has happened more than identifying what needs to change to prevent such events. In conclusion, identifying and controlling the preventable risk factors may contribute to reduce injury and illness rates and events, and possibly eliminate these events all together.

CHAPTER III

MATERIALS AND METHODS

3.1 National Inpatient Sample Data

The data was available by the Healthcare Cost and Utilization Project (HCUP) sponsored by the Agency for Health Care Policy and Research. (Reference Agency for Health Care Policy and Research) The National Inpatient Sample (NIS) was provided by HCUP as a partnership between the Federal and State government and industry to collect national health care data for use in research and policy planning[1]. Biomedical Informatics Department of Rutgers Biomedical and Health Science (RBHS) University provided the permissions to download and access the use of this data. The use of this database allowed the analysis of injuries and illnesses diagnosed during admittance based on the following variables: (1) patient demographics, (2) years of admission, (3) total charges, (4) length of stay, (5) day of admission, (6) economic status, (7) characteristics of hospital, and (8) mortality.

3.2 Data and Methods

The following injuries and illnesses were selected in the NIS dataset due to literature review that showed these 10 specific injuries and illnesses prevalent in the US as work-related injuries and illnesses in the Industrial location. Specifically, amputation of finger, burns 3rd degree of hand, falls from same level, fracture of upper limbs, heat stress, laceration of upper limbs, machine accidents, overexertion, sprains/strains, and struck by or against object were the injuries and illnesses diagnosed when hospitalized. A total of 31,793,174 patients were hospitalized in over 1,500 hospitals in 47 states between years 2007 through 2011. The study focuses all working aged patients who were 18 to 64 years of age and non-fatality during admittance totaled 15,150,545 patients. A total of 143,164 patients were admitted with the 10 specific injuries and illnesses.

These injuries and illnesses were identified using the International Classification of Diseases (ICD-9) procedure codes. Within the ICD-9-CM codes, the external code of injury codes (E-codes) were used to determine: E886.0 (amputation of finger), E944.4 (burns 3rd degree of the hand), E885.9 (falls on same level), E819.0 (fracture of upper limbs), E900.0 (heat stress), E870.0 (laceration of upper limbs), E919.0 (machine accidents), E927.0 (overexertion), E848.9 (sprains/strains), and E916 (struck by or against object).

The main variables of the NIS dataset included: length of hospital stay, total charges of healthcare service, economic status, region, day, and demographics. There are dependent or independent variables classified in this NIS datasets. The dependent variables are the length of hospital stay, total charges, day, and hospital located in urban or suburban area. On the other hand, the independent variables are patients' demographic characteristics (age, gender, and race), type of insurance, household income, and other clinical variables. The Statistical Package for the Social Sciences (SPSS) version 26 was used to analyze the data to determine the most appropriate statistical tests. For the p values to be considered significant, all results were less than 0.05. The statistical tests utilized were Chi-Square, Bivariate Pearson Correlation, and Multiple Linear Regression. The Chi-square test is used to find the association between variables like race categories and economic status. The Bivariate Pearson correlation test is used to determine the type and strength of correlation between two or more numerical variables like the relationship between the injury and illness and patient demographics. The multiple linear regressions are used to determine the predictors of length of hospital stay and total hospital charges.

3.3 Data Variables, Research Questions, and Statistical Analysis Procedures

The patients in this NIS dataset cover years 2007 through 2011. The illustration in Table 1 describes all critical variables needed to achieve the objectives of this study.

Table 1 Data Analysis for the Used Variables

Study Variables	Original Variables in NIS	Variable Description
MORTALITY	DIED	The patient did not die during hospitalization (Died=0); The patient died during hospitalization (Died=1), Categorical Variable
GENDER	FEMALE	Gender of patient FEMALE=1 is Female; FEMALE=0 is Male; Categorical Variable
AGE	AGE	Age in years; Numerical Variable Changed; Value 1=18-30 Years Old, Value 2=31-64 Years Old; Categorical Variable
RACE	RACE	1=White, 2=Black, 3=Hispanic, 4=Asian/Pacific, 5=Native American, 6=Other; Categorical Variable
TOTAL CHARGES	TOTCHG	Total charges; Numerical Variable

REGION	HOSP_RE	1=Northeast, 2=Midwest, 3=South, 4=West; Categorical Variable
DAY	AWEEKEND	Day of admission, AWEEKEND=0 is Weekday; AWEEKEND=1 is Weekend; Categorical Variable
SOCIO_ ECONOMIC STATUS	ZIPINC_QRTL	Median household income for patient's Zip Code, 1=76th to 100th percentile, 2=51st to 75th percentile, 3=26th to 50th percentile 4=0-25th percentile; Categorical Variable
LENGTH OF STAY	LOS	The number of days the patient was hospitalized; Numerical Variable
INJURY & ILLNESS	ICD9_E8860 ICD9_E9444 ICD9_E8859 ICD9_E8190 ICD9_E9000 ICD9_E8700 ICD9_E9190 ICD9_E9270 ICD9_E8489 ICD9_E916	Amputation of Finger, Burns 3rd Degree of Hand, Falls on Same Level, Fracture of Upper Limbs, Heat Stress, Laceration of Upper Limbs, Machine Accidents, Overexertion, Sprains/Strains, Struck By or Against Object;

		Categorical Variable

3.4 Study Hypothesis and Statistical Tests

A total of 5 hypotheses were tested to answer all the research questions. Table 2 illustrates research questions, hypotheses, outcomes, independent variables, and statistical tests.

Table 2 Study Hypotheses, Research Questions, and Appropriate Statistical Tests

Research Question	**Hypotheses**	**Independent Variables**	**Outcome Variables**	**Inferential Statistical Analysis**
Is there an association between demographics with injury and illness?	Hypothesis 1	Age Categorical, Gender, and Race	Injury and Illness	Bivariate Pearson Correlation
Is there an association between race and economic status with injury and illness?	Hypothesis 2	Race & Economic Status	Injury and Illness	Chi-square (6x4)
Is there an association between race and region with injury and illness?	Hypothesis 3	Race & Region	Injury and Illness	Chi-square (6x4)
Are there predictors for length of stay for patients with an injury and illness?	Hypothesis 4	Patients' information	Length of Stay	Multiple Linear Regression
Are there predictors for total charges for patients with an injury and illness?	Hypothesis 5	Patients' information	Total Charges	Multiple Linear Regression

The NIS database encompassed 31,793,174 patients that were hospitalized between years 2007 through 2011 and the study extracted patients with 10 specific injuries and illnesses. In the next chapter, these 10 specific injuries and illnesses will be analyzed and illustrated.

CHAPTER IV

RESULTS AND ANALYSIS

4.1 Introduction

This chapter contains the results including descriptive and statistical analysis. The Statistical Package for Social Sciences (SPSS) version 26 was used for the analysis of the NIS dataset for the years 2007 through 2011, involving 143,164 total patients who suffered these specific injuries and illnesses, which are amputation of finger, burns 3rd degree of the hand, falls on same level, fracture of upper limbs, heat stress, laceration of upper limbs, machine accidents, overexertion, sprains/strains, and struck by or against object. The ICD-9-CM codes are: E886.0, E944.4, E885.9, E819.0, E900.0, E870.0, E919.0, E927.0, E848.9, and E916, respectively. The results with p values less than 0.05 were considered as significant.

4.2 Demographic Characteristics and Health Information

4.2.1 Age for Amputation of Finger

The patients were categorized into two age groups, where younger age was 18 to 30 years of age, and older age was 31 to 64 years of age. All other ages were excluded, because this range is the adult working age for work-related injuries[60,67,69]. The total amount of patients with ECODE1= "E8860" was 767 patients where younger aged 18-30 years (58.5%) and older aged 31-64 years (41,5%), respectively, as shown in Table 3 below.

Table 3 Amputation of Finger Age Groups

Age Groups	Frequency	Percent
18-30	449	58.5%
31-64	318	41.5%
Total	767	100.0%

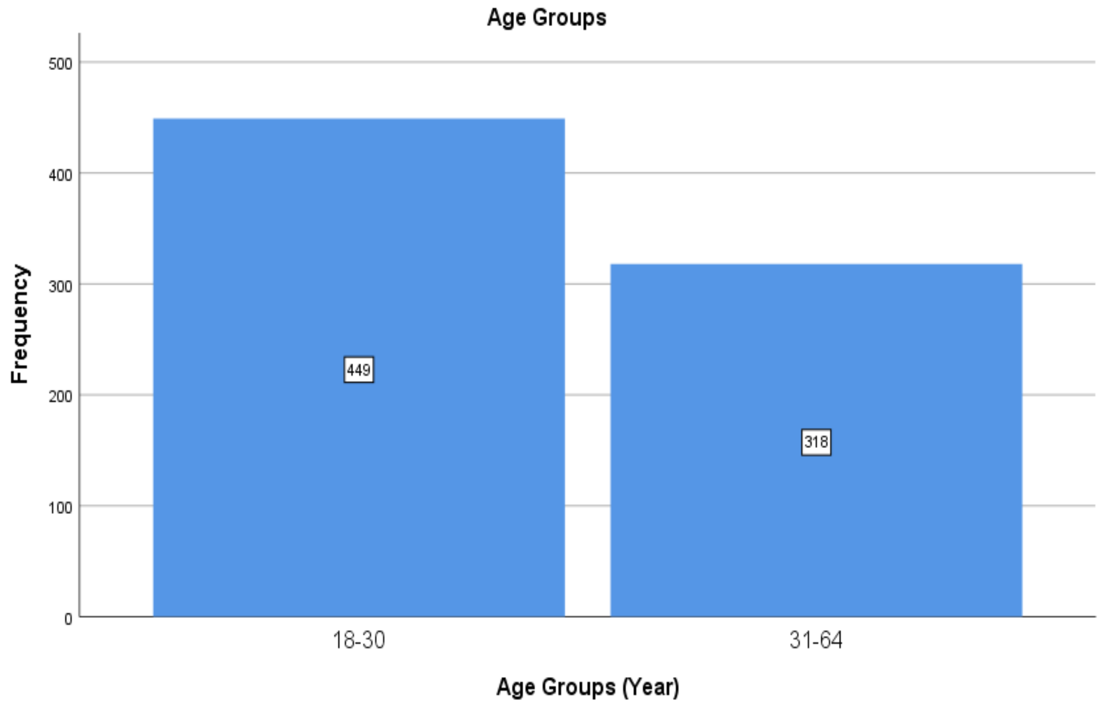

Figure 2 Age Groups of Amputation of Finger

4.2.2 Race for Amputation of Finger

White patients occupied the highest frequency for amputation of finger at 54.9%, followed by Black patients at 19.0%, closely following Hispanic at 17.7%, and others as shown in Table 4.

Table 4 Amputation of Finger Race Groups

Race	Frequency	Percent
White	379	54.9%
Black	131	19.0%
Hispanic	122	17.7%
Asian or Pacific Islander	27	3.9%
Native American	1	0.1%
Other	30	4.3%
Missing System	77	11.2%
Total	690	100.0%

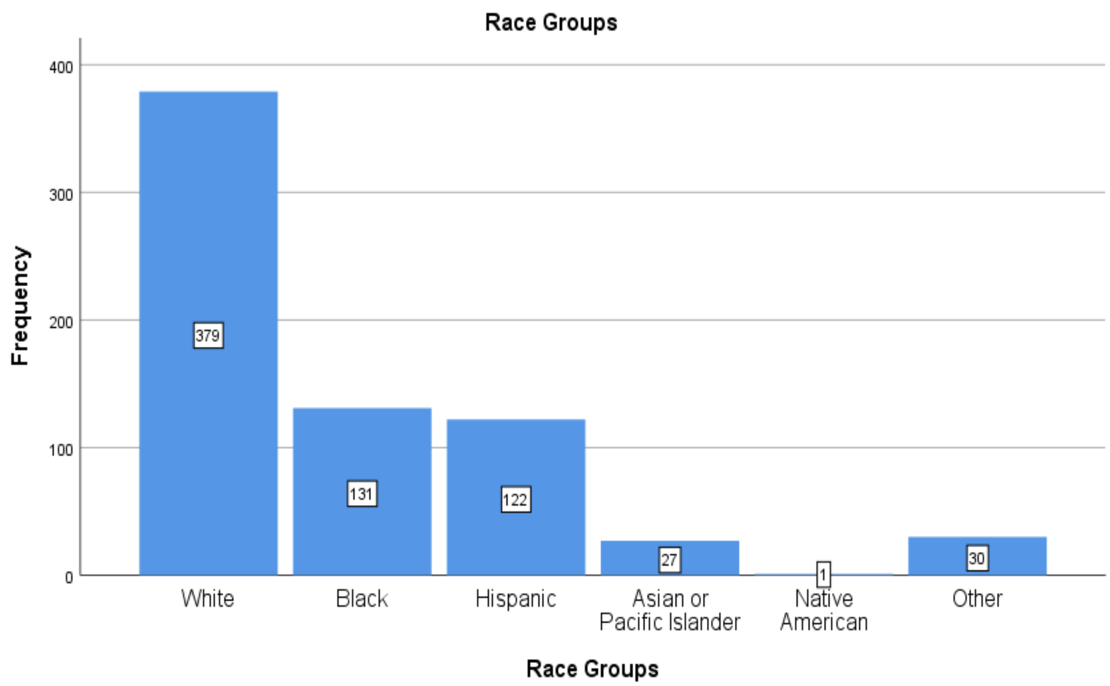

Figure 3 Frequency of Amputation of Finger Among Races

4.2.3 Gender for Amputation of Finger

Males showed higher frequency of amputation of finger compared to females (84.6% vs 15.4%), as shown in Table 5.

Table 5 Frequency of Amputation of Finger between Genders

Genders	Frequency	Percent
Male	643	84.6%
Female	117	15.4%
Missing System	7	0.9%
Total	760	100.0%

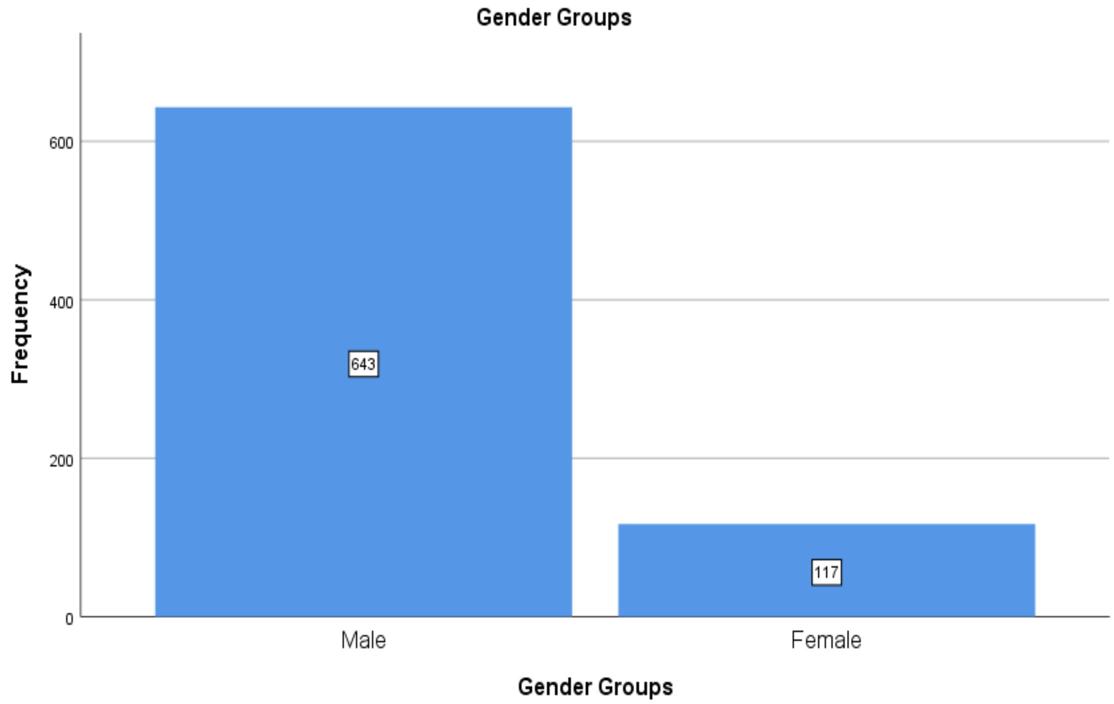

Figure 4 Frequency of Amputation of Finger Among Genders

4.2.4 Length of Stay and Total Charges of Amputation of Finger Patients

The mean for length of stay for patients with an amputation of finger was 2.56 with a standard deviation (±SD) of ±2.742. The mean for total charges was $26,671.39 with ±SD of ±25,266.993 as shown in Table 6.

Table 6 Length of Stay and Total Charges of Amputation of Finger

Parameters	Mean	Median	±SD	Skewness	Kurtosis
Length of Hospital Stay (Days)	2.56	2.00	2.742	5.515	47.404
Total Charges ($)	26,671.39	19,955.00	25,266.993	3.908	24.758

4.2.5 Median Household Income

Four levels of median household income were observed in this study, which are 0-25th percentile, 26th to 50th percentile, 51st to 75th percentile, and 76th to 100th percentile. The percentages of median income for patients with an amputation of finger is the following: 18.7% (76th to 100th percentile), 23.1% (51st to 75th percentile), 25.2% (26th to 50th percentile), and 33% (0 to 25th percentile) respectively, as shown in Table 7. The 0 to 25th Percentile has the highest frequency for amputation of finger patients.

Table 7 Median Household Income of Amputation of Finger Patients (Year 2011)

Levels of Household Income	Dollar Amount	Frequency	Percent
76th to 100th Percentile	$ 1 to $38,999	140	18.7%
51st to 75th Percentile	$39,000 to $47,999	173	23.1%
26th to 50th Percentile	$48,000 to $63,999	189	25.2%
0 to 25th Percentile	$64,000 +	247	33.0%
Total		749	97.7%
Missing System		18	2.3%
Total Cumulation		767	100.0%

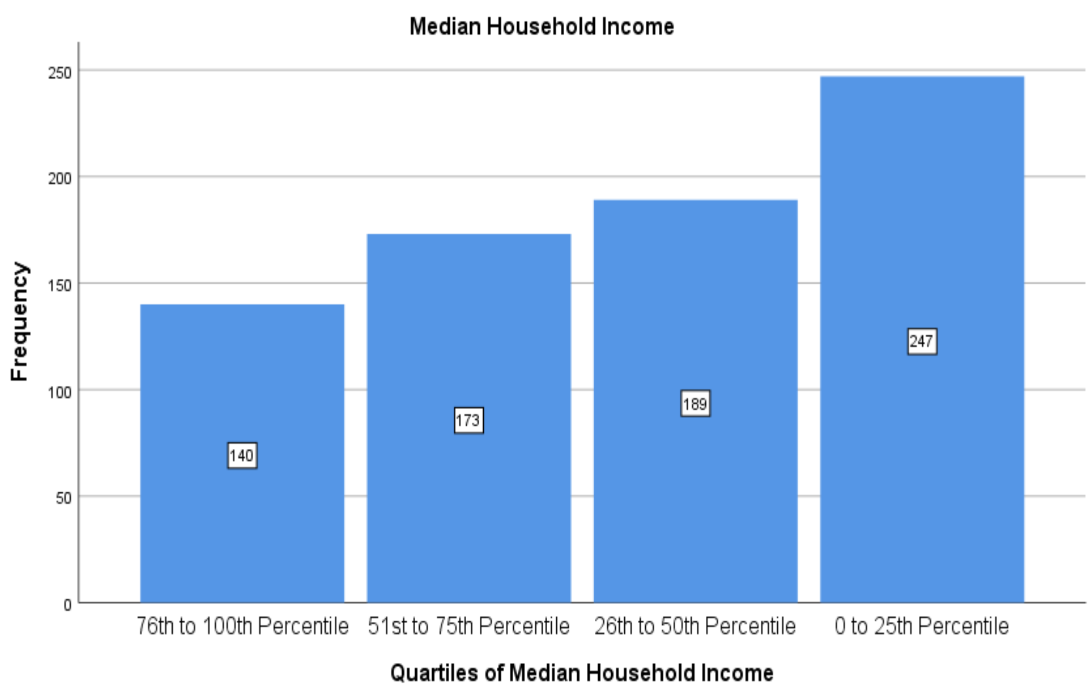

Figure 5 Median Household Income of Amputation of Finger Patients

4.2.6 Admission Day is a Weekend for Amputation of Finger Patients

The admission of the patient was admitted to the weekday at 63.4% versus the weekend at 36.6% respectively, as shown in Table 8.

Table 8 Admission Day is a Weekend for Amputation of Finger

Admission Day is a Weekend	Frequency	Percent
Weekday	486	63.4%
Weekend	281	36.6%
Total	767	100.0%

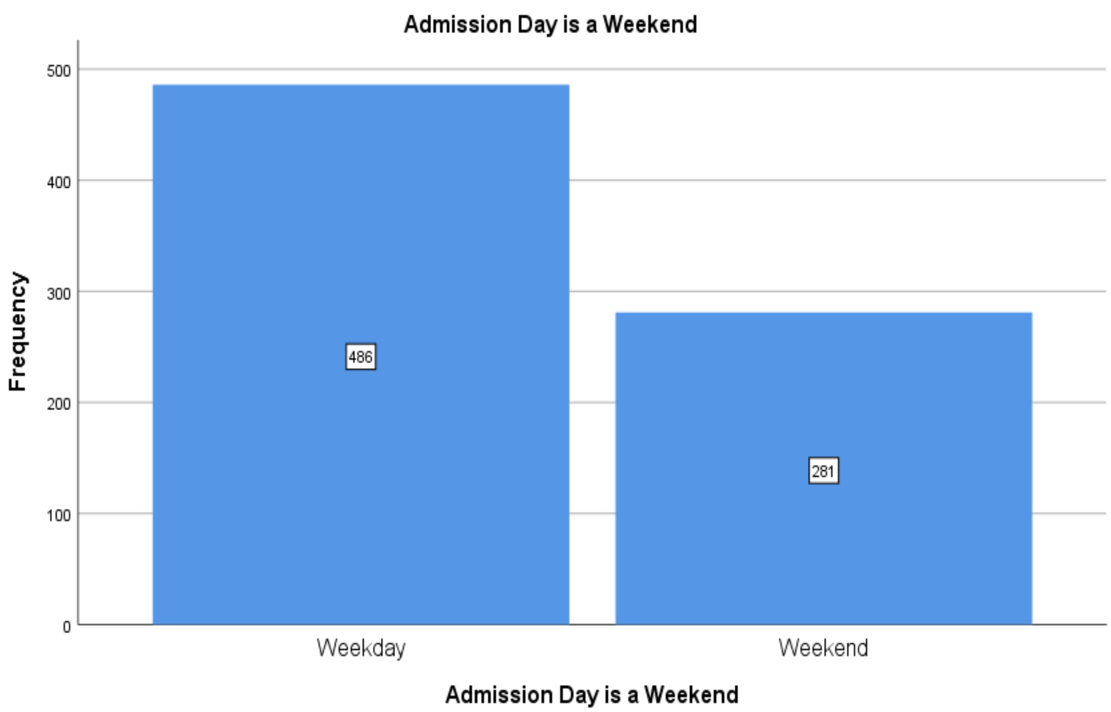

Figure 6 Admission Day is a Weekend for Amputation of Finger

4.2.7 Admission Month for Amputation of Finger Patients

The month of admission for amputation of finger has more injuries during the month of April with 78 patients (11.0%) compared to December with the lowest frequency of 46 patients (6.5%). Table 9 below describes the frequencies of injury per month.

Table 9 Admission Month for Amputation of Finger

Admission Month	Frequency	Percent
January	49	6.9%
February	50	7.1%
March	49	6.9%
April	78	11.0%
May	60	8.5%
June	57	8.1%
July	59	8.4%
August	63	8.9%
September	57	8.1%
October	74	10.5%
November	64	9.1%
December	46	6.5%
Total	706	100.0%
Missing System	61	8.6%
Total Cumulation	767	100.0%

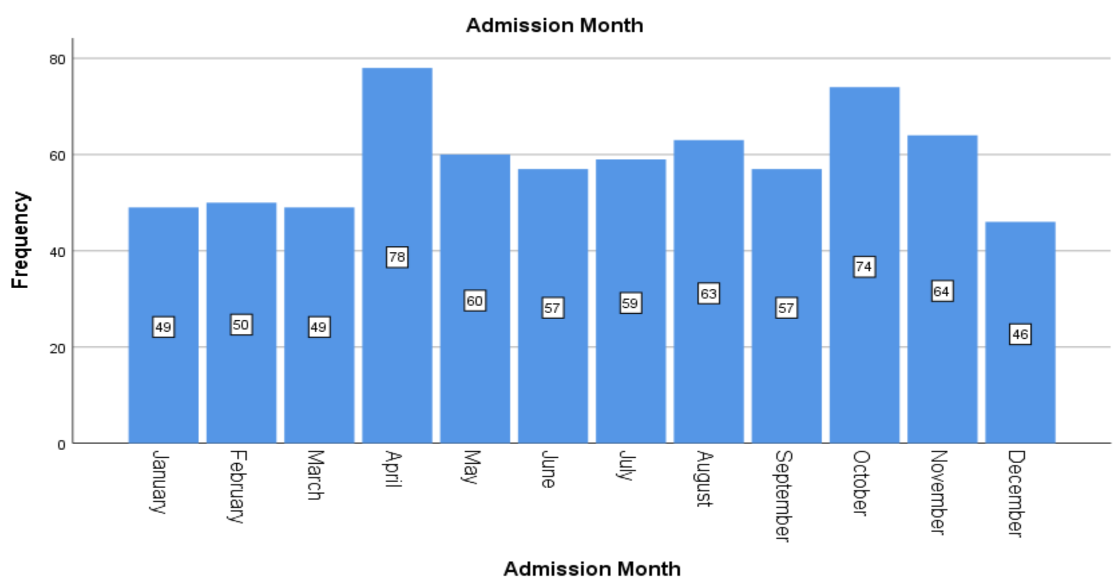

Figure 7 Month of Admission for Amputation of Finger

4.2.8 Region of Hospital for Amputation of Finger

The region with the highest and lowest frequencies is the Northeast at 33.1% (254 patients) versus the Midwest at 15% (115 patients). Table 10 below describes all the region frequencies.

Table 10 Region of Hospital for Amputation of Finger

Region of Hospital	Frequency	Percent
Northeast	254	33.1%
Midwest	115	15.0%
South	209	27.2%
West	189	24.6%
Total	767	100.0%

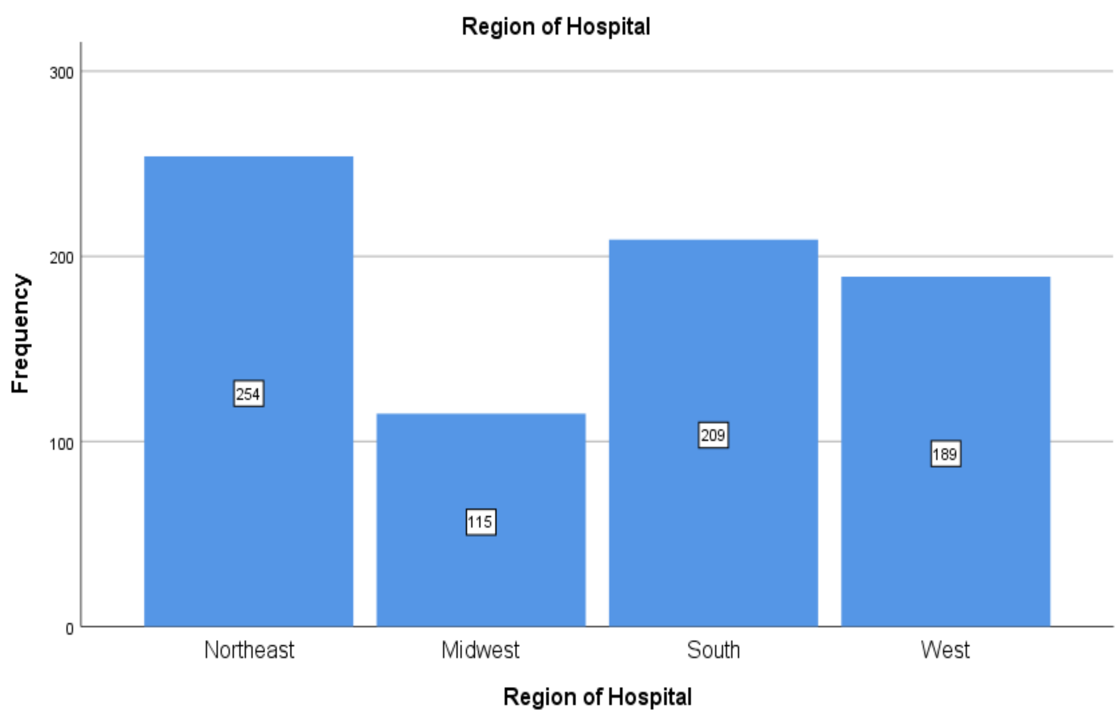

Figure 8 Region of Hospital for Amputation of Finger

4.2.9 Bivariate Pearson Correlation for Amputation of Finger Patients

The Bivariate Pearson Correlation shows correlation between indicator of sex and race and age groups and race with amputation of finger patients. There is a negative correlation between age and race, and indication of sex and race where if one variable increases, the other variable decreases with the same magnitude. Table 11 below describes the correlation of age groups, indicator of sex, and race with amputation of finger patients.

Table 11 Bivariate Pearson Correlation for Amputation of Finger Patients

Correlations

		Age Groups	Indicator of Sex	Race (Uniform)
Age Groups	Pearson Correlation	1	.063	-.077*
	Sig. (2-tailed)		.083	.043
	N	767	760	690
Indicator of Sex	Pearson Correlation	.063	1	-.107**
	Sig. (2-tailed)	.083		.005
	N	760	760	690
Race (Uniform)	Pearson Correlation	-.077*	-.107**	1
	Sig. (2-tailed)	.043	.005	
	N	690	690	690

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

4.2.10 Chi-Square Test Race & Economic Status

The case processing summary counts 673 with 94 cases missing. Table 12 below describes the case summary.

Table 12 Case Summary Race & Economic Status for Amputation of Finger

Case Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Median Household Income	673	87.7%	94	12.3%	767	100.0%

The crosstabulation for race and economic status shows the expected count versus the actual count for each race and median household income quartiles 1 through 4 in Table 13 shown below.

Table 13 Race and Economic Status Crosstabulation for Amputation of Finger

Race (Uniform) * Median Household Income Crosstabulation

			Median Household Income Quartile for Patients				
			1	2	3	4	Total
Race (Uniform)	White	Count	39	78	99	157	373
		Expected Count	70.9	85.4	89.2	127.5	373.0
	Black	Count	40	32	21	30	123
		Expected Count	23.4	28.1	29.4	42.0	123.0
	Hispanic	Count	37	33	30	20	120
		Expected Count	22.8	27.5	28.7	41.0	120.0
	Asian / Pacific	Count	4	6	5	12	27
		Expected Count	5.1	6.2	6.5	9.2	27.0
	Native American	Count	1	0	0	0	1
		Expected Count	.2	.2	.2	.3	1.0
	Other	Count	7	5	6	11	29
		Expected Count	5.5	6.6	6.9	9.9	29.0
Total		Count	128	154	161	230	673
		Expected Count	128.0	154.0	161.0	230.0	673.0

The Chi-Square Tests has a Pearson Chi-Square value of 68.570 and degrees of freedom (df) of 15 with significance equaling 0.000. See Table 14 below of Chi-Square Test.

Table 14 Chi-Square Tests for Amputation of Finger (Race & Economic Status)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	68.570[a]	15	.000
Likelihood Ratio	69.561	15	.000
Linear-by-Linear Association	17.066	1	.000
N of Valid Cases	673		

a. 4 cells (16.7%) have expected count less than 5. The minimum expected count is .19.

The Cramer's V values of 0.184 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 15 below as shown.

Table 15 Symmetric Measure for Amputation of Finger (Race & Economic Status)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.184	.000
N of Valid Cases		673	

4.2.11 Chi-Square Test Race & Region of Hospital

The case processing summary counts 690 with 77 cases missing. Table 16 describes the case summary.

Table 16 Case Processing Summary Race & Region of Hospital for Amputation of Finger

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Region of Hospital	690	90.0%	77	10.0%	767	100.0%

The crosstabulation for race and region shows the expected count versus the actual count for each race and regions 1 through 4. In Table 17 as shown below.

Table 17 Race and Region of Hospital Crosstabulation for Amputation of Finger

Race (Uniform) * Region of Hospital Crosstabulation

			Region of Hospital				Total
			1	2	3	4	
Race (Uniform)	White	Count	145	52	85	97	379
		Expected Count	136.8	40.6	108.2	93.4	379.0
	Black	Count	48	11	59	13	131
		Expected Count	47.3	14.0	37.4	32.3	131.0
	Hispanic	Count	27	6	43	46	122
		Expected Count	44.0	13.1	34.8	30.1	122.0
	Asian / Pacific	Count	13	3	2	9	27
		Expected Count	9.7	2.9	7.7	6.7	27.0
	Native American	Count	0	0	0	1	1
		Expected Count	.4	.1	.3	.2	1.0
	Other	Count	16	2	8	4	30
		Expected Count	10.8	3.2	8.6	7.4	30.0
Total		Count	249	74	197	170	690
		Expected Count	249.0	74.0	197.0	170.0	690.0

The Chi-Square Tests has a Pearson Chi-Square value of 67.966 and degrees of freedom (df) of 15 with significance equaling 0.000. See Table 18 below of Chi-Square Test.

Table 18 Chi-Square Tests for Amputation of Finger (Race & Region)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	67.966[a]	15	.000
Likelihood Ratio	71.793	15	.000
Linear-by-Linear Association	.472	1	.492
N of Valid Cases	690		

a. 6 cells (25.0%) have expected count less than 5. The minimum expected count is .11.

The Cramer's V values of 0.181 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 19 below as shown.

Table 19 Symmetric Measure for Amputation of Finger (Race & Region)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.181	.000
N of Valid Cases		690	

4.2.12 Multiple Linear Regression for Length of Stay and Total Charges

The Multiple Linear Regression method is used to find the predictors of length of hospital stay and total charges for amputation of finger patients. In modeling, we normally check for 5 assumptions, which are the following: (1) relationship between the outcomes and the predictors is linear, (2) error term has mean almost equal to zero for each value of outcome, (3) Error term has constant variance, (4) errors are uncorrelated, and (5) errors are normally distributed or we have an adequate sample size to rely on large sample theory. The dependent variable should be continuous as the dependent variable length of stay is continuous. Two or more independent variables are either numerical, ordinal, or categorical. Gender and Income are categorical, and age is numerical. The Durbin Watson (DW) statistic is a test for autocorrelation in the residuals from a statistical regression analysis. The Durbin-Watson statistic will always have a value between 0 and 4. A value of 2.0 means that there is no autocorrelation detected in the sample. Values from 0 to less than 2 indicate positive autocorrelation and values from 2 to 4 indicate negative autocorrelation. An ideal Durbin Watson value is 2.0 and the results yielded at 1.831 DW as shown in Table 20 below.

Table 20 Model Summary for Amputation of Finger (LOS)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.105[a]	.011	.007	2.723	1.831

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Length of Stay (Cleaned)

There is a significant relationship between dependent and independent variables.

The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 9 below.

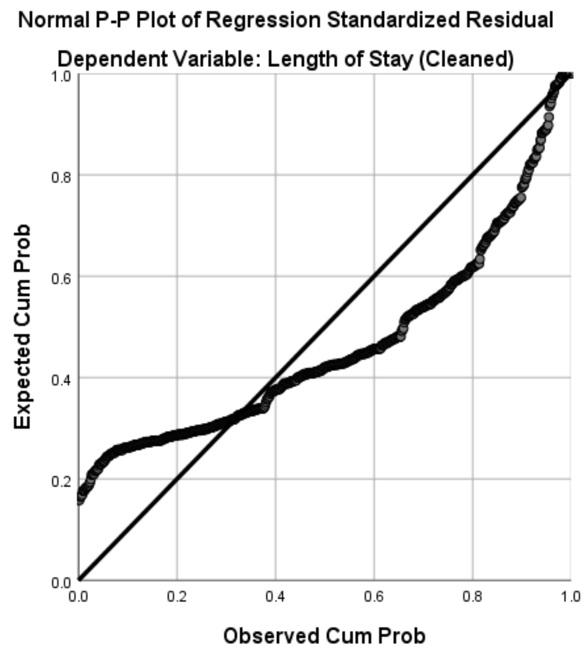

Figure 9 Normal P-P Plot of Regression Residual (LOS) for Amputation of Finger

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 10 below, the scatterplot shows perfect residual distribution.

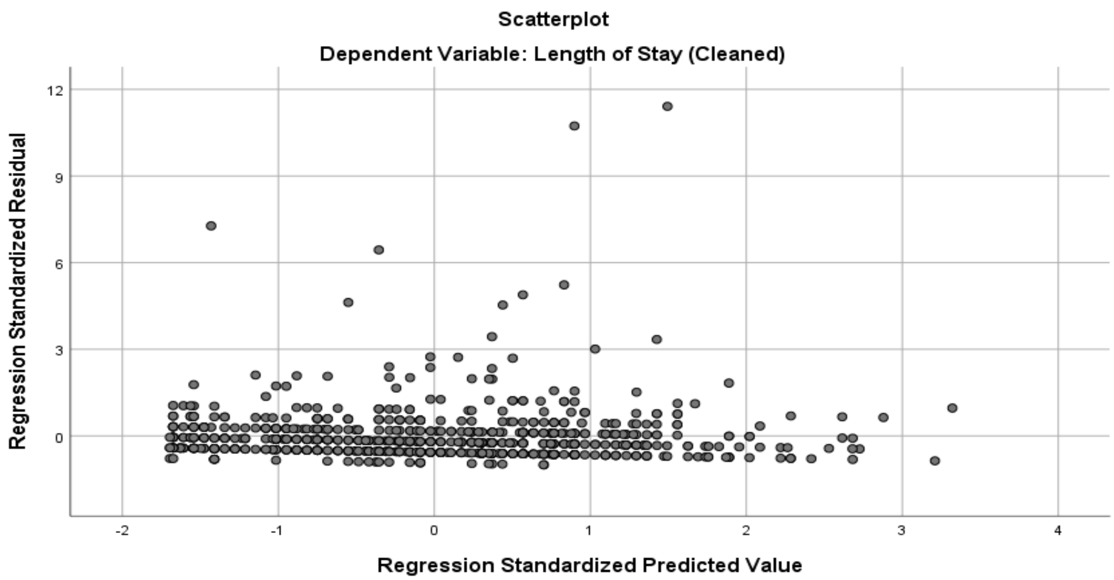

Figure 10 Scatterplot (LOS) for Amputation of Finger

After accepting all assumptions for length of stay, the final models for predictors for amputation of finger are shown in Table 21 below.

Table 21 Predictors for Length of Hospital Stay for Amputation of Finger Patients

						95.0% Confidence			
Predictors	B	Std. Error	Beta	t	*Sig.	Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	2.401	0.365		6.582	0.000	1.685	3.117		
Age in Years at Admission	0.020	0.009	0.082	2.219	0.027	0.002	0.037	0.980	1.020
Indicator of Sex	0.112	0.280	0.015	0.401	0.688	-0.438	0.663	0.983	1.017
Economic Status	-0.173	0.091	-0.070	-1.905	0.057	-0.352	0.005	0.987	1.013

Collinearity diagnostics is used to determine multicollinearity. The **Variance Inflation Factor (VIF)** must result less than 2 or near 1 as an ideal result. All variables resulted less than 2.

Moreover, the data shows no multicollinearity. Of the three independent factors, indicator of sex is the predictor with the highest effects on the length of hospital stay for amputation of finger with 0.112 days, where economic status was the factor that reduced the time for length of stay by -0.173 days. The length of hospital stay for amputation of finger = 2.401 (Constant) + 0.020 (Age in Years) + 0.112 (Indicator of Sex) – 0.173 (Economic Status).

The Durbin-Watson value for Total Charges yielded 1.671, which is close to the ideal Durbin Watson value of 2.0. Table 22 below displays the results.

Table 22 Model Summary for Amputation of Finger (TOTCHG)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.057[a]	.003	-.001	25277.385	1.671

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Total Charges (Cleaned)

There is a significant relationship between dependent and independent variables.
The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 11 below.

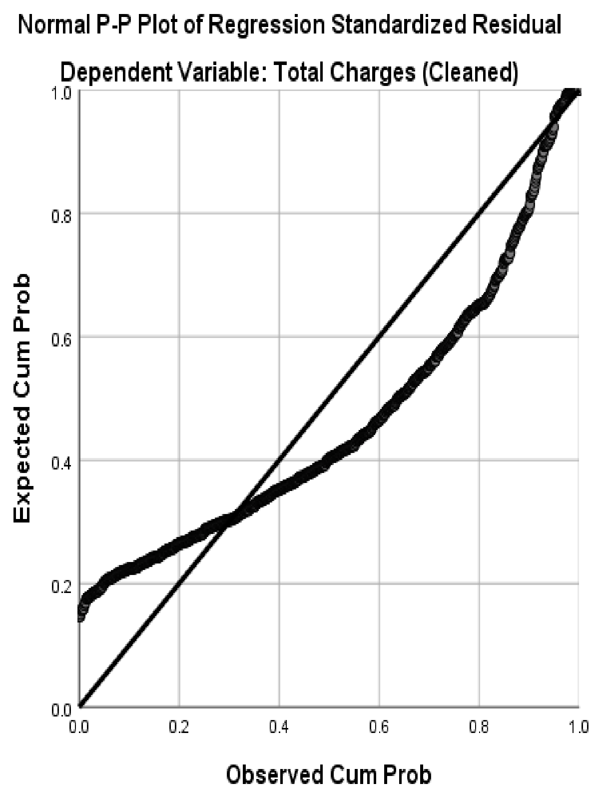

Figure 11 Normal P-P Plot of Regression Residual (TOTCHG) for Amputation of Finger

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 12 below, the scatterplot shows perfect residual distribution.

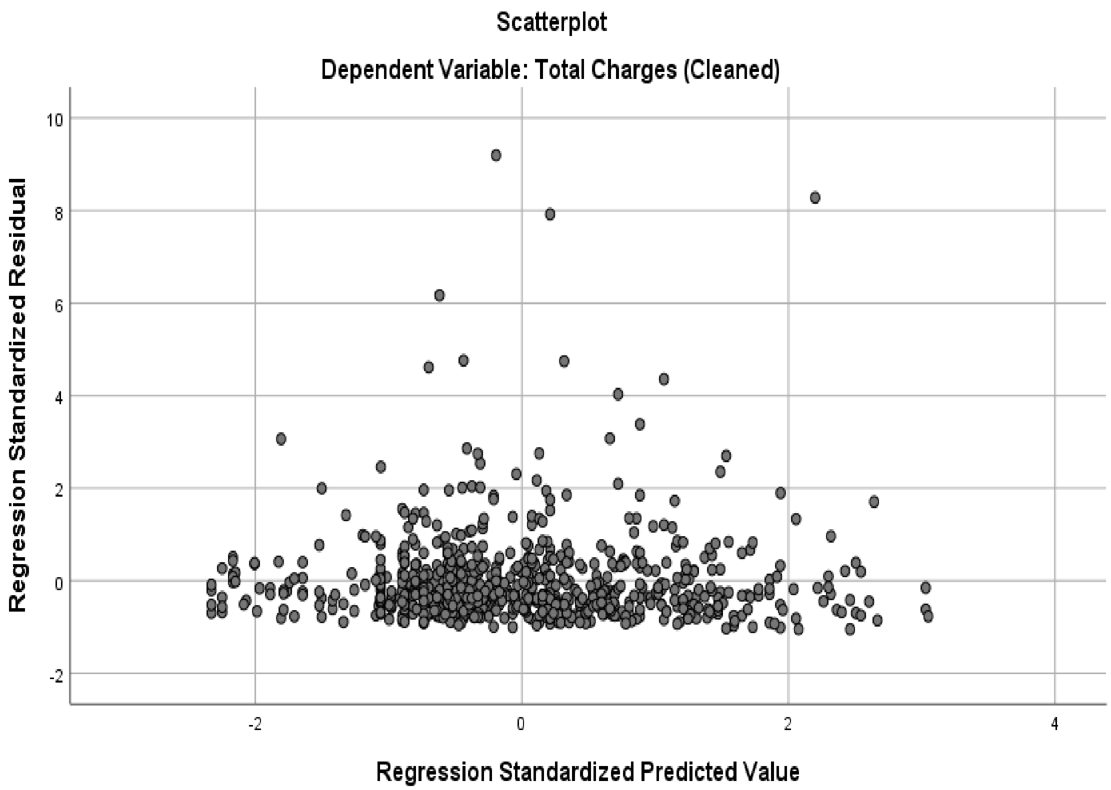

Figure 12 Scatterplot (TOTCHG) for Amputation of Finger

After accepting all assumptions for total charges, the final models for predictors for amputation of finger are shown in Table 23 below.

Table 23 Predictors for Total Charges for Amputation of Finger Patients

Predictors	B	Std. Error	Beta	t	*Sig.	95.0% Confidence Lower Bound	95.0% Confidence Upper Bound	Tolerance	VIF
(Constant)	23372.169	3374.580		6.926	0.000	16747.249	29997.090		
Age in Years at Admission	126.454	82.806	0.057	1.527	0.127	-36.110	289.018	0.980	1.020
Indicator of Sex	-1022.282	2593.151	-0.015	-0.394	0.694	-6113.113	4068.549	0.980	1.020
Economic Status	-153.691	841.119	-0.007	-0.183	0.855	-1804.962	1497.580	0.987	1.013

The VIF results must be less than 2 or near 1 as an ideal result. All variables resulted less than 2. Of the three independent factors, age is the predictor with the highest effects on total charges for amputation of finger with $126.454. The factors related to reduction of total charges were indication of sex ($-1,022.282) and followed by economic status ($-153.691). The total charges of amputation of finger = 23,372.169 (Constant) + 126.454 (Age in Years) – 1,022.282 (Indicator of Sex) – 153.691 (Economic Status).

4.3.1 Age for Burns 3rd Degree of the Hand

The patients were categorized into two age groups, where younger age was 18 to 30 years of age, and older age was 31 to 64 years of age. All other ages were excluded, because this range is the adult working age for work-related injuries[60,67,69]. The total amount of patients with ECODE1= "E9444" was 13,794 patients where younger aged 18-30 years (2.1%) and older aged 31-64 years (97.9%), respectively, as shown in Table 24 below.

Table 24 Burns 3rd Degree of the Hand Age Groups

Age Groups	Frequency	Percent
18-30	290	2.1%
31-64	13504	97.9%
Total	13794	100.0%

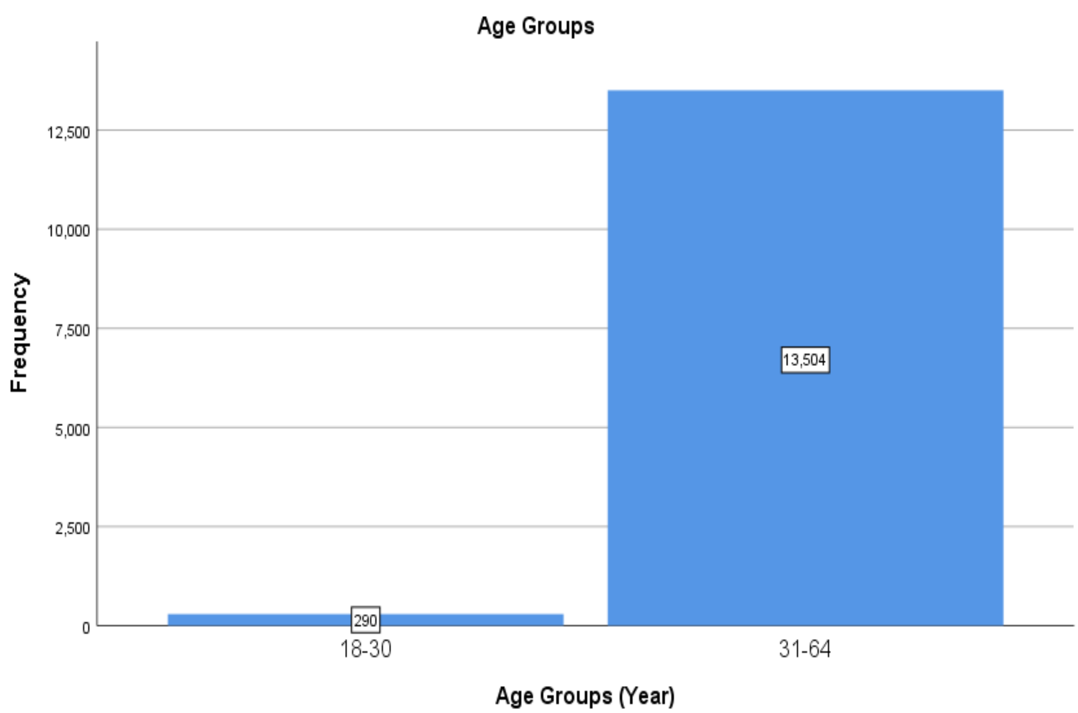

Figure 13 Age Groups of Burns 3rd Degree of the Hand

4.3.2 Race for Burns 3rd Degree of the Hand

White patients occupied the highest frequency for burns 3rd degree of the hand at 56.2%, followed by Black patients at 19.8%, closely following Hispanic at 7.9%, and others as shown in Table 25.

Table 25 Burns 3rd Degree of the Hand Race Groups

Race	Frequency	Percent
White	7757	56.2%
Black	2725	19.8%
Hispanic	1085	7.9%
Asian or Pacific Islander	231	1.7%
Native American	76	0.6%
Other	259	1.9%
Missing System	1661	12.0%
Total	13794	100.0%

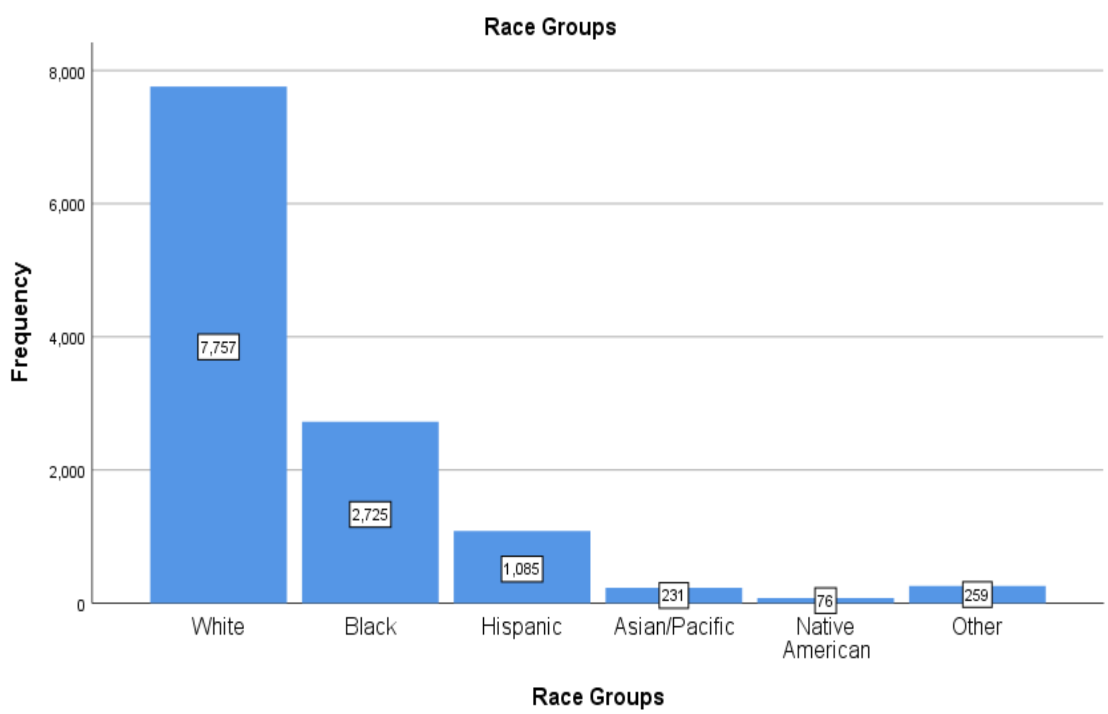

Figure 14 Frequency of Burns 3rd Degree of the Hand Among Races

4.3.3 Gender for Burns 3rd Degree of the Hand

Females showed higher frequency of burns 3rd degree of the hand compared to males (51.0% vs 49.0%), as shown in Table 26.

Table 26 Frequency of Burns 3rd Degree of the Hand between Genders

Genders	Frequency	Percent
Male	6753	49.0%
Female	7041	51.0%
Total	13794	100.0%

Figure 15 Frequency of Burns 3rd Degree of the Hand Among Genders

4.3.4 Length of Stay and Total Charges of Burns 3rd Degree of the Hand Patients

The mean for length of stay for patients with a burn 3rd degree of the hand was 5.69 with a standard deviation (±SD) of ±7.118. The mean for total charges was $41,067.68 with ±SD of ±69,112.246 as shown in Table 27 below.

Table 27 Length of Stay and Total Charges of Burns 3rd Degree of the Hand

Parameters	Mean	Median	±SD	Skewness	Kurtosis
Length of Hospital Stay (Days)	5.69	4.00	7.118	7.602	112.556
Total Costs ($)	41,067.68	21,822.00	69,112.246	7.195	81.906

4.3.5 Median Household Income

Four levels of median household income were observed in this study, which are 0-25th percentile, 26th to 50th percentile, 51st to 75th percentile, and 76th to 100th percentile. The percentages of median income for patients with burns 3rd degree of the hand is the following: 31.5% (76th to 100th percentile), 26.9% (51st to 75th percentile), 23.7% (26th to 50th percentile), and 17.9% (0 to 25th percentile) respectively, as shown in Table 28. The 76th to 100th Percentile has the highest frequency for burns 3rd degree of the hand patients.

Table 28 Median Household Income of Burns 3rd Degree of the Hand Patients (Year 2011)

Levels of Household Income	Dollar Amount	Frequency	Percent
76th to 100th Percentile	$ 1 to $38,999	4227	31.5%
51st to 75th Percentile	$39,000 to $47,999	3611	26.9%
26th to 50th Percentile	$48,000 to $63,999	3188	23.7%
0 to 25th Percentile	$64,000 +	2409	17.9%
Total		13435	97.4%
Missing System		359	2.6%
Total Cumulation		13794	100.0%

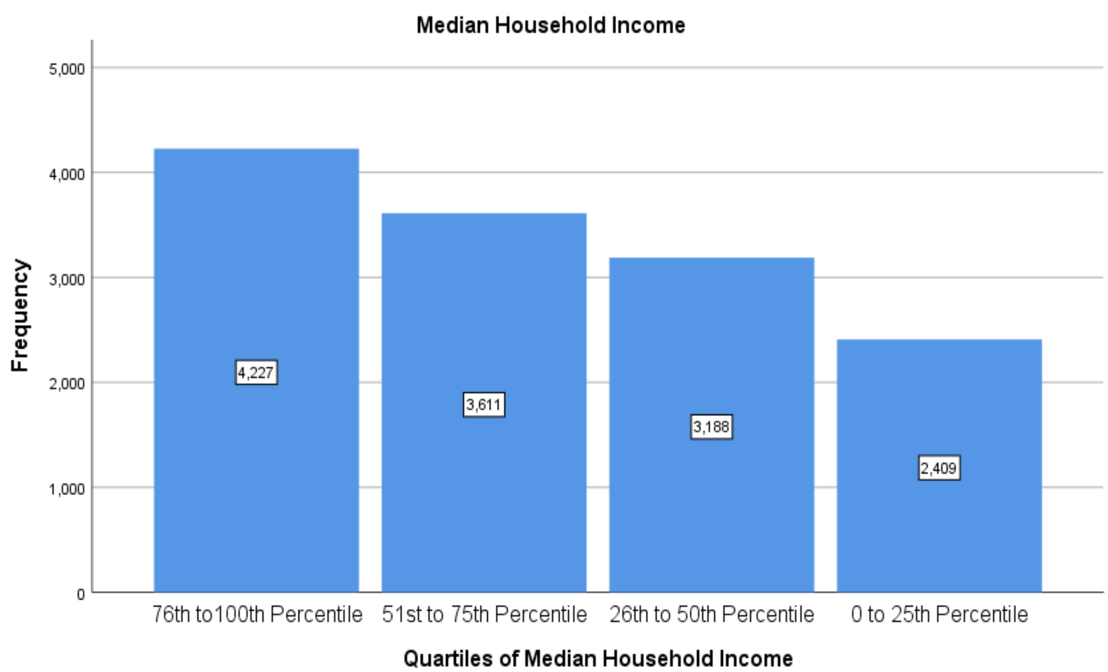

Figure 16 Median Household Income of Burns 3rd Degree of the Hand

4.3.6 Admission Day is a Weekend for Burns 3rd Degree of the Hand Patients

The admission of the patient was admitted to the weekday at 79.2% versus the weekend at 20.8% respectively, as shown in Table 29.

Table 29 Admission Day is a Weekend for Burns 3rd Degree of the Hand

Admission Day is a Weekend	Frequency	Percent
Weekday	10929	79.2%
Weekend	2865	20.8%
Total	13794	100.0%

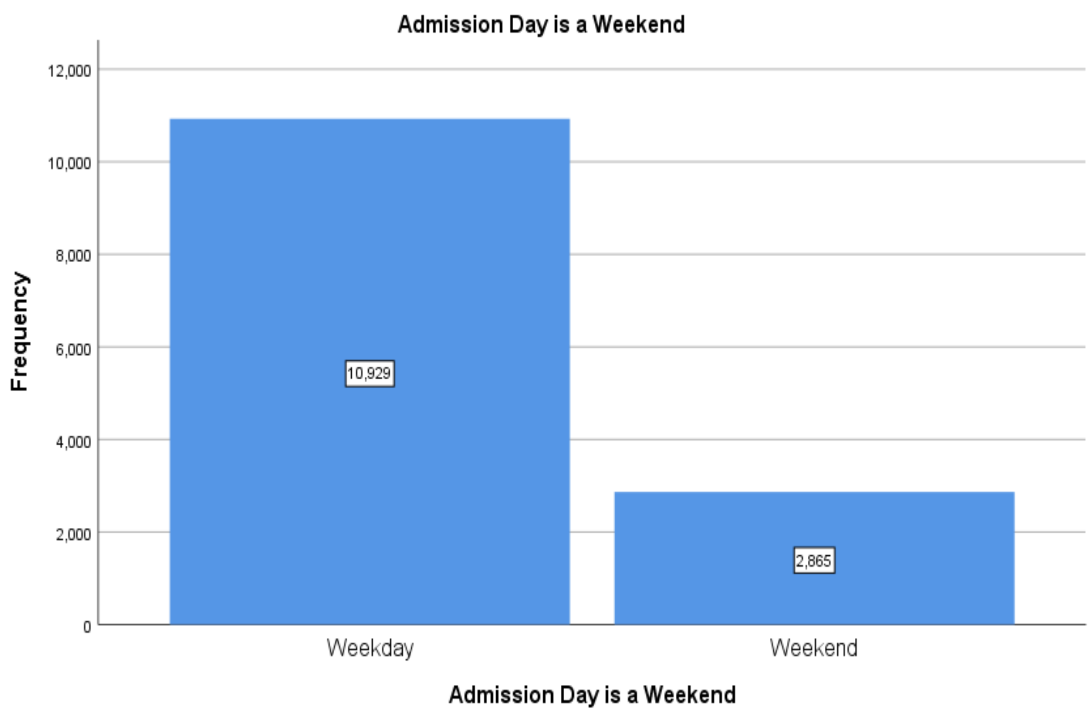

Figure 17 Admission Day is a Weekend for Burns 3rd Degree of the Hand

4.3.7 Admission Month for Burns 3rd Degree of the Hand Patients

The month of admission for burns 3rd degree of the hand has more injuries during the month of March with 1,109 patients (8.9%) and November has the least patients with 966 (7.7%). Table 30 below describes the frequencies of injury per month.

Table 30 Admission Month for Burns 3rd Degree of the Hand

Admission Month	Frequency	Percent
January	1008	8.1%
February	967	7.7%
March	1109	8.9%
April	1100	8.8%
May	1108	8.9%
June	1076	8.6%
July	1087	8.7%
August	1107	8.8%
September	1029	8.2%
October	978	7.8%
November	966	7.7%
December	976	7.8%
Total	12511	100.0%
Missing System	1283	10.3%
Total Cumulation	13794	100.0%

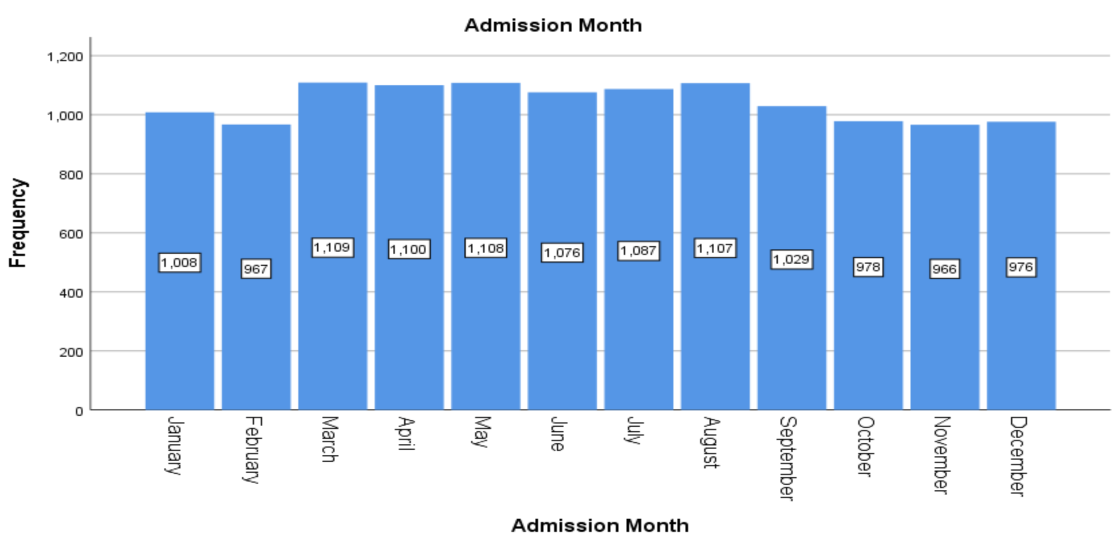

Figure 18 Month of Admission for Burns 3rd Degree of the Hand

4.3.8 Region of Hospital for Burns 3rd Degree of the Hand Patients

The region with the highest and lowest frequencies is the South at 41.9% (5,780 patients) versus the Northeast at 13.3% (1,828 patients). Table 31 below describes all the region frequencies.

Table 31 Region of Hospital for Burns 3rd Degree of the Hand

Region of Hospital	Frequency	Percent
Northeast	1828	13.3%
Midwest	3142	22.8%
South	5780	41.9%
West	3044	22.1%
Total	767	100.0%

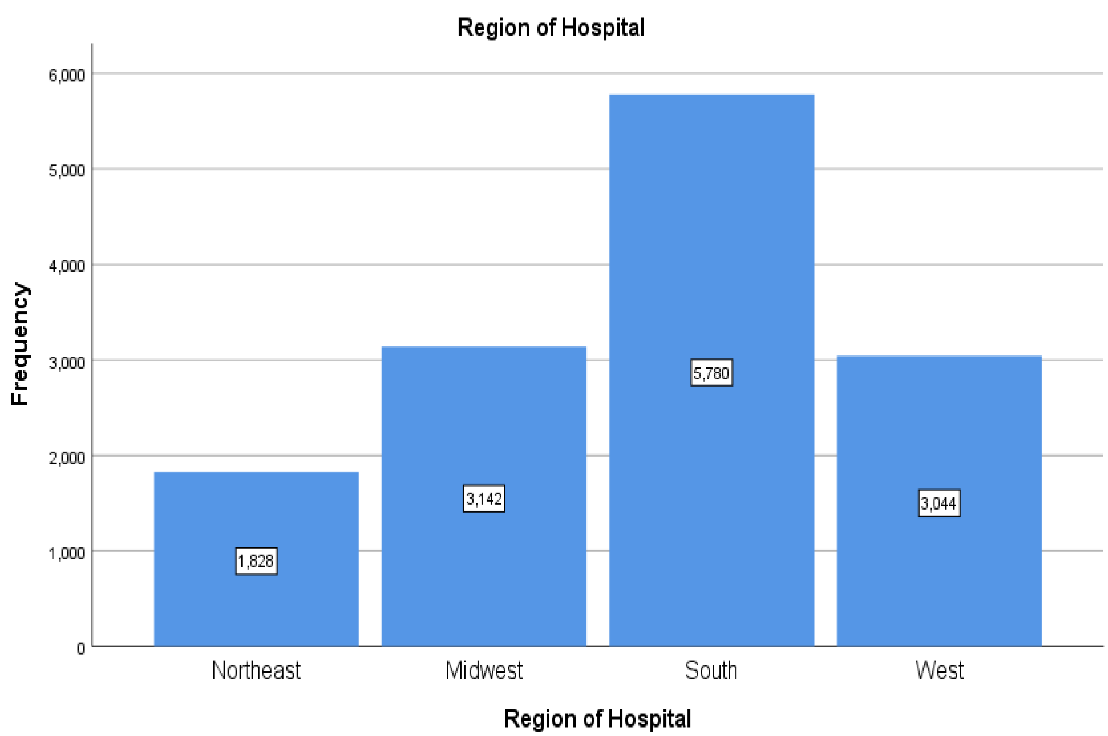

Figure 19 Region of Hospital for Burns 3rd Degree of the Hand

4.3.9 Bivariate Pearson Correlation for Burns 3rd Degree of the Hand Patients

The Bivariate Pearson Correlation shows significant correlation between indicator of sex and race and indicator of sex and age groups. Also, correlation with age groups and race with burns 3rd degree of the hand patients. There is a negative correlation between: age groups and indicator of sex, age groups and race, and indicator of sex and race. Moreover, if one variable increases, the other variable decreases with the same magnitude. Table 32 below describes the correlation of age groups, indicator of sex, and race with burns 3rd degree of the hand patients.

Table 32 Bivariate Pearson Correlation for Burns 3rd Degree of the Hand

Correlations

		Age Groups	Indicator of Sex	Race (Uniform)
Age Groups	Pearson Correlation	1	-.007	-.077**
	Sig. (2-tailed)		.402	.000
	N	13794	13794	12133
Indicator of Sex	Pearson Correlation	-.007	1	-.038**
	Sig. (2-tailed)	.402		.000
	N	13794	13794	12133
Race (Uniform)	Pearson Correlation	-.077**	-.038**	1
	Sig. (2-tailed)	.000	.000	
	N	12133	12133	12133

**. Correlation is significant at the 0.01 level (2-tailed).

4.3.10 Chi-Square Test Race & Economic Status

The case processing summary counts 11,814 with 1,980 cases missing. Table 33 below describes the case summary.

Table 33 Case Processing Summary Race & Economic Status for Burns 3rd Degree of the Hand

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Median Household Income	11814	85.6%	1980	14.4%	13794	100.0%

The crosstabulation for race and economic status shows the expected count versus the actual count for each race and median household income quartiles 1 through 4 in Table 34 below.

Table 34 Race and Economic Status Crosstabulation for Burns 3rd Degree of the Hand

Race (Uniform) * Median Household Income Crosstabulation

			Median Household Income Quartile for Patients				
			1	2	3	4	Total
Race (Uniform)	White	Count	1879	2068	1971	1644	7562
		Expected Count	2386.9	1956.7	1810.8	1407.6	7562.0
	Black	Count	1345	602	446	268	2661
		Expected Count	839.9	688.6	637.2	495.3	2661.0
	Hispanic	Count	373	261	264	159	1057
		Expected Count	333.6	273.5	253.1	196.7	1057.0
	Asian/ Pacific	Count	31	43	69	81	224
		Expected Count	70.7	58.0	53.6	41.7	224.0
	Native American	Count	37	24	7	5	73
		Expected Count	23.0	18.9	17.5	13.6	73.0
	Other	Count	64	59	72	42	237
		Expected Count	74.8	61.3	56.8	44.1	237.0
Total		Count	3729	3057	2829	2199	11814
		Expected Count	3729.0	3057.0	2829.0	2199.0	11814.0

The Chi-Square Tests has a Pearson Chi-Square value of 752.512 and degrees of freedom (df) of 15 with significance equaling 0.000. See Table 35 below of Chi-Square Test.

Table 35 Chi-Square Tests for Burns 3rd Degree of the Hand (Race & Economic Status)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	752.512[a]	15	.000
Likelihood Ratio	739.805	15	.000
Linear-by-Linear Association	71.204	1	.000
N of Valid Cases	11814		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 13.59.

The Cramer's V values of 0.146 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 36 below as shown.

Table 36 Symmetric Measure for Burns 3rd Degree of the Hand (Race & Economic Status)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.146	.000
N of Valid Cases		11814	

4.3.11 Chi-Square Test Race & Region of Hospital

The case processing summary counts 12,133 with 1,661 cases missing. Table 37 below describes the case summary.

Table 37 Case Processing Summary Race & Region of Hospital for Burns 3rd Degree of the Hand

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Region of Hospital	12133	88.0%	1661	12.0%	13794	100.0%

The crosstabulation for race and region shows the expected count versus the actual count for each race and regions 1 through 4 in Table 38.

Table 38 Race and Region of Hospital Crosstabulation for Burns 3rd Degree of the Hand

Race (Uniform) * Region of Hospital Crosstabulation

			Region of Hospital				
			1	2	3	4	Total
Race (Uniform)	White	Count	1245	1542	3142	1828	7757
		Expected Count	1158.5	1382.2	3382.1	1834.2	7757.0
	Black	Count	376	500	1532	317	2725
		Expected Count	407.0	485.6	1188.1	644.4	2725.0
	Hispanic	Count	110	49	451	475	1085
		Expected Count	162.0	193.3	473.1	256.6	1085.0
	Asian/ Pacific	Count	31	12	41	147	231
		Expected Count	34.5	41.2	100.7	54.6	231.0
	Native American	Count	1	10	28	37	76
		Expected Count	11.4	13.5	33.1	18.0	76.0
	Other	Count	49	49	96	65	259
		Expected Count	38.7	46.2	112.9	61.2	259.0

Total	Count	1812	2162	5290	2869	12133
	Expected Count	1812.0	2162.0	5290.0	2869.0	12133.0

The Chi-Square Tests has a Pearson Chi-Square value of 871.761 and degrees of freedom (df) of 15 with significance equaling 0.000. See Table 39 below of Chi-Square Test.

Table 39 Chi-Square Tests for Burns 3rd Degree of the Hand (Race & Region)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	871.761[a]	15	.000
Likelihood Ratio	882.710	15	.000
Linear-by-Linear Association	103.369	1	.000
N of Valid Cases	12133		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.35.

The Cramer's V values of 0.155 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 40 below as shown.

Table 40 Symmetric Measure for Burns 3rd Degree of the Hand (Race & Region)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.155	.000
N of Valid Cases		12133	

4.3.12 Multiple Linear Regression for Length of Stay and Total Charges

The Multiple Linear Regression method is used to find the predictors of length of hospital stay and total charges for burns 3rd degree of the hand patients. The Durbin Watson (DW) statistic yielded at 1.879 DW as shown in Table 41 below.

Table 41 Model Summary for Burns 3rd Degree of the Hand (LOS)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.035[a]	.001	.001	7.114	1.879

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Length of stay (Cleaned)

There is a significant relationship between dependent and independent variables.

The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 20.

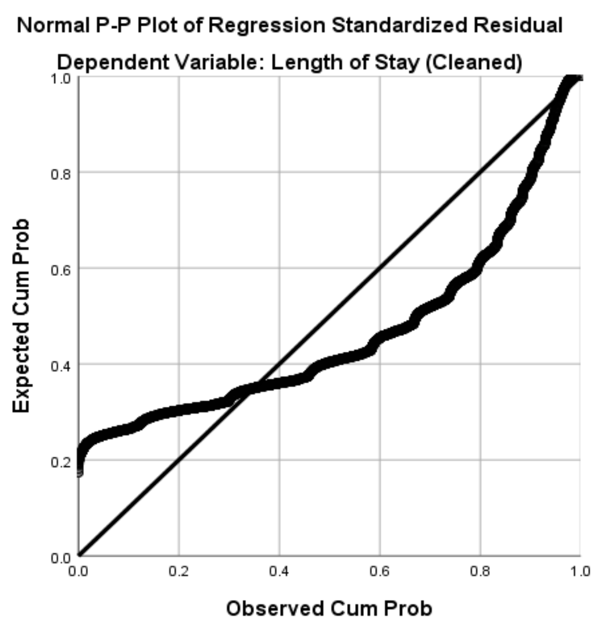

Figure 20 Normal P-P Plot of Regression Residual (LOS) Burns 3rd Degree of the Hand

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 21 below, the scatterplot shows perfect residual distribution.

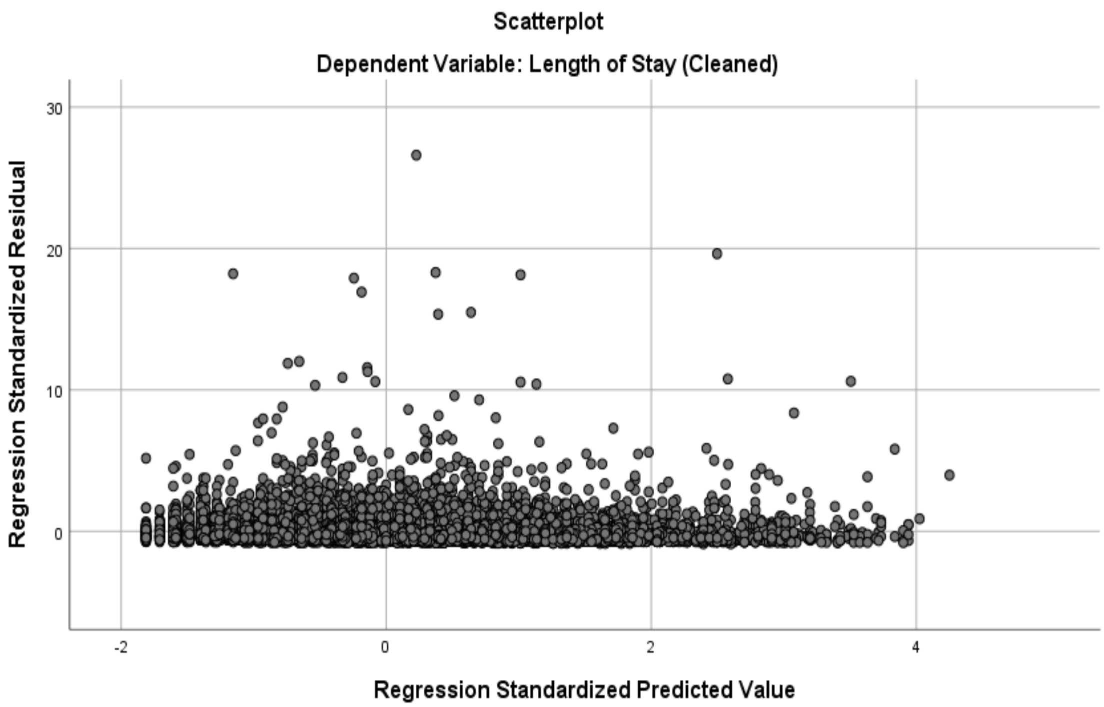

Figure 21 Scatterplot (LOS) for Burns 3rd Degree of the Hand

After accepting all assumptions for length of stay, the final models for predictors for burns 3rd degree of the hand is shown in Table 42.

Table 42 Predictors for Length of Hospital Stay for Burns 3rd Degree of the Hand Patients

Predictors	B	Std. Error	Beta	t	*Sig.	95.0% Confidence Lower Bound	95.0% Confidence Upper Bound	Tolerance	VIF
(Constant)	7.307	0.409		17.858	0.000	6.505	8.109		
Age in Years at Admission	-0.026	0.007	-0.031	-3.637	0.000	-0.040	-0.012	0.999	1.001
Indicator of Sex	-0.186	0.123	-0.013	-1.518	0.129	-0.427	0.054	1.000	1.000
Economic Status	-0.057	0.056	-0.009	-1.005	0.315	-0.167	0.054	0.999	1.001

Collinearity diagnostics is used to determine multicollinearity. The **Variance Inflation Factor (VIF)** must result less than 2 or near 1 as an ideal result. All variables resulted less than 2. Moreover, the data shows no multicollinearity. All three variables in the regression model predict length of stay with negative 0.026, 0.186, and 0.57 days, respectively. Age in years was the only significant factor in the length of stay for burns 3rd degree of the hand patient. The length of hospital stay for burns 3rd degree of the hand = 7.307 (Constant) - 0.026 (Age in Years) – 0.186 (Indicator of Sex) – 0.057 (Economic Status).

The Durbin-Watson value for Total Charges yielded 1.758, which is close to the ideal Durbin Watson value of 2.0. Table 43 below displays the results.

Table 43 Model Summary for Burns 3rd Degree of the Hand (TOTCHG)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.059[a]	.003	.003	69000.443	1.758

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Total Charges (Cleaned)

There is a significant relationship between dependent and independent variables.

The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 22.

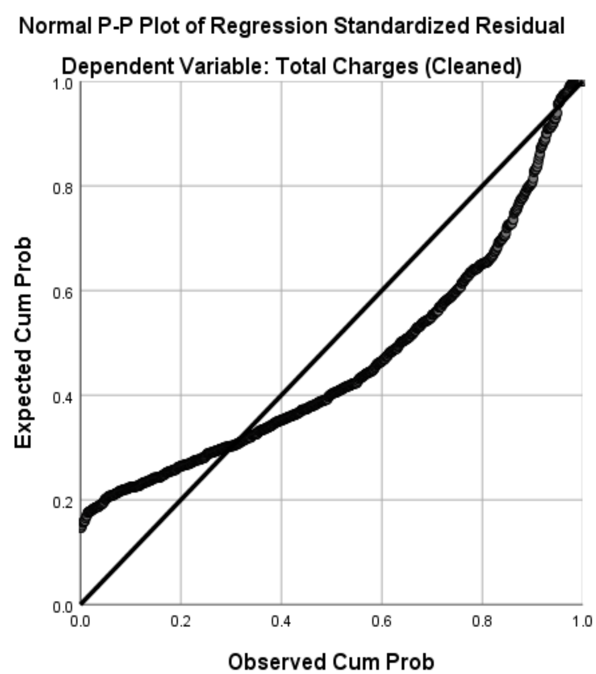

Figure 22 Normal P-P Plot of Regression Residual (TOTCHG) Burns 3rd Degree of the Hand

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 23, the scatterplot shows perfect residual distribution.

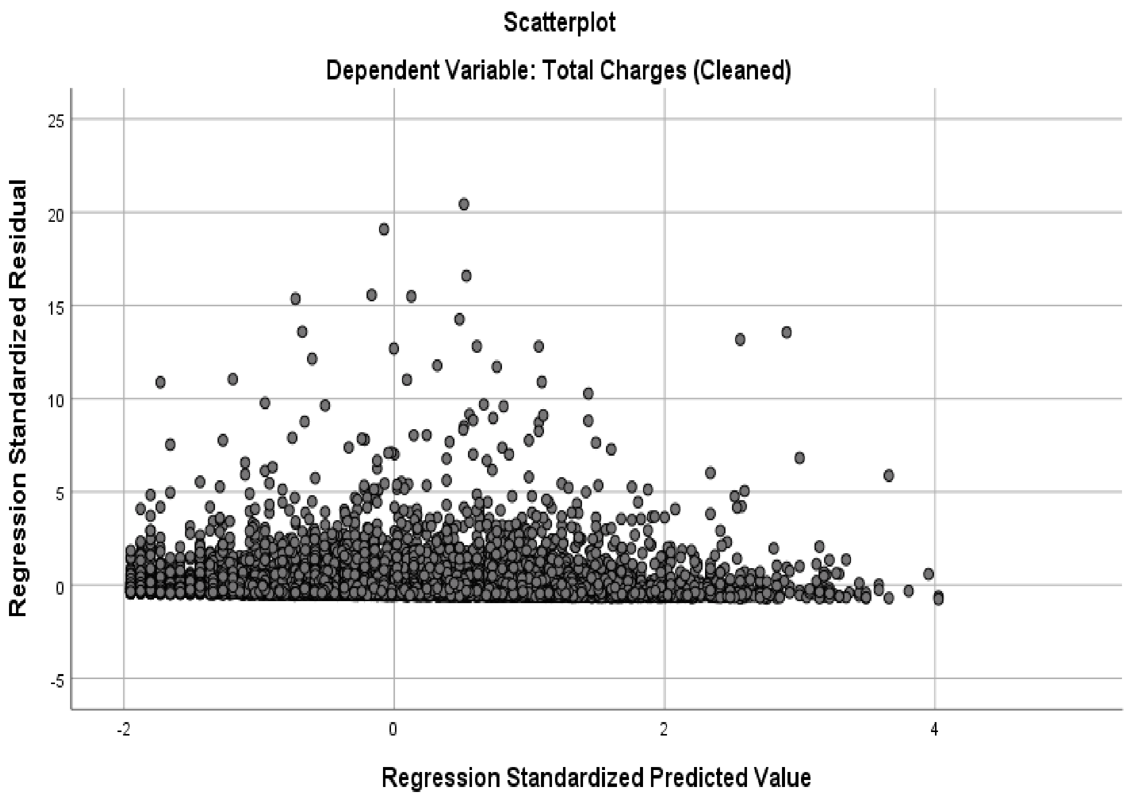

Figure 23 Scatterplot (TOTCHG) for Burns 3rd Degree of the Hand

After accepting all assumptions for total charges, the final models for predictors for burns 3rd degree of the hand is shown in Table 44 below.

Table 44 Predictors for Total Charges for Burns 3rd Degree of the Hand Patients

Predictors	B	Std. Error	Beta	t	*Sig.	95.0% Confidence Lower Bound	95.0% Confidence Upper Bound	Tolerance	VIF
(Constant)	53193.677	4016.080		13.245	0.000	45321.578	61065.776		
Age in Years at Admission	-298.228	69.751	-0.037	-4.276	0.000	-434.949	-161.506	0.999	1.001
Indicator of Sex	-3444.619	1205.174	-0.025	-2.858	0.004	-5806.935	-1082.303	1.000	1.000
Economic Status	2477.620	552.508	0.039	4.484	0.000	1394.624	3560.615	0.999	1.001

The VIF results must be less than 2 or near 1 as an ideal result. All variables resulted less than 2. Of the three independent factors, economic status is the predictor with the highest effects on total charges for burns 3rd degree of the hand with $2,477.62. The factors related to reduction of total charges were Age in Years and Indicator of Sex, which is negative $ 298.228 and $3,444.619, respectively. All three factors were significant variables that effect the total charges of patients with burns 3rd degree of the hand. The total charges of burns 3rd degree of the hand = 53,193.677 (Constant) – 298.228 (Age in Years) -3,444.619 (Indicator of Sex) + 2,477.62 (Economic Status).

4.4.1 Age for Falls on Same Level

The patients were categorized into two groups, where younger group age was 18 to 30 years of age, and older age was 31 to 64 years of age. All other ages were excluded, because this range is the adult working age for work-related injuries. The total amount of patients with ECODE1= "E8859", was 70,226 patients where younger aged 18-30 years (7.9%) and older aged 31-64 years (92.1%), respectively, as shown in Table 45 below.

Table 45 Falls on Same Level Age Groups

Age Groups	Frequency	Percent
18-30	5576	7.9%
31-64	64650	92.1%
Total	70226	100.0%

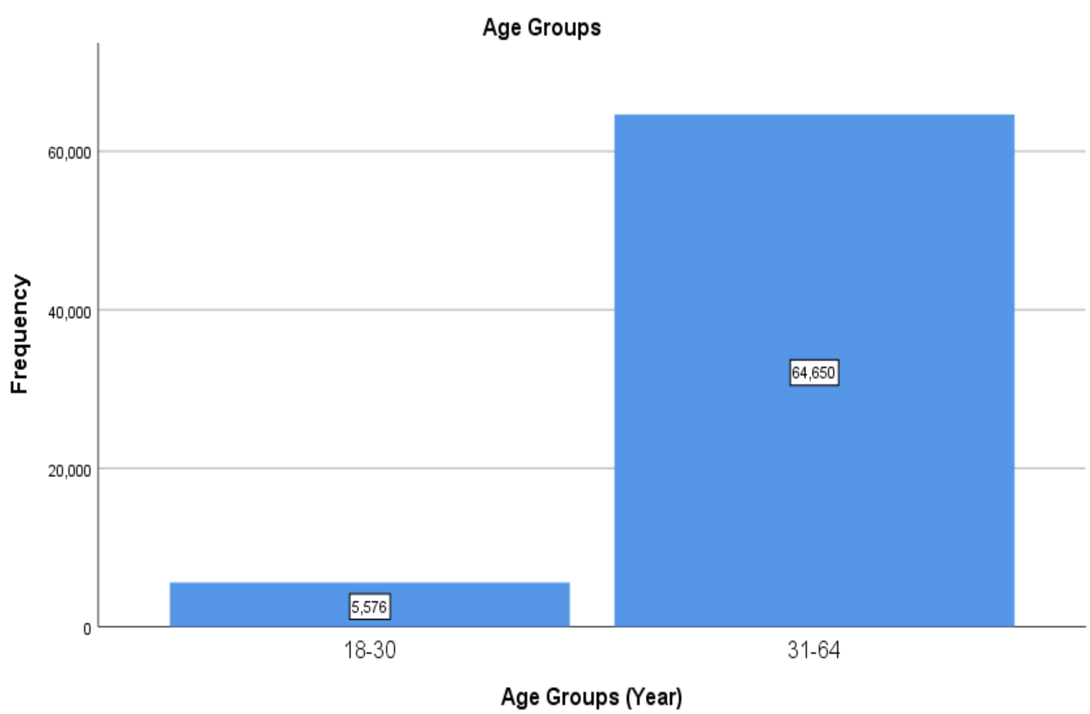

Figure 24 Age Groups of Falls on Same Level

4.4.2 Race for Falls on Same Level

White patients occupied the highest frequency for falls on same level at 65%, followed by Black patients at 9.6%, closely following Hispanic at 8.1%, and others as shown in Table 46.

Table 46 Falls on Same Level Race Groups

Race	Frequency	Percent
White	45618	65.0%
Black	6739	9.6%
Hispanic	5686	8.1%
Asian or Pacific Islander	934	1.3%
Native American	496	0.7%
Other	2044	2.9%
Missing System	8709	12.4%
Total	70226	100.0%

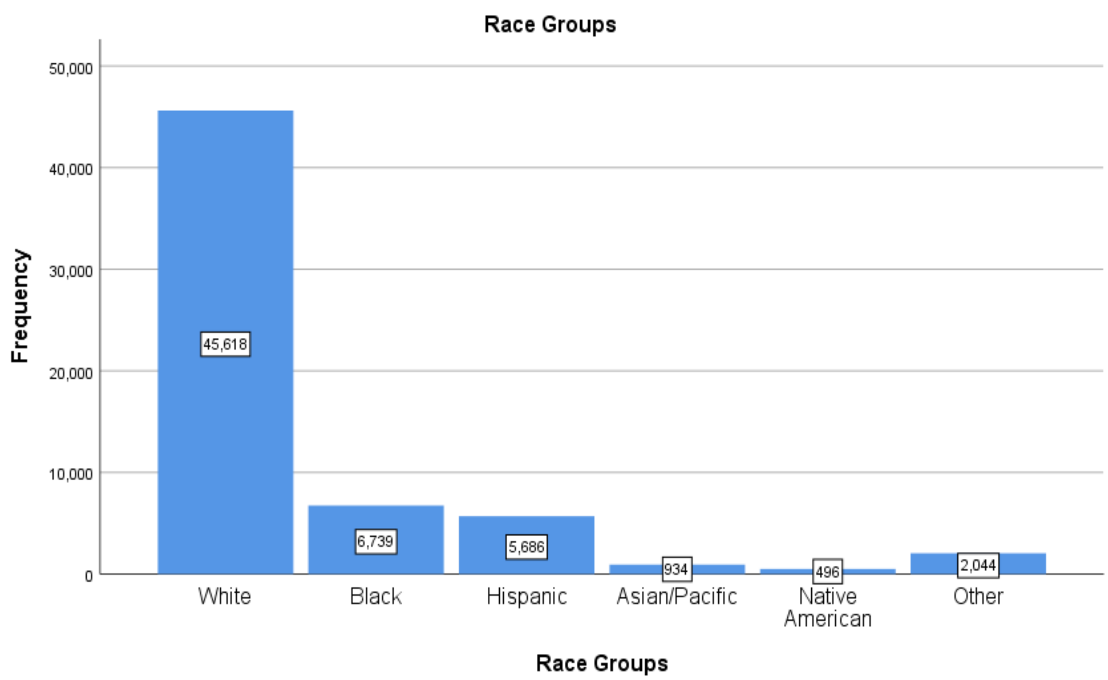

Figure 25 Frequency of Falls on Same Level Among Races

4.4.3 Gender for Falls on Same Level

Females showed higher frequency of falls on same level compared to males (58.1% vs 41.7%), as shown in Table 47.

Table 47 Frequency of Falls on Same Level between Genders

Genders	Frequency	Percent
Male	29253	41.7%
Female	40833	58.1%
Total	70226	100.0%

Figure 26 Frequency of Falls on Same Level Among Genders

4.4.4 Length of Stay and Total Charges of Falls on Same Level Patients

The mean for length of stay for patients with falls on same level was 4.52 with a standard deviation (±SD) of ±6.543. The mean for total charges was $37,074.16 with ±SD of ±45,925.763 as show in Table 48 below.

Table 48 Length of Stay and Total Charges of Falls on Same Level

Parameters	Mean	Median	±SD	Skewness	Kurtosis
Length of Hospital Stay (Days)	4.52	3.00	6.543	14.075	426.260
Total Charges ($)	37,074.16	25,533	45,925.763	7.683	123.714

4.4.5 Median Household Income

Four levels of median household income were observed in this study, which are 0-25th percentile, 26th to 50th percentile, 51st to 75th percentile, and 76th to 100th percentile. The percentages of median income for patients with falls on same level is the following: 27% (76th to 100th percentile), 25.9% (51st to 75th percentile), 24.8% (26th to 50th percentile), and 22.3% (0 to 25th percentile) respectively, as shown in Table 49. The 76th to 100th Percentile has the highest frequency for falls on same level patients.

Table 49 Median Household Income of Falls on Same Level Patients (Year 2011)

Levels of Household Income	Dollar Amount	Frequency	Percent
76th to 100th Percentile	$ 1 to $38,999	18258	27.0%
51st to 75th Percentile	$39,000 to $47,999	17554	25.9%
26th to 50th Percentile	$48,000 to $63,999	16768	24.8%
0 to 25th Percentile	$64,000 +	15129	22.3%
Total		67709	96.4%
Missing System		2517	3.6%
Total Cumulation		70226	100.0%

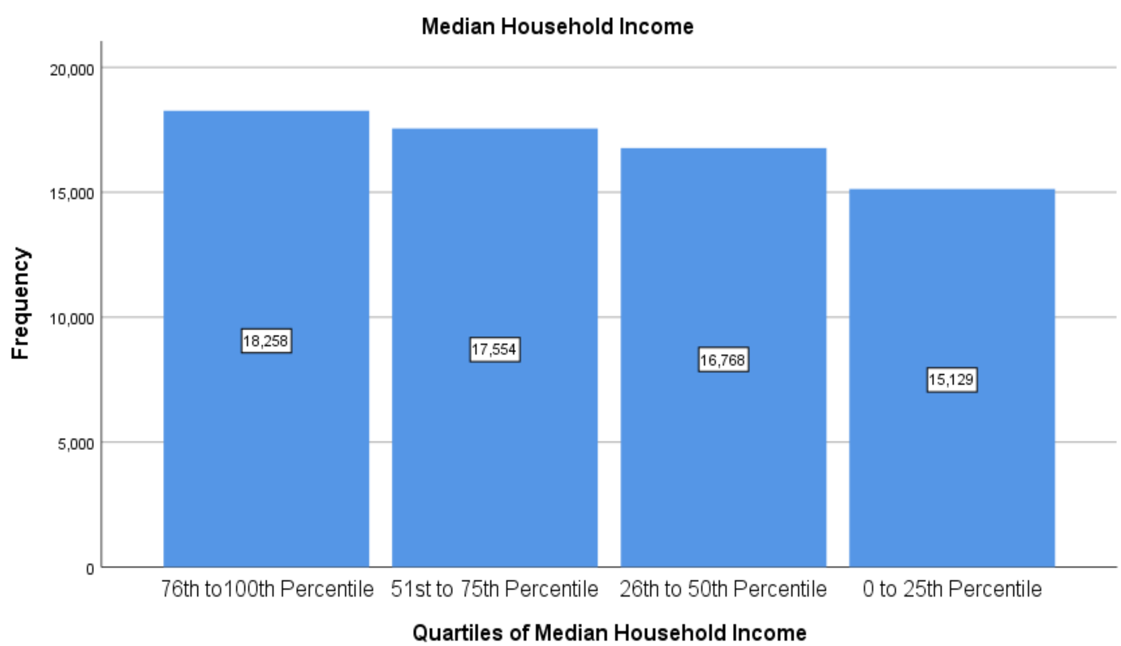

Figure 27 Median Household Income of Falls on Same Level Patients

4.4.6 Admission Day is a Weekend for Falls on Same Level Patients

The admission of the patient was admitted to the weekday at 73.4% versus the weekend at 26.6% respectively, as shown in Table 50.

Table 50 Admission Day is a Weekend for Falls on Same Level

Admission Day is a Weekend	Frequency	Percent
Weekday	51536	73.4%
Weekend	18690	26.6%
Total	70226	100.0%

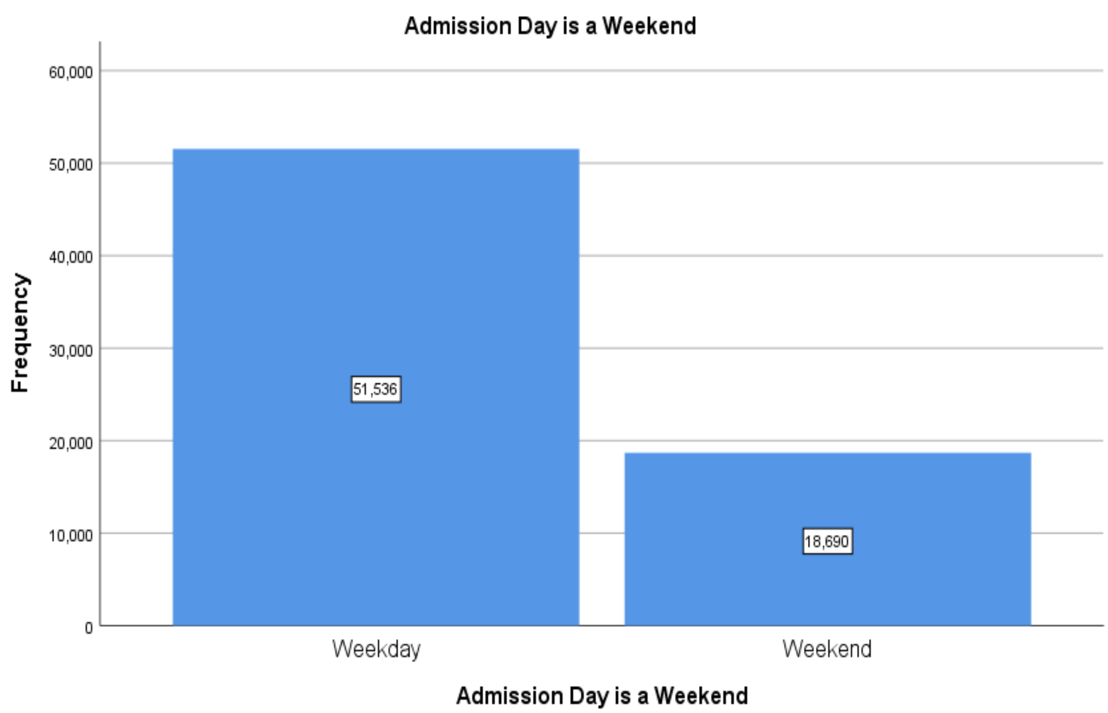

Figure 28 Admission Day is a Weekend for Falls on Same Level

4.4.7 Admission Month for Falls on Same Level Patients

The month of admission for falls on same level has more injuries during the month of January with 7,579 patients (12%) and November has the least patients with 4,354 (6.8%). Table 51 below describes the frequencies of injury per month.

Table 51 Admission Month for Falls on Same Level

Admission Month	Frequency	Percent
January	7579	12.0%
February	7313	11.6%
March	5284	8.4%
April	4377	6.9%
May	4583	7.3%
June	4612	7.3%
July	4800	7.6%
August	4542	7.2%
September	4433	7.0%
October	4506	7.1%
November	4354	6.8%
December	6829	10.8%
Total	63212	100.0%
Missing System	7014	11.1%
Total Cumulation	70226	100.0%

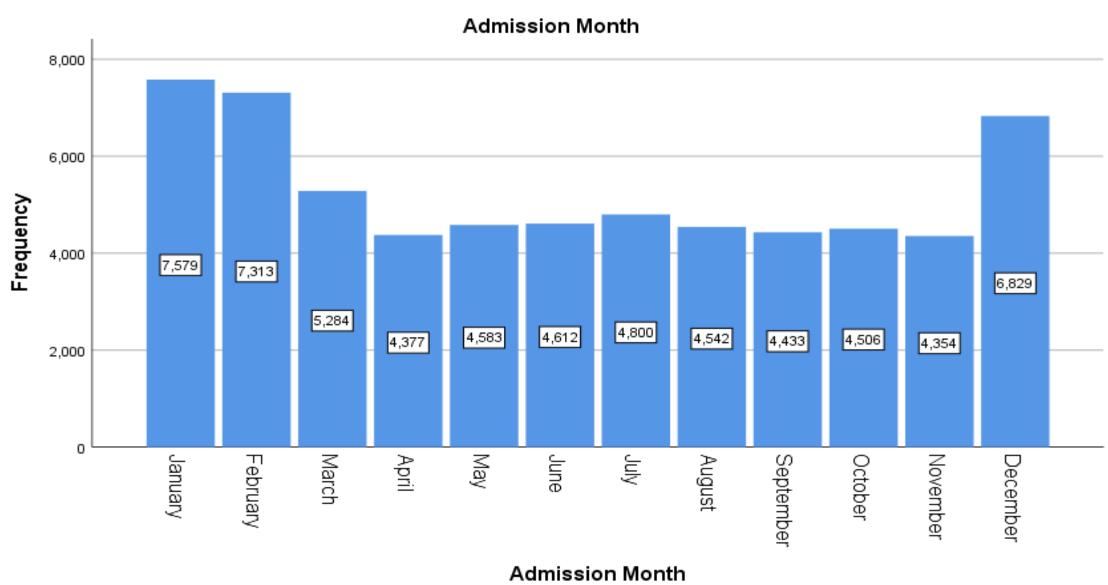

Figure 29 Month of Admission for Falls on Same Level

4.4.8 Region of Hospital for Falls on Same Level Patients

The region with the highest and lowest frequencies is the South at 33.1% (23,211 patients) versus the Midwest at 21.6% (15,200 patients). Table 52 below describes all the region frequencies.

Table 52 Region of Hospital for Falls on Same Level

Region of Hospital	Frequency	Percent
Northeast	16499	23.5%
Midwest	15200	21.6%
South	23211	33.1%
West	15316	21.8%
Total	70226	100.0%

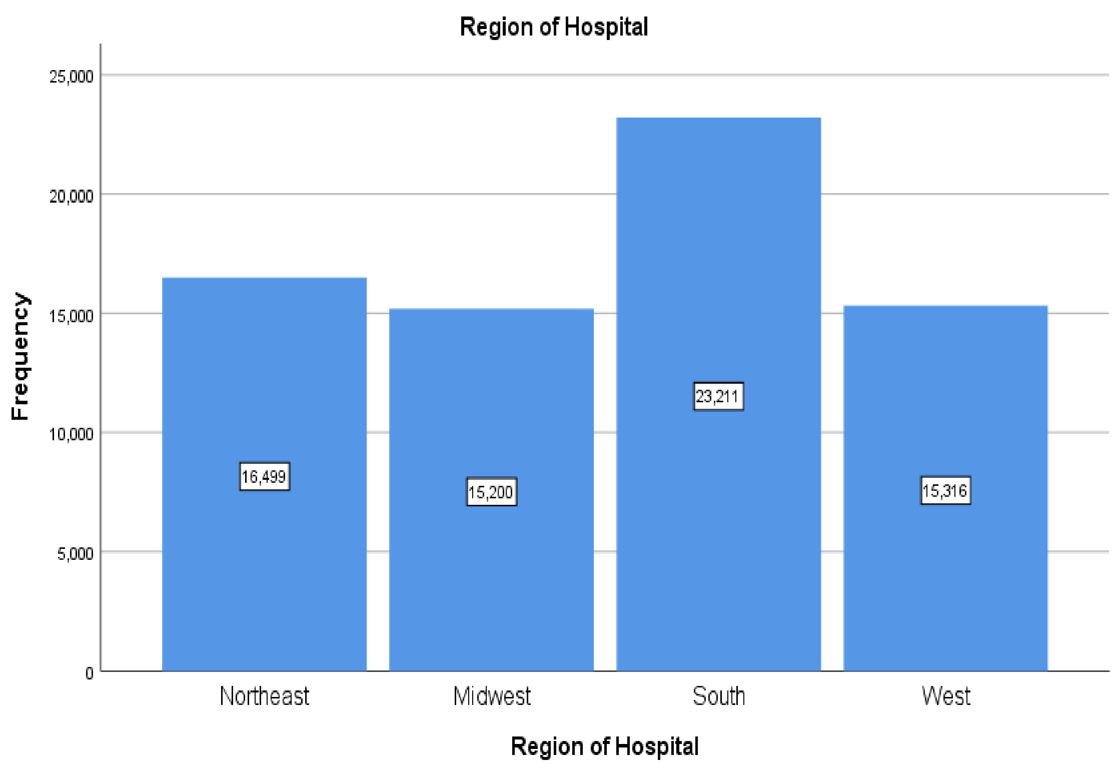

Figure 30 Region of Hospital for Falls on Same Level

4.4.9 Bivariate Pearson Correlation for Falls on Same Level Patients

The Bivariate Pearson Correlation shows significant correlation between indicator of sex and age groups and indicator of sex and race, and age groups and race with falls on same level. All significant findings are negative correlations, where one variable increases as the other variable decreases with the same magnitude. Table 53 below describes the correlation of age groups, indicator of sex, and race with falls on same level.

Table 53 Bivariate Pearson Correlation for Falls on Same Level Patients

Correlations

		Age Groups	Indicator of Sex	Race (Uniform)
Age Groups	Pearson Correlation	1	.092**	-.121**
	Sig. (2-tailed)		.000	.000
	N	70226	70086	61517
Indicator of Sex	Pearson Correlation	.092**	1	-.049**
	Sig. (2-tailed)	.000		.000
	N	70086	70086	61517
Race (Uniform)	Pearson Correlation	-.121**	-.049**	1
	Sig. (2-tailed)	.000	.000	
	N	61517	61517	61517

**. Correlation is significant at the 0.01 level (2-tailed).

4.4.10 Chi-Square Test Race & Economic Status

The case processing summary counts 59,184 with 11,042 cases missing. Table 54 describes the case summary.

Table 54 Case Processing Summary Race & Economic Status for Falls on Same Level

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Median Household Income	59184	84.3%	11042	15.7%	70226	100.0%

The crosstabulation for race and economic status shows the expected count versus the actual count for each race and median household income quartiles 1 through 4 in Table 55 below.

Table 55 Race and Economic Status Crosstabulation for Falls on Same Level

Race (Uniform) * Median Household Income Crosstabulation

			Median Household Income Quartile for Patients				
			1	2	3	4	Total
Race (Uniform)	White	Count	9877	11580	11475	11431	44363
		Expected Count	11987.2	11117.0	10955.1	10303.7	44363.0
	Black	Count	3304	1287	1019	687	6297
		Expected Count	1701.5	1578.0	1555.0	1462.5	6297.0
	Hispanic	Count	1973	1244	1396	795	5408
		Expected Count	1461.3	1355.2	1335.5	1256.1	5408.0
	Asian/ Pacific	Count	125	165	209	379	878
		Expected Count	237.2	220.0	216.8	203.9	878.0
	Native American	Count	208	129	72	41	450
		Expected Count	121.6	112.8	111.1	104.5	450.0
	Other	Count	505	426	444	413	1788
		Expected Count	483.1	448.1	441.5	415.3	1788.0
Total		Count	15992	14831	14615	13746	59184
		Expected Count	15992.0	14831.0	14615.0	13746.0	59184.0

The Chi-Square Tests has a Pearson Chi-Square value of 3,393.658 and degrees of freedom (df) of 15 with significance equaling 0.000. See Table 56 of the Chi-Square Tests.

Table 56 Chi-Square Tests for Fall on Same Level (Race & Economic Status)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3393.658[a]	15	.000
Likelihood Ratio	3207.326	15	.000
Linear-by-Linear Association	426.774	1	.000
N of Valid Cases	59184		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 104.52.

The Cramer’s V values of 0.138 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 57 below as shown.

Table 57 Symmetric Measure for Falls on Same Level (Race & Economic Status)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer’s V	.138	.000
N of Valid Cases		59184	

4.4.11 Chi-Square Test Race & Region of Hospital

The case processing summary counts 61,517 with 8,709 cases missing in Table 58 below.

Table 58 Case Processing Summary Race & Region of Hospital for Falls on Same Level

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Region of Hospital	61517	87.6%	8709	12.4%	70226	100.0%

The crosstabulation for race and region shows the expected count versus the actual count for each race and regions 1 through 4 in Table 59.

Table 59 Race and Region of Hospital Crosstabulation for Falls on Same Level

Race (Uniform) * Region of Hospital Crosstabulation

			Region of Hospital				
			1	2	3	4	Total
Race (Uniform)	White	Count	11695	8127	15838	9958	45618
		Expected Count	12057.6	7335.4	15886.2	10338.7	45618.0
	Black	Count	2148	1035	2886	670	6739
		Expected Count	1781.2	1083.6	2346.8	1527.3	6739.0
	Hispanic	Count	1213	280	1907	2286	5686
		Expected Count	1502.9	914.3	1980.1	1288.7	5686.0
	Asian/ Pacific	Count	281	69	159	425	934
		Expected Count	246.9	150.2	325.3	211.7	934.0
	Native American	Count	31	131	112	222	496
		Expected Count	131.1	79.8	172.7	112.4	496.0
	Other	Count	892	250	521	381	2044
		Expected Count	540.3	328.7	711.8	463.2	2044.0
Total		Count	16260	9892	21423	13942	61517
		Expected Count	16260.0	9892.0	21423.0	13942.0	61517.0

The Chi-Square Tests has a Pearson Chi-Square value of 2,963.552 and degrees of freedom (df) of 15 with significance equaling 0.000 in Table 60 below.

Table 60 Chi-Square Tests for Falls on Same Level (Race & Region)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2963.552[a]	15	.000
Likelihood Ratio	3060.890	15	.000
Linear-by-Linear Association	11.512	1	.001
N of Valid Cases	61517		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 79.76.

The Cramer's V values of 0.127 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 61 below as shown.

Table 61 Symmetric Measure for Fall on Same Level (Race & Region)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.127	.000
N of Valid Cases		61517	

4.4.12 Multiple Linear Regression for Length of Stay and Total Charges

The Multiple Linear Regression method is used to find the predictors of length of hospital stay and total charges for falls on same level patients. The Durbin Watson (DW) statistic yielded at 1.861 DW as shown in Table 62 below.

Table 62 Model Summary for Falls on Same Level (LOS)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.110[a]	.012	.012	6.504	1.861

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Length of Stay (Cleaned)

There is a significant relationship between dependent and independent variables.

The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 31.

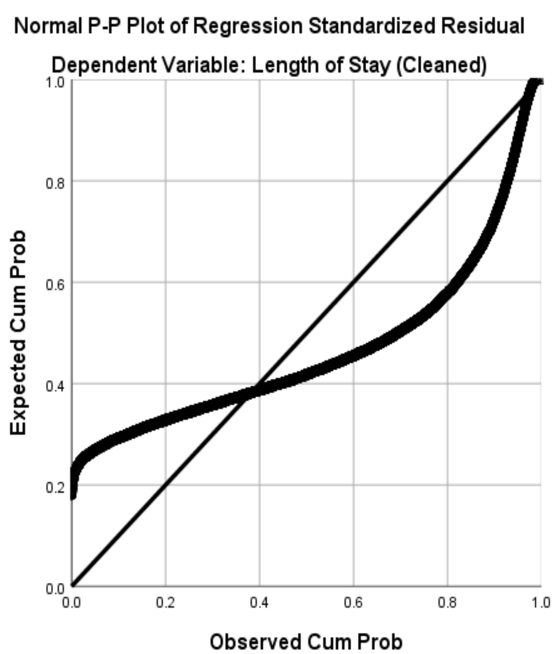

Figure 31 Normal P-P Plot of Regression Residual (LOS) for Falls on Same Level

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 32 below, the scatterplot shows perfect residual distribution.

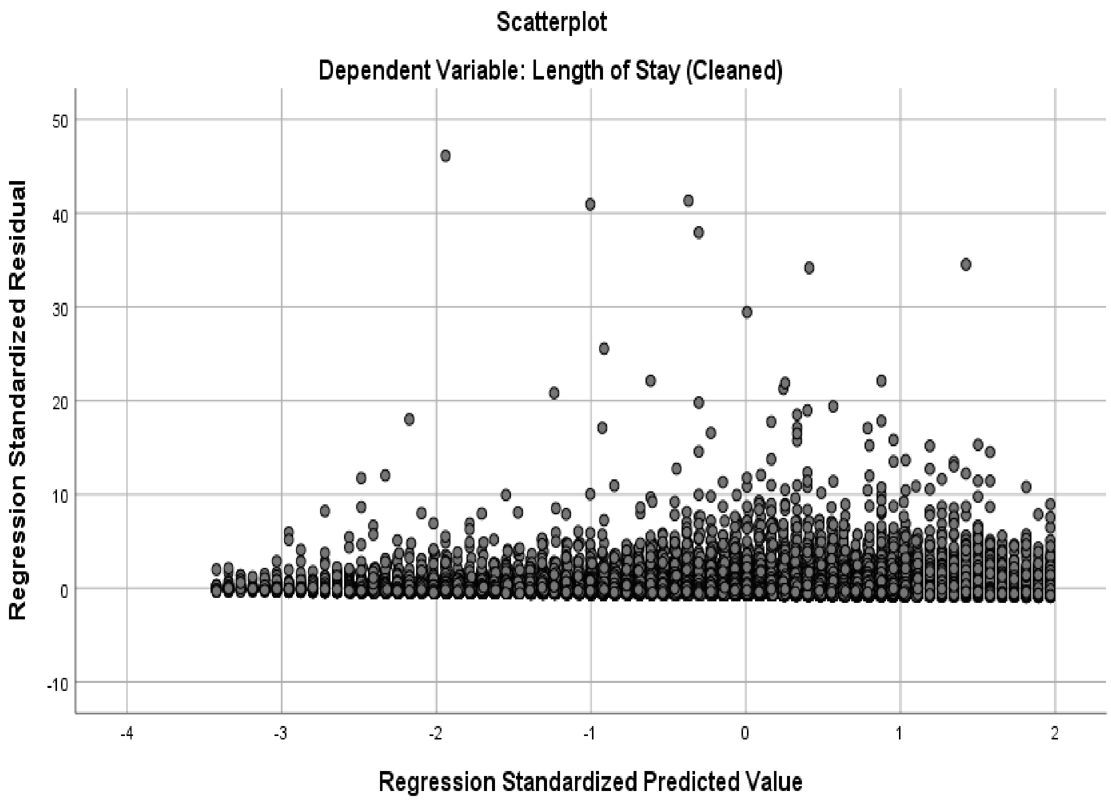

Figure 32 Scatterplot (LOS) for Falls on Same Level

After accepting all assumptions for length of stay, the final models for predictors for falls on same level are shown in Table 63 below.

Table 63 Predictors for Length of Hospital Stay for Falls on Same Level Patients

Predictors	B	Std. Error	Beta	t	*Sig.	95.0% Confidence Lower Bound	95.0% Confidence Upper Bound	Tolerance	VIF
(Constant)	2.570	0.128		20.070	0.000	2.319	2.821		
Age in Years at Admission	0.056	0.002	0.097	25.161	0.000	0.052	0.060	0.991	1.009
Indicator of Sex	-0.625	0.051	-0.047	12.262	0.000	-0.725	-0.525	0.991	1.009
Economic Status	-0.224	0.023	-0.038	-9.942	0.000	-0.269	-0.180	0.999	1.001

Collinearity diagnostics is used to determine multicollinearity. The **Variance Inflation Factor (VIF)** must result less than 2 or near 1 as an ideal result. All variables resulted less than 2. Moreover, the data shows no multicollinearity. Of the three independent factors are significant where age in years is the highest at 0.056 days, and indicator of sex and economic status factors in the regression model predict length of stay with negative 0.625 days and 0.224 days. The length of hospital stay for falls on same level = 2.57 (Constant) + 0.056 (Age in Years) -0.625 (Indicator of Sex) – 0.224 (Economic Status).

The Durbin-Watson value for Total Charges yielded 1.673, which is close to the ideal Durbin Watson value of 2.0. Table 64 below displays the results.

Table 64 Model Summary for Falls on Same Level (TOTCHG)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.099[a]	.010	.010	45702.558	1.673

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Total charges (Cleaned)

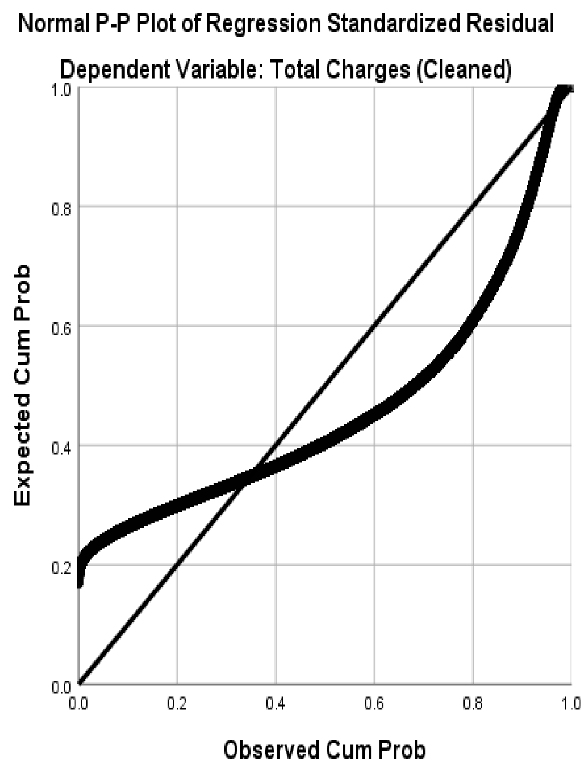

Figure 33 Normal P-P Plot of Regression Residual (TOTCHG) for Falls on Same Level

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 34, the scatterplot shows perfect residual distribution.

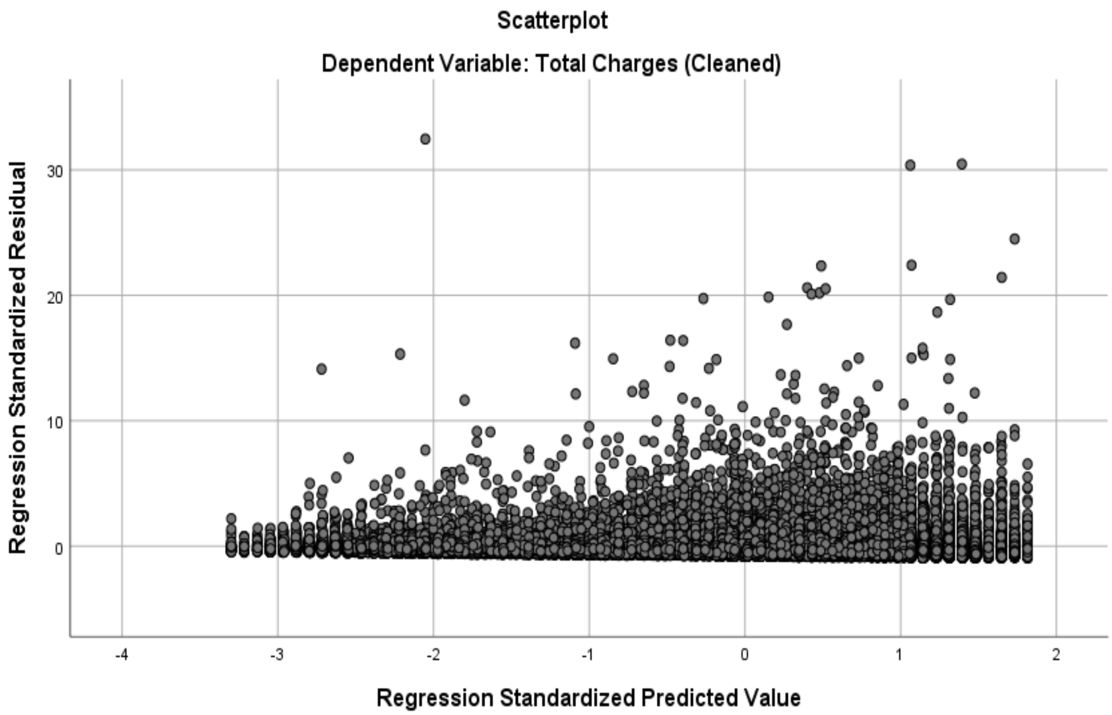

Figure 34 Scatterplot (TOTCHG) for Falls on Same Level

After accepting all assumptions for total charges, the final models for predictors for falls on same level are shown in Table 65 below.

Table 65 Predictors for Total Charges for Falls on Same Level Patients

Predictors	B	Std. Error	Beta	t	*Sig.	95.0% Confidence Lower Bound	95.0% Confidence Upper Bound	Tolerance	VIF
(Constant)	18220.714	905.744		20.117	0.000	16445.457	19995.971		
Age in Years at Admission	374.487	15.758	0.091	23.764	0.000	343.601	405.374	0.991	1.009
Indicator of Sex	-3652.985	360.484	-0.039	-10.134	0.000	-4359.533	-2946.437	0.991	1.009
Economic Status	785.066	159.621	0.019	4.918	0.000	472.209	1097.923	0.999	1.001

The VIF results must be less than 2 or near 1 as an ideal result. All variables resulted less than 2. All three factors are significant and economic status has the highest effects on total charges for falls on same level with $785.066. The factors related to reduction of total charges was indicator of sex, which is negative $3,652.985. The regression model to predict the total charges for falls on same level = 18,220.714 (Constant) + 374.487 (Age in Years) – 3,652.985 (Indicator of Sex) + 785.066 (Economic Status).

4.5.1 Age for Fracture of Upper Limbs

The patients were categorized into two groups, where younger group age was 18 to 30 years of age, and older age was 31 to 64 years of age. All other ages were excluded, because this range is the adult working age for work-related injuries. The total amount of patients with ECODE1= "E8190", was 7,049 patients where younger aged 18-30 years (37.4%) and older aged 31-64 years (62.6%), respectively, as shown in Table 66 below.

Table 66 Fracture of Upper Limbs Age Groups

Age Groups	Frequency	Percent
18-30	2634	37.4%
31-64	4415	62.6%
Total	7049	100.0%

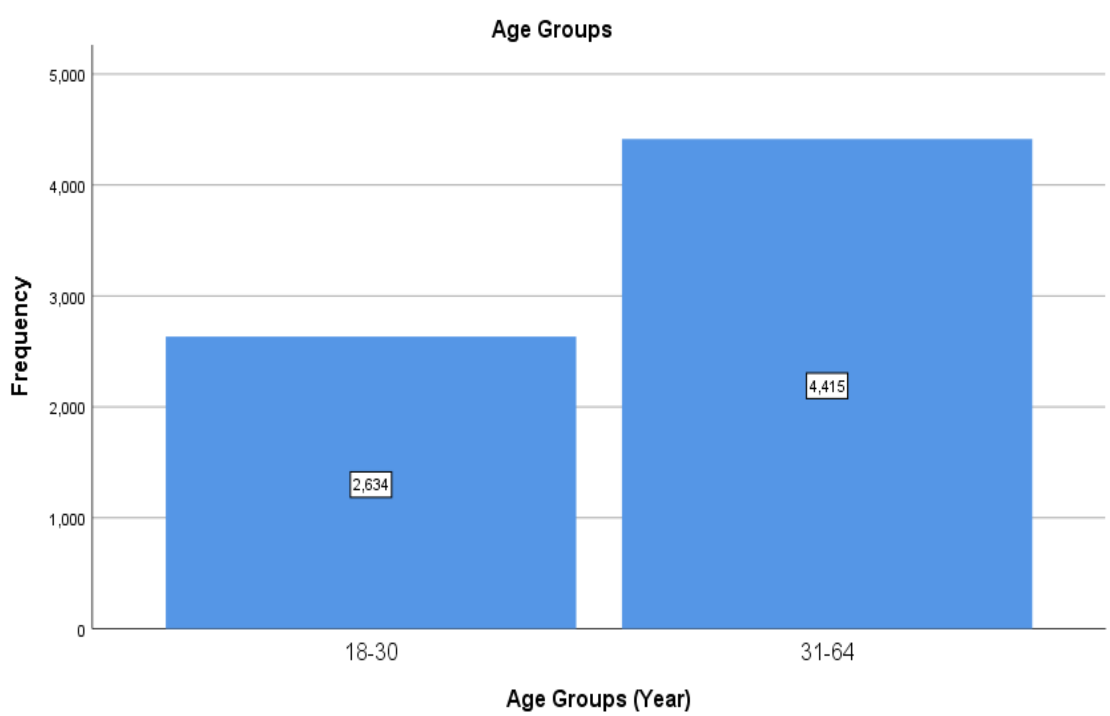

Figure 35 Age Groups of Fracture of Upper Limbs

4.5.2 Race for Fracture of Upper Limbs

White patients occupied the highest frequency for fracture of upper limbs at 60.6%, followed by Black patients at 12.6%, closely following Hispanic at 9.0%, and others as shown in Table 67.

Table 67 Fracture of Upper Limbs Race Groups

Race	Frequency	Percent
White	4270	60.6%
Black	909	12.9%
Hispanic	635	9.0%
Asian or Pacific Islander	61	0.9%
Native American	40	0.6%
Other	222	3.1%
Missing System	912	12.9%
Total	7049	100.0%

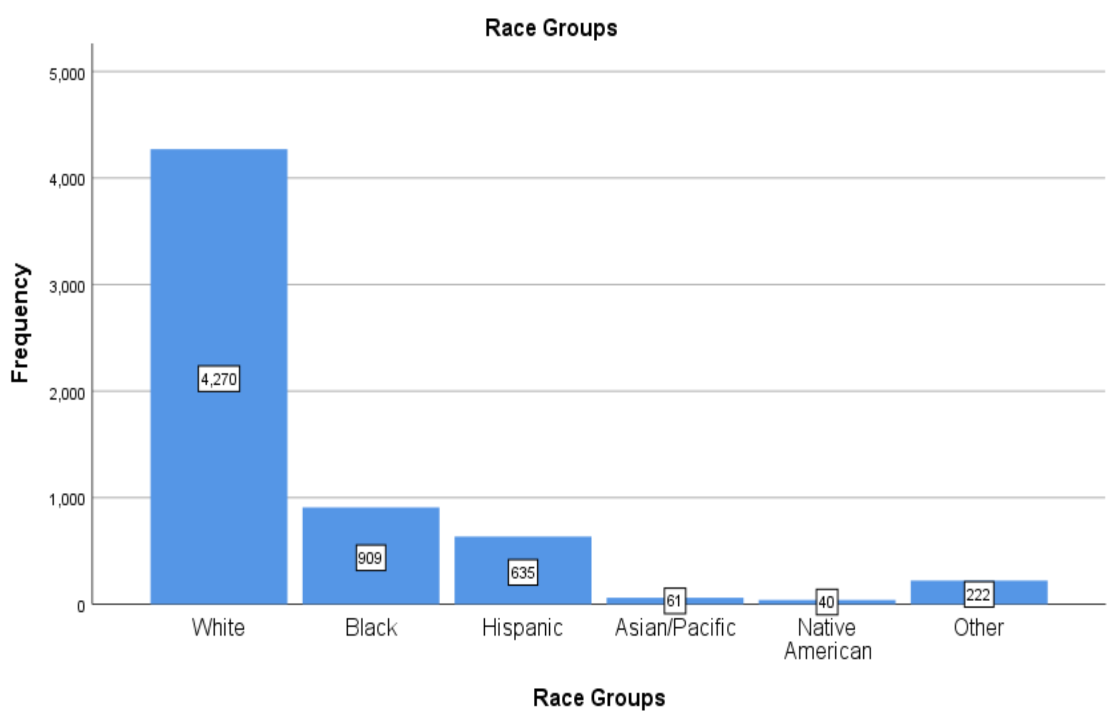

Figure 36 Frequency of Fracture of Upper Limbs Among Races

4.5.3 Gender for Fracture of Upper Limbs

Males showed higher frequency of fracture of upper limbs compared to females (63.3% vs 36.7%), as shown in Table 68.

Table 68 Gender for Fracture of Upper Limbs

Genders	Frequency	Percent
Male	4446	63.3%
Female	2579	36.7%
Total	7025	100.0%

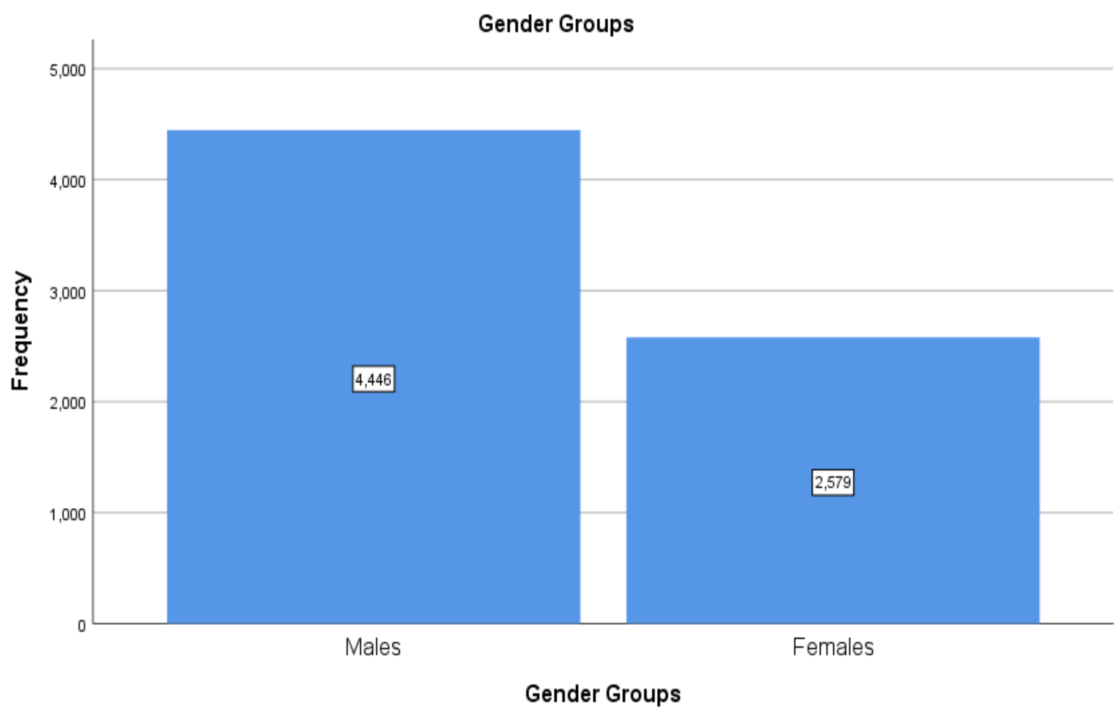

Figure 37 Frequency of Fracture of Upper Limbs Among Genders

4.5.4 Length of Stay and Total Charges of Fracture of Upper Limbs Patients

The mean for length of stay for patients with fracture of upper limbs was 5.79 with a standard deviation (±SD) of ±9.213. The mean for total charges was $60,845.95 with ±SD of ±92,556.524 as show in Table 69 below.

Table 69 Length of Stay and Total Charges of Fracture of Upper Limbs

Parameters	Mean	Median	±SD	Skewness	Kurtosis
Length of Hospital Stay (Days)	5.79	3.00	9.213	6.023	62.295
Total Costs ($)	60,845.95	32,589.00	92,556.524	5.558	49.660

4.5.5 Median Household Income

Four levels of median household income were observed in this study, which are 0-25th percentile, 26th to 50th percentile, 51st to 75th percentile, and 76th to 100th percentile. The percentages of median income for patients with fracture of upper limbs is the following: 35% (76th to 100th percentile), 26.5% (51st to 75th percentile), 22.4 (26th to 50th percentile), and 16.2% (0 to 25th percentile) respectively, as shown in Table 70. The 76th to 100th Percentile has the highest frequency for fracture of upper limbs patients.

Table 70 Median Household Income of Fracture of Upper Limbs Patients (Year 2011)

Levels of Household Income	Dollar Amount	Frequency	Percent
76th to 100th Percentile	$ 1 to $38,999	2403	35.0%
51st to 75th Percentile	$39,000 to $47,999	1818	26.5%
26th to 50th Percentile	$48,000 to $63,999	1535	22.4%
0 to 25th Percentile	$64,000 +	1109	16.2%
Total		6865	97.4%
Missing System		184	2.6%
Total Cumulation		7049	100.0%

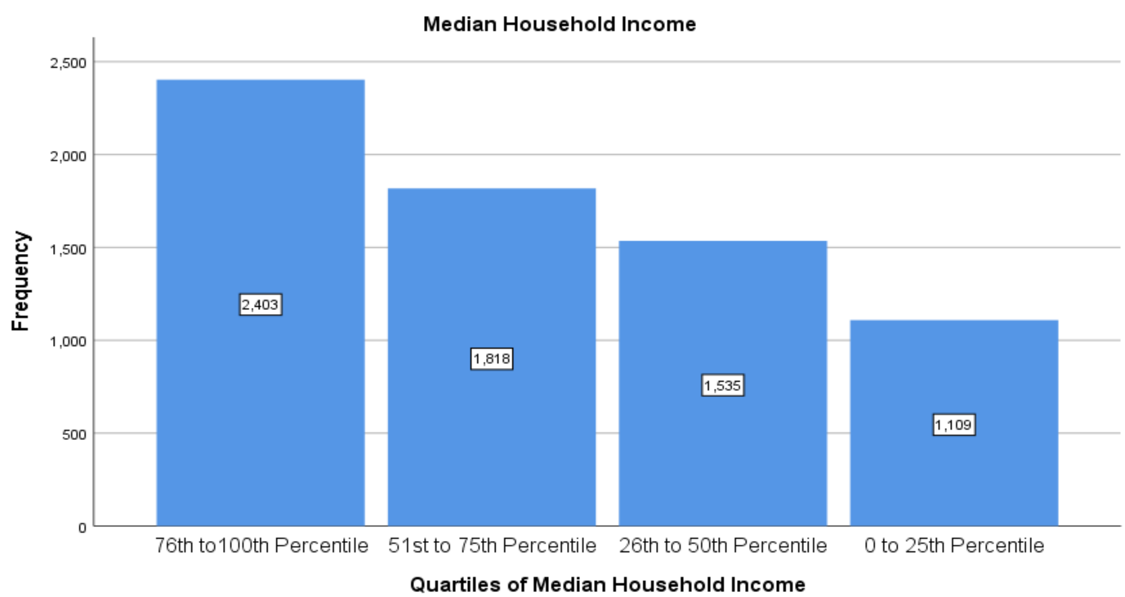

Figure 38 Median Household Income of Fracture of Upper Limbs Patients

4.5.6 Admission Day is a Weekend for Fracture of Upper Limbs Patients

The admission of the patient was admitted to the weekday at 66.4% versus the weekend at 33.6% respectively, as shown in Table 71.

Table 71 Admission Day is a Weekend for Fracture of Upper Limbs

Admission Day is a Weekend	Frequency	Percent
Weekday	4683	66.4%
Weekend	2366	33.6%
Total	7049	100.0%

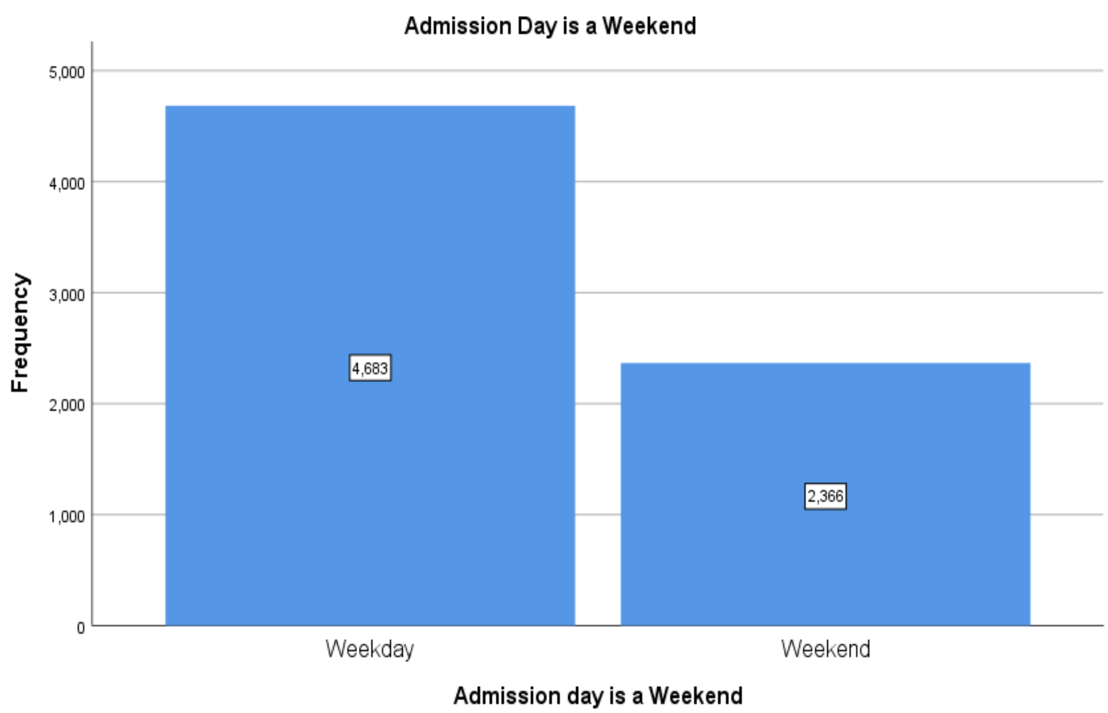

Figure 39 Admission Day is a Weekend for Fracture of Upper Limbs

4.5.7 Admission Month for Fracture of Upper Limbs Patients

The month of admission for fracture of upper limbs has more injuries during the month of October with 562 patients (8.9%) and February has the least patients with 459 (7.3%). Table 72 below describes the frequencies of injury per month.

Table 72 Admission Month for Fracture of Upper Limbs

Admission Month	Frequency	Percent
January	542	8.6%
February	459	7.3%
March	492	7.8%
April	527	8.3%
May	560	8.8%
June	486	7.7%
July	558	8.8%
August	542	8.6%
September	534	8.4%
October	562	8.9%
November	520	8.2%
December	549	8.7%
Total	6331	100.0%
Missing System	718	11.3%
Total Cumulation	7049	100.0%

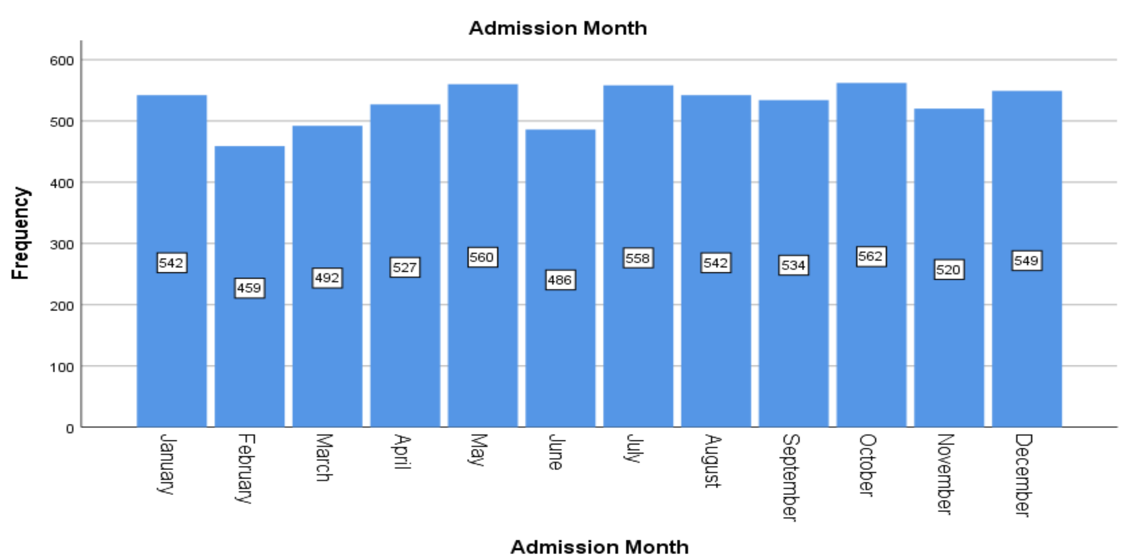

Figure 40 Month of Admission for Fracture of Upper Limbs

4.5.8 Region of Hospital for Fracture of Upper Limbs Patients

The region with the highest and lowest frequencies is the South at 55.4% (3,903 patients) versus the West at 10.8% (758 patients). Table 73 below describes all the region frequencies.

Table 73 Region of Hospital for Fracture of Upper Limbs

Region of Hospital	Frequency	Percent
Northeast	1369	19.4%
Midwest	1019	14.5%
South	3903	55.4%
West	758	10.8%
Total	7049	100.0%

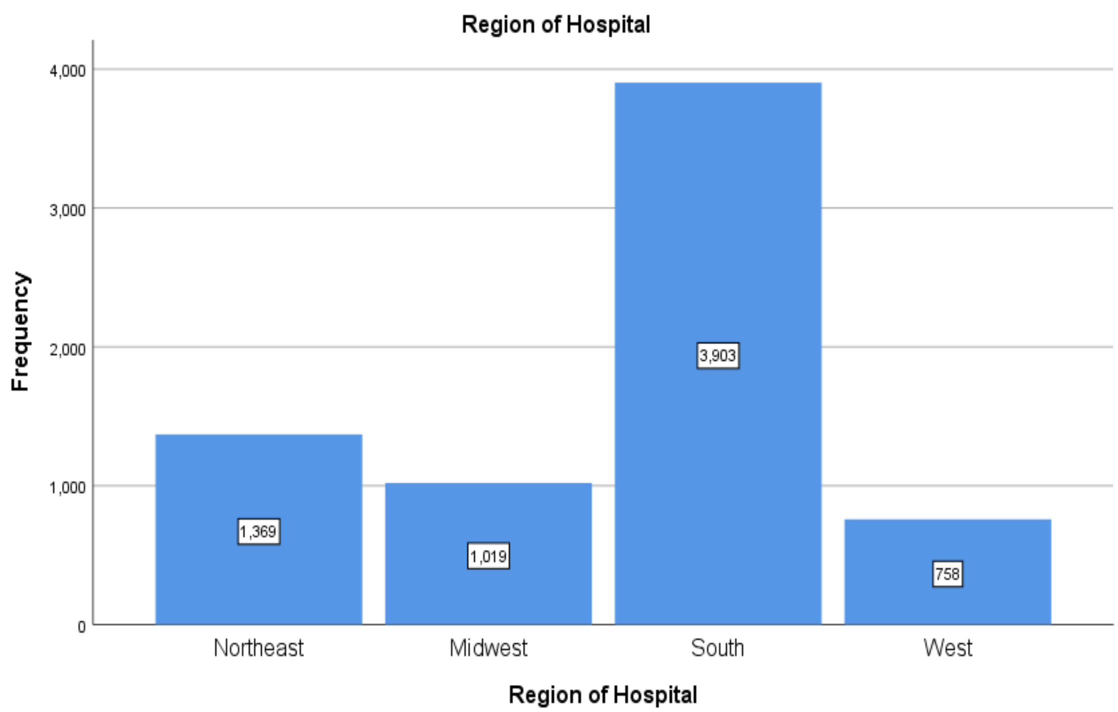

Figure 41 Region of Hospital for Fracture of Upper Limbs

4.5.9 Bivariate Pearson Correlation for Fracture of Upper Limbs Patients

The Bivariate Pearson Correlation shows significant correlation between indicator of sex and age groups and indicator of sex and race, and age groups and race with fracture of upper limbs. Indicator of sex and race and age groups and race have negative correlations, where one variable increases as the other variable decreases with the same magnitude. Indicator of sex and age groups has a positive correlation where both variables move in the same direction, as one increases the other increases or vice versa as one decreases the other decreases. Table 74 below describes the correlation of age groups, indicator of sex, and race with fracture of upper limbs.

Table 74 Bivariate Pearson Correlation for Fracture of Upper Limbs Patients

Correlations

		Age Groups	Indicator of Sex	Race (Uniform)
Age Groups	Pearson Correlation	1	.027*	-.080**
	Sig. (2-tailed)		.026	.000
	N	7049	7025	6137
Indicator of Sex	Pearson Correlation	.027*	1	-.032*
	Sig. (2-tailed)	.026		.013
	N	7025	7025	6128
Race (Uniform)	Pearson Correlation	-.080**	-.032*	1
	Sig. (2-tailed)	.000	.013	
	N	6137	6128	6137

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

4.5.10 Chi-Square Test Race & Economic Status

The case processing summary counts 5,982 with 1,067 cases missing. Table 75 describes the case summary.

Table 75 Case Processing Summary Race & Economic Status for Fracture of Upper Limbs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Median Household Income	5982	84.9%	1067	15.1%	7049	100.0%

The crosstabulation for race and economic status shows the expected count versus the actual count for each race and median household income quartiles 1 through 4 in Table 76 shown below.

Table 76 Race and Economic Status Crosstabulation for Fracture of Upper Limbs

Race (Uniform) * Median Household Income Crosstabulation

			Median Household Income Quartile for Patients				
			1	2	3	4	Total
Race (Uniform)	White	Count	1330	1142	935	760	4167
		Expected Count	1419.6	1099.2	943.9	704.3	4167.0
	Black	Count	405	220	157	100	882
		Expected Count	300.5	232.7	199.8	149.1	882.0
	Hispanic	Count	211	150	183	78	622
		Expected Count	211.9	164.1	140.9	105.1	622.0
	Asian/ Pacific	Count	6	15	18	20	59
		Expected Count	20.1	15.6	13.4	10.0	59.0
	Native American	Count	17	8	7	5	37
		Expected Count	12.6	9.8	8.4	6.3	37.0
	Other	Count	69	43	55	48	215
		Expected Count	73.2	56.7	48.7	36.3	215.0
Total		Count	2038	1578	1355	1011	5982
		Expected Count	2038.0	1578.0	1355.0	1011.0	5982.0

The Chi-Square Tests has a Pearson Chi-Square value of 127.026 and degrees of freedom (df) of 15 with significance equaling 0.000. See Table 77 of the Chi-Square Tests.

Table 77 Chi-Square Tests for Fracture of Upper Limbs (Race & Economic Status)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	127.026[a]	15	.000
Likelihood Ratio	127.102	15	.000
Linear-by-Linear Association	.025	1	.874
N of Valid Cases	5982		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.25.

The Cramer's V values of 0.084 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 78 below as shown.

Table 78 Symmetric Measure for Fracture of Upper Limbs (Race & Economic Status)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.084	.000
N of Valid Cases		5992	

4.5.11 Chi-Square Test Race & Region of Hospital

The case processing summary counts 6,137 with 912 cases missing in Table 79 below.

Table 79 Case Processing Summary Race & Region of Hospital for Fracture of Upper Limbs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Region of Hospital	6137	87.1%	912	12.9%	7049	100.0%

The crosstabulation for race and region shows the expected count versus the actual count for each race and regions 1 through 4 in Table 80.

Table 80 Race and Region of Hospital Crosstabulation for Fracture of Upper Limbs

Race (Uniform) * Region of Hospital Crosstabulation

			Region of Hospital				Total
			1	2	3	4	
Race (Uniform)	White	Count	941	533	2433	363	4270
		Expected Count	915.0	486.4	2409.5	459.2	4270.0
	Black	Count	182	92	578	57	909
		Expected Count	194.8	103.5	512.9	97.8	909.0
	Hispanic	Count	119	26	303	187	635
		Expected Count	136.1	72.3	358.3	68.3	635.0
	Asian/ Pacific	Count	16	3	21	21	61
		Expected Count	13.1	6.9	34.4	6.6	61.0
	Native American	Count	4	18	12	6	40
		Expected Count	8.6	4.6	22.6	4.3	40.0
	Other	Count	53	27	116	26	222
		Expected Count	47.6	25.3	125.3	23.9	222.0
Total		Count	1315	699	3463	660	6137
		Expected Count	1315.0	699.0	3463.0	660.0	6137.0

The Chi-Square Tests has a Pearson Chi-Square value of 388.938 and degrees of freedom (df) of 15 with significance equaling 0.000 in Table 81 below.

Table 81 Chi-Square Tests for Fracture of Upper Limbs (Race & Region)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	388.938[a]	15	.000
Likelihood Ratio	310.543	15	.000
Linear-by-Linear Association	19.101	1	.000
N of Valid Cases	6137		

a. 2 cells (8.3%) have expected count less than 5. The minimum expected count is 4.30.

The Cramer's V values of 0.145 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 82 below as shown.

Table 82 Symmetric Measure for Fracture of Upper Limbs (Race & Region)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.145	.000
N of Valid Cases		6137	

4.5.12 Multiple Linear Regression for Length of Stay and Total Charges

The Multiple Linear Regression method is used to find the predictors of length of hospital stay and total charges for fracture of upper limbs patients. The Durbin Watson (DW) statistic yielded at 1.780 DW as shown in Table 83.

Table 83 Model Summary for Fracture of Upper Limbs

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.093[a]	.009	.008	9.175	1.780

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years in Admission

b. Dependent Variable: Length of Stay (Cleaned)

There is a significant relationship between dependent and independent variables.

The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 42.

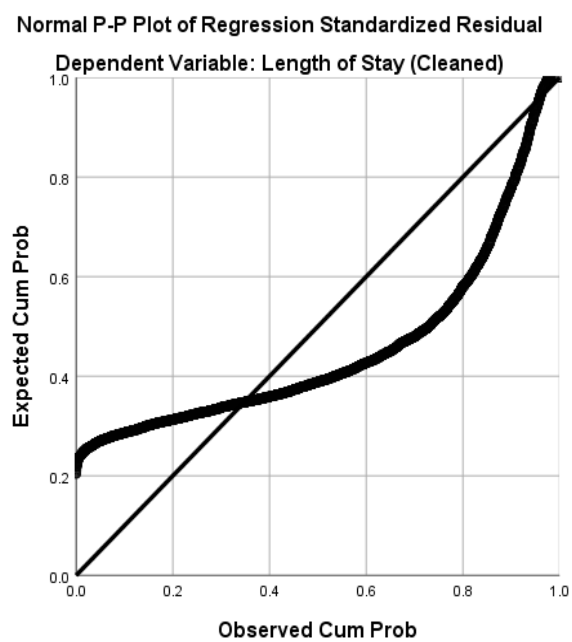

Figure 42 Normal P-P Plot of Regression Residual (LOS) Fracture of Upper Limbs

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 43 below, the scatterplot shows perfect residual distribution.

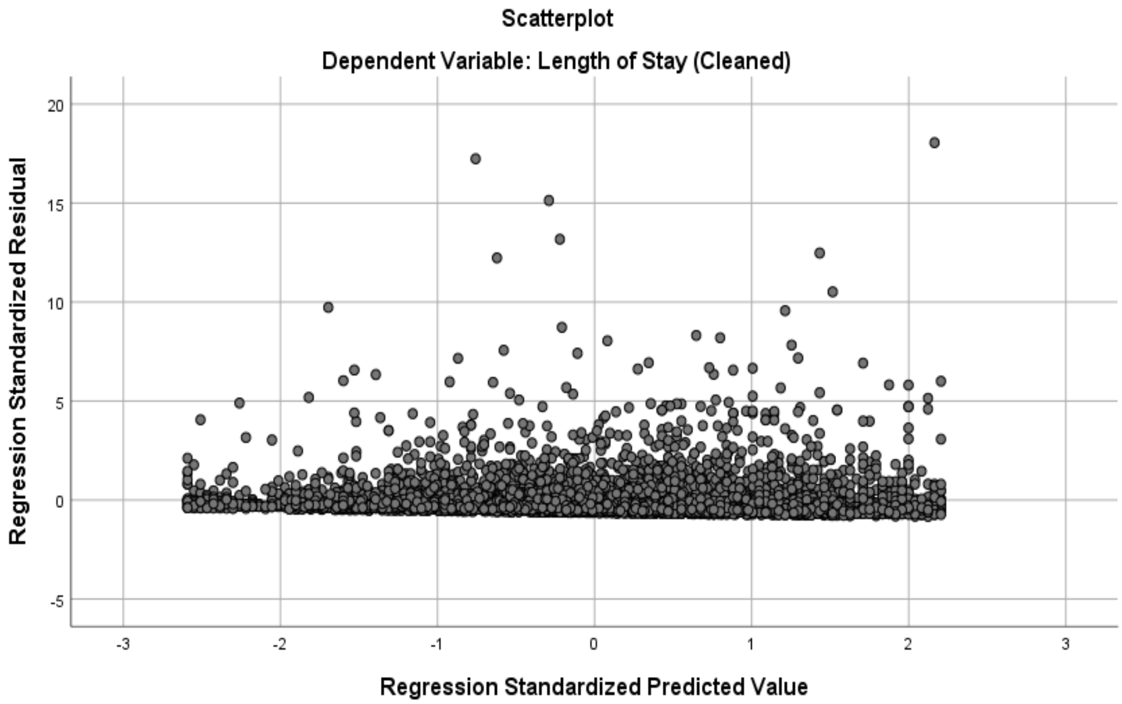

Figure 43 Scatterplot (LOS) for Fracture of Upper Limbs

After accepting all assumptions for length of stay, the final models for predictors for fracture of upper limbs are shown in Table 84 below.

Table 84 Predictors for Length of Hospital Stay for Fracture of Upper Limbs Patients

Predictors	B	Std. Error	Beta	t	*Sig.	95.0% Confidence Lower Bound	95.0% Confidence Upper Bound	Tolerance	VIF
(Constant)	5.996	0.398		15.050	0.000	5.215	6.777		
Age in Years at Admission	0.035	0.008	0.051	4.270	0.000	0.019	0.051	0.998	1.002
Indicator of Sex	-0.818	0.230	-0.043	-3.553	0.000	-1.270	-0.367	0.998	1.002
Economic Status	-0.561	0.102	-0.066	-5.489	0.000	-0.761	-0.360	0.998	1.002

Collinearity diagnostics is used to determine multicollinearity. The **Variance Inflation Factor (VIF)** must result less than 2 or near 1 as an ideal result. All variables resulted less than 2. Moreover, the data shows no multicollinearity. Of the three independent factors, age in years is the highest value at 0.035 days, and indicator of sex and economic status factors in the regression model predict length of stay with negative 0.818 days and 0.561 days. Also, all three factors have significance in predicting the length of stay for fracture of upper limbs patience. The length of hospital stay for fracture of upper limbs = 5.996 (Constant) + 0.035 (Age in Years) -0.818 (Indicator of Sex) – 0.561 (Economic Status).

The Durbin-Watson value for Total Charges yielded 1.711, which is close to the ideal Durbin Watson value of 2.0. Table 85 below displays the results.

Table 85 Model Summary for Fracture of Upper Limbs (TOTCHG)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.048[a]	.002	.002	92468.458	1.711

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Total charges (Cleaned)

There is a significant relationship between dependent and independent variables.

The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 44.

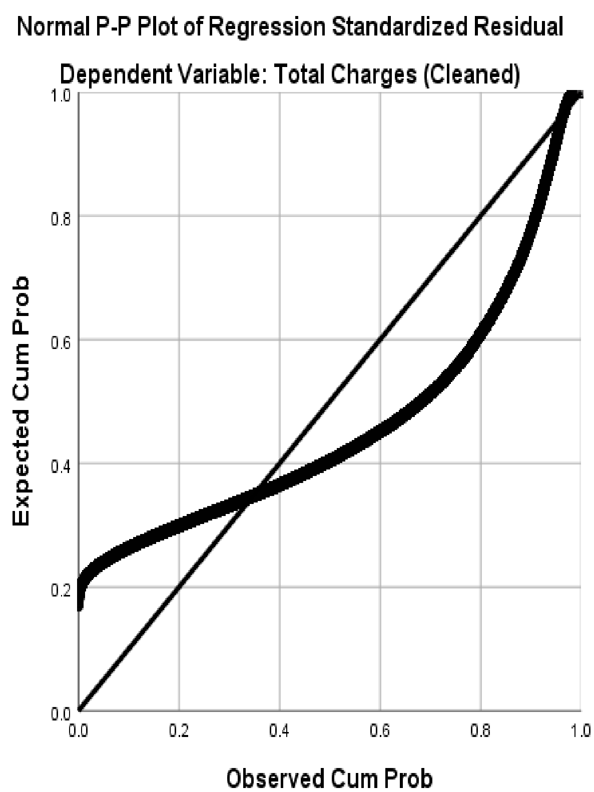

Figure 44 Normal P-P Plot of Regression Residual (TOTCHG) Fracture of Upper Limbs

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 45, the scatterplot shows residuals forming two clusters on the left and right side of the 0.0 axis that has values from lower to higher grouped together. The model did not violate the assumptions of homoscedasticity.

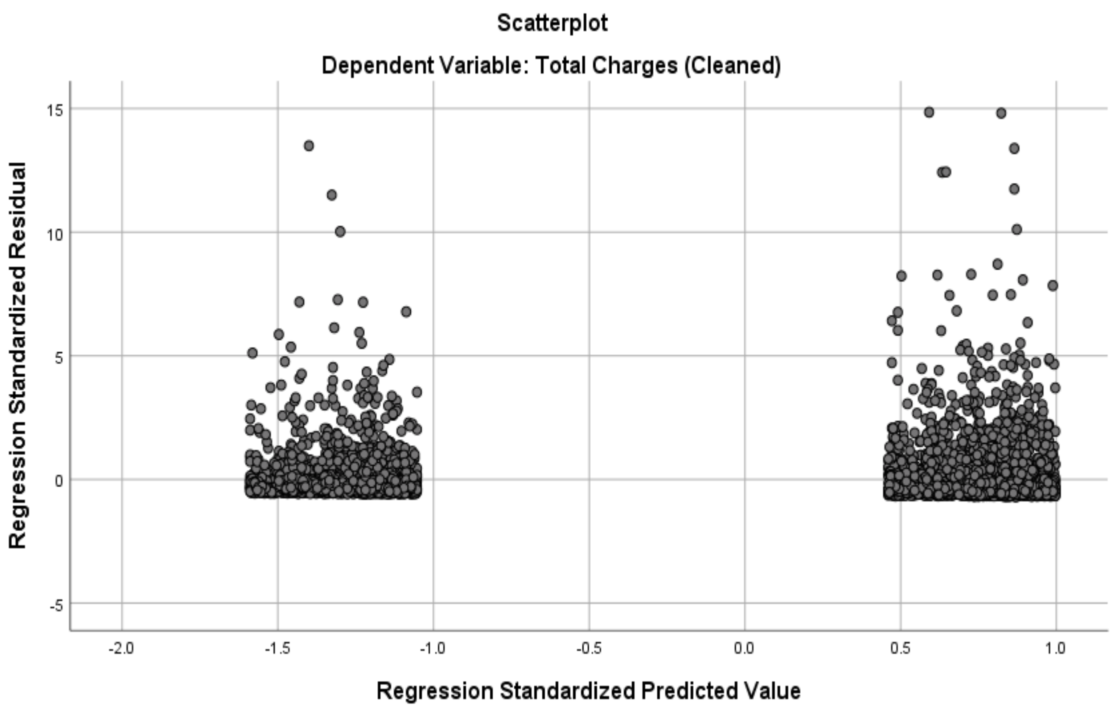

Figure 45 Scatterplot (TOTCHG) for Fracture of Upper Limbs

After accepting all assumptions for total charges, the final models for predictors for fracture of upper limbs are shown in Table 86 below.

Table 86 Predictors for Total Charges for Fracture of Upper Limbs Patients

Predictors	B	Std. Error	Beta	t	*Sig.	95.0% Confidence Lower Bound	95.0% Confidence Upper Bound	Tolerance	VIF
(Constant)	64740.709	4024.969		16.085	0.000	56850.511	72630.907		
Age in Years at Admission	17.237	82.679	0.002527	0.208	0.835	-144.839	179.313	0.998	1.002
Indicator of Sex	-9179.072	2326.789	-0.04781	-3.945	0.000	-13740.306	-4617.839	0.998	1.002
Economic Status	-535.892	1032.189	-0.006	-0.519	0.604	-2559.306	1487.521	0.998	1.002

The VIF results must be less than 2 or near 1 as an ideal result. All variables resulted less than 2. Indicator of sex is a significant factor in reducing the total charges for fracture of upper limbs with negative $ 9,179.072. The total charges of fracture of upper limbs = 64,740.709 (Constant) + 17.237 (Age in Years) – 9,179.072 (Indicator of Sex) – 535.892 (Economic Status).

4.6.1 Age for Heat Stress

The patients were categorized into two age groups, where younger age was 18 to 30 years of age, and older age was 31 to 64 years of age. All other ages were excluded, because this range is the adult working age for work-related injuries[60,67,69]. The total amount of patients with ECODE1= "E9000" was 3,373 patients where younger aged 18-30 years (18.8%) and older aged 31-64 years (81.2%), respectively, as shown in Table 87 below.

Table 87 Heat Stress Age Groups

Age Groups	Frequency	Percent
18-30	634	18.8%
31-64	2739	81.2%
Total	3373	100%

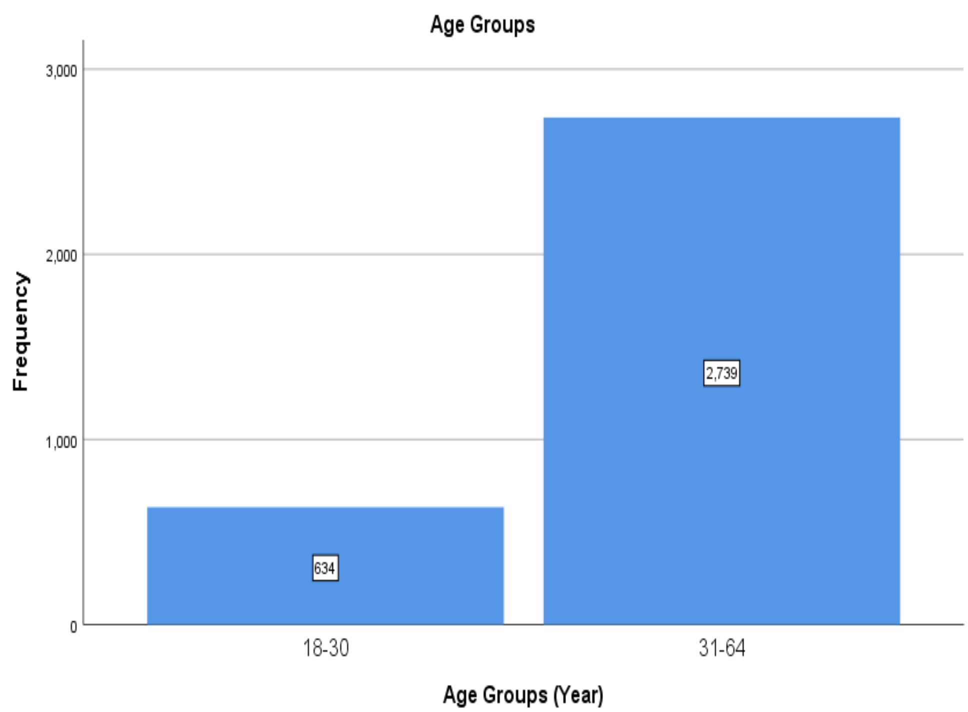

Figure 46 Age Groups of Heat Stress

4.6.2 Race for Heat Stress

White patients occupied the highest frequency for heat stress at 55.5%, followed by Black patients at 20.6%, closely following Hispanic at 12.6%, and others as shown in Table 88.

Table 88 Heat Stress Race Groups

Race	Frequency	Percent
White	1873	55.5%
Black	696	20.6%
Hispanic	426	12.6%
Asian or Pacific Islander	25	0.7%
Native American	38	1.1%
Other	85	2.5%
Missing System	230	6.8%
Total	3373	100.0%

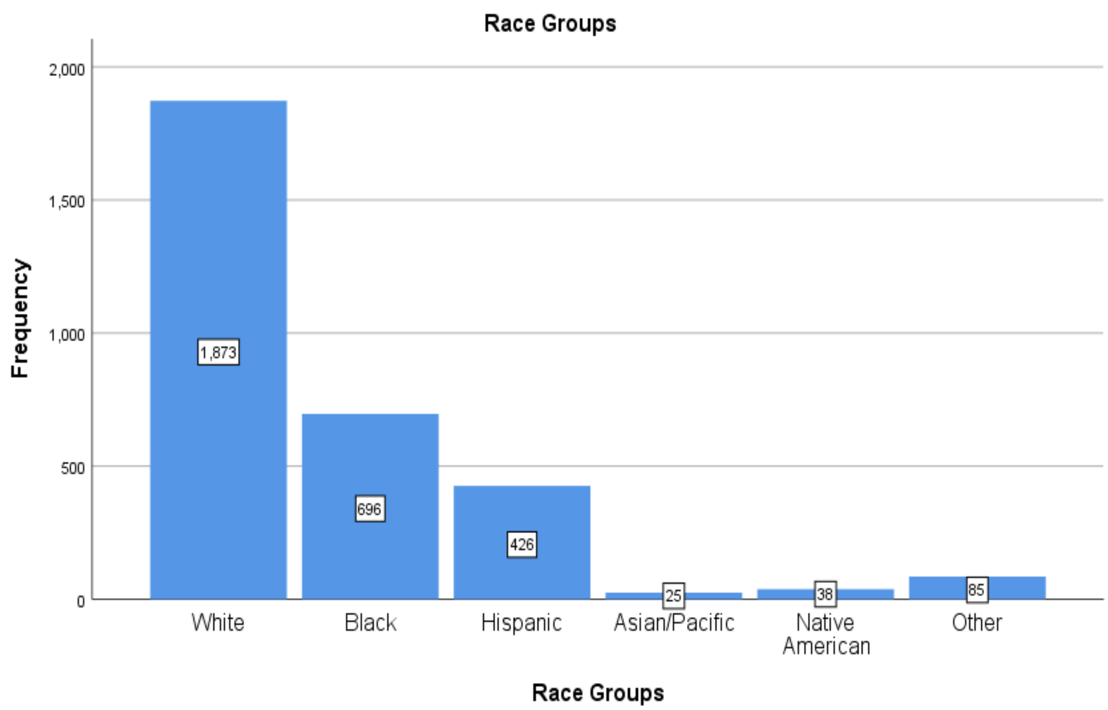

Figure 47 Frequency of Heat Stress Among Races

4.6.3 Gender for Heat Stress

Males showed higher frequency of heat stress compared to females (84.9% vs 15.1%), as shown in Table 89 below.

Table 89 Frequency of Heat Stress between Genders

Genders	Frequency	Percent
Male	2862	84.9%
Female	511	15.1%
Total	3373	100.0%

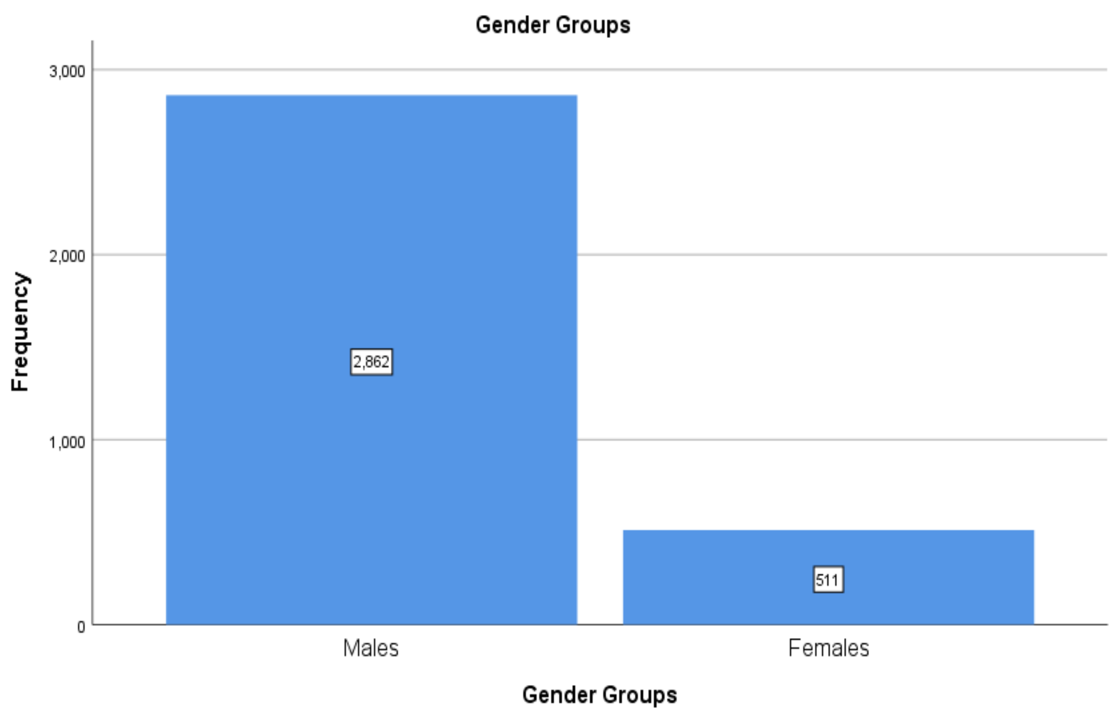

Figure 48 Frequency of Heat Stress Among Genders

4.6.4 Length of Stay and Total Charges of Heat Stress Patients

The mean for length of stay for patients with heat stress was 2.76 with a standard deviation (±SD) of ±4.729. The mean for total charges was $20,799.81 with ±SD of ±49,378.17 as shown in Table 90 below.

Table 90 Length of Stay and Total Charges of Heat Stress

Parameters	Mean	Median	±SD	Skewness	Kurtosis
Length of Hospital Stay (Days)	2.76	2.00	4.729	11.595	201.448
Total Costs ($)	20,799.81	11,332.50	49,378.17	21.434	735.820

4.6.5 Median Household Income

Four levels of median household income were observed in this study, which are 0-25th percentile, 26th to 50th percentile, 51st to 75th percentile, and 76th to 100th percentile. The percentages of median income for patients with heat stress is the following: 40.7% (76th to 100th percentile), 27.7% (51st to 75th percentile), 18.4% (26th to 50th percentile), and 13.1% (0 to 25th percentile) respectively, as shown in Table 91. The 76th to 100th Percentile has the highest frequency for heat stress patients.

Table 91 Median Household Income of Heat Stress Patients (Year 2011)

Levels of Household Income	Dollar Amount	Frequency	Percent
76th to 100th Percentile	$ 1 to $38,999	1317	40.7%
51st to 75th Percentile	$39,000 to $47,999	896	27.7%
26th to 50th Percentile	$48,000 to $63,999	596	18.4%
0 to 25th Percentile	$64,000 +	425	13.1%
Total		3234	95.9%
Missing System		139	4.1%
Total Cumulation		3373	100.0%

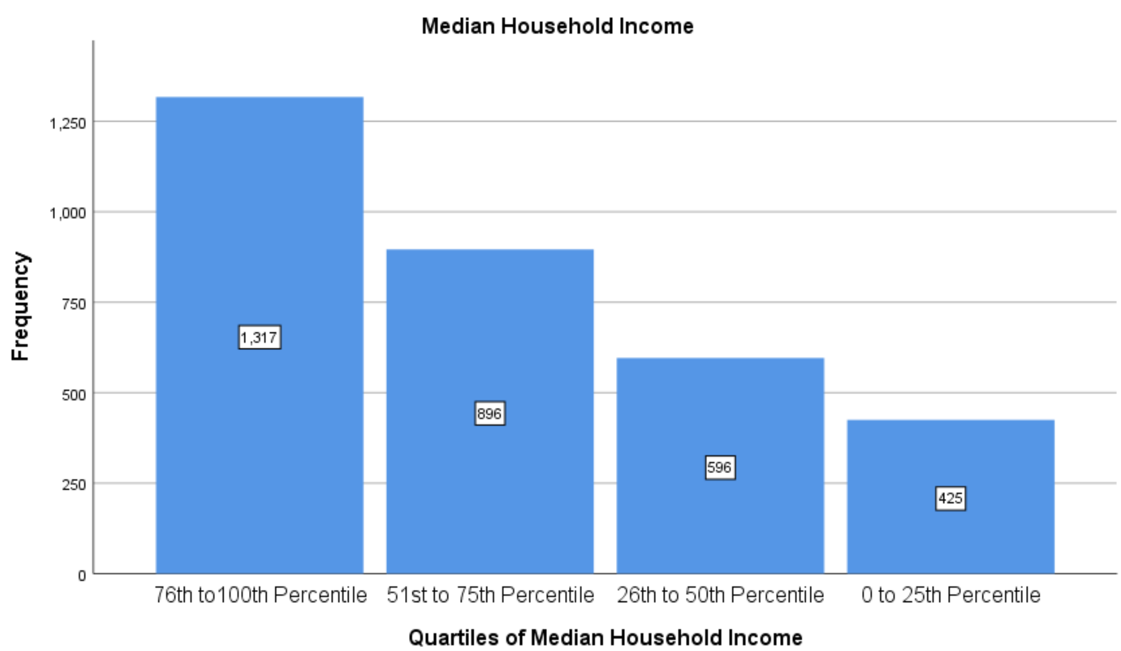

Figure 49 Median Household Income of Heat Stress Patients

4.6.6 Admission Day is a Weekend for Heat Stress Patients

The admission of the patient was admitted to the weekday at 74.1% versus the weekend at 25.9% respectively, as shown in Table 92.

Table 92 Admission Day is a Weekend for Heat Stress

Admission Day is a Weekend	Frequency	Percent
Weekday	2499	74.1%
Weekend	874	25.9%
Total	3373	100.0%

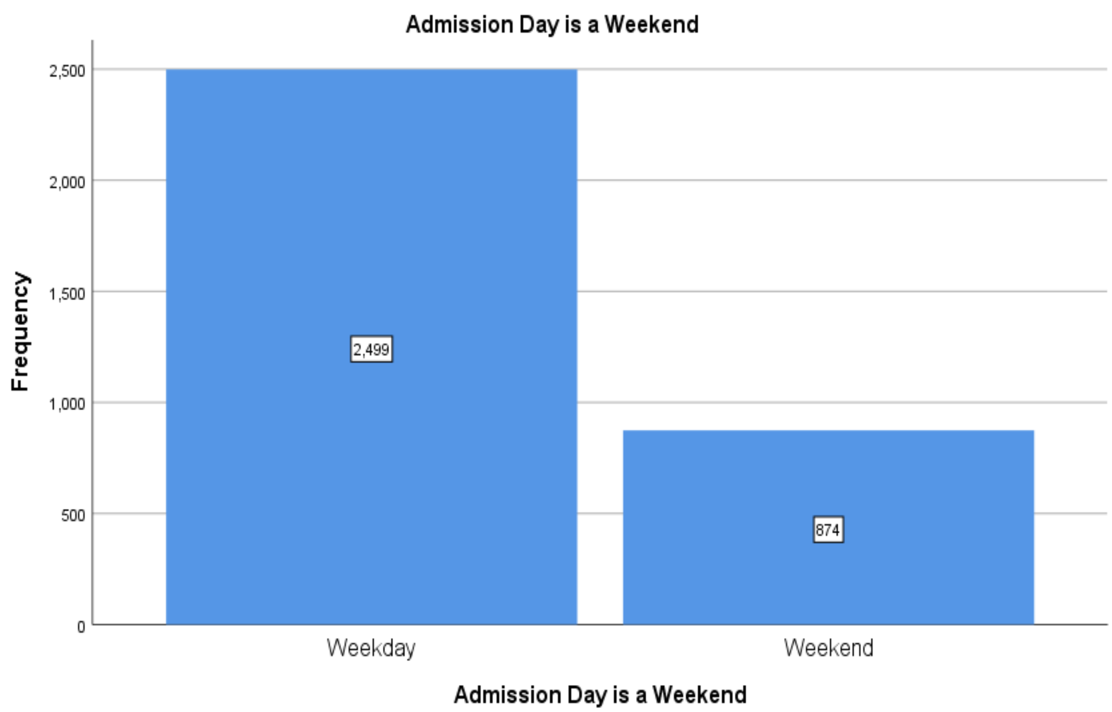

Figure 50 Admission Day is a Weekend for Heat Stress

4.6.7 Admission Month for Heat Stress Patients

The month of admission for heat stress has more injuries during the month of July with 1,078 patients (17.0%) and the winter months December, January, and February have the least patients with 2 each (0.0%). Table 93 below describes the frequencies of injury per month.

Table 93 Admission Month for Heat Stress

Admission Month	Frequency	Percent
January	2	0.0%
February	2	0.0%
March	10	0.2%
April	46	0.7%
May	160	2.5%
June	744	11.8%
July	1078	17.0%
August	743	11.7%
September	158	2.5%
October	21	0.3%
November	10	0.2%
December	2	0.0%
Total	6331	100.0%
Missing System	718	11.3%
Total Cumulation	7049	100.0%

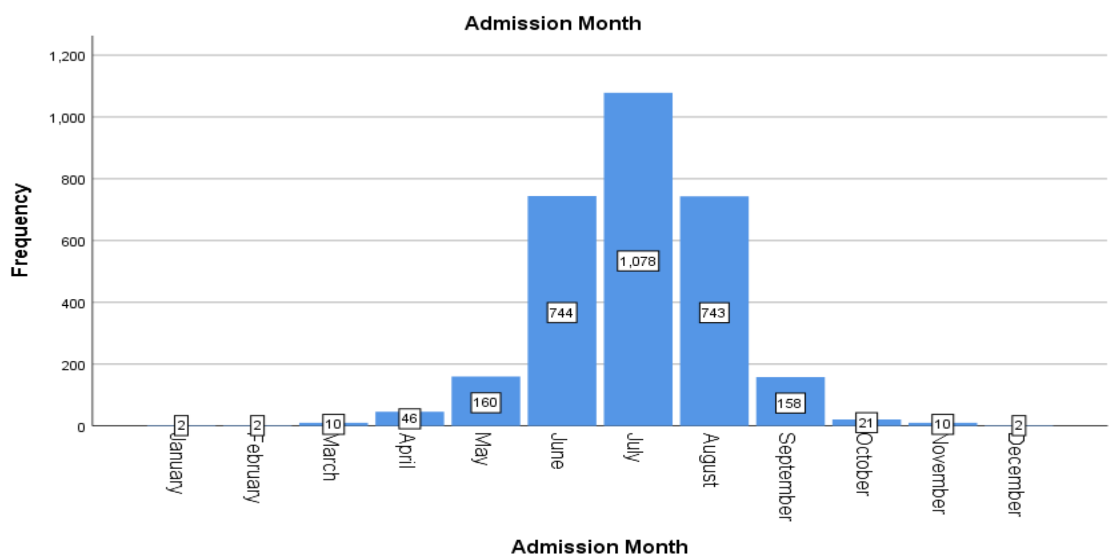

Figure 51 Month of Admission for Heat Stress

4.6.8 Region of Hospital for Heat Stress Patients

The region with the highest and lowest frequencies is the South at 60.8% (2,051 patients) versus the Northeast at 8.9% (301 patients). Table 94 below describes all the region frequencies.

Table 94 Region of Hospital for Heat Stress

Region of Hospital	Frequency	Percent
Northeast	301	8.9%
Midwest	545	16.2%
South	2051	60.8%
West	476	14.1%
Total	3373	100.0%

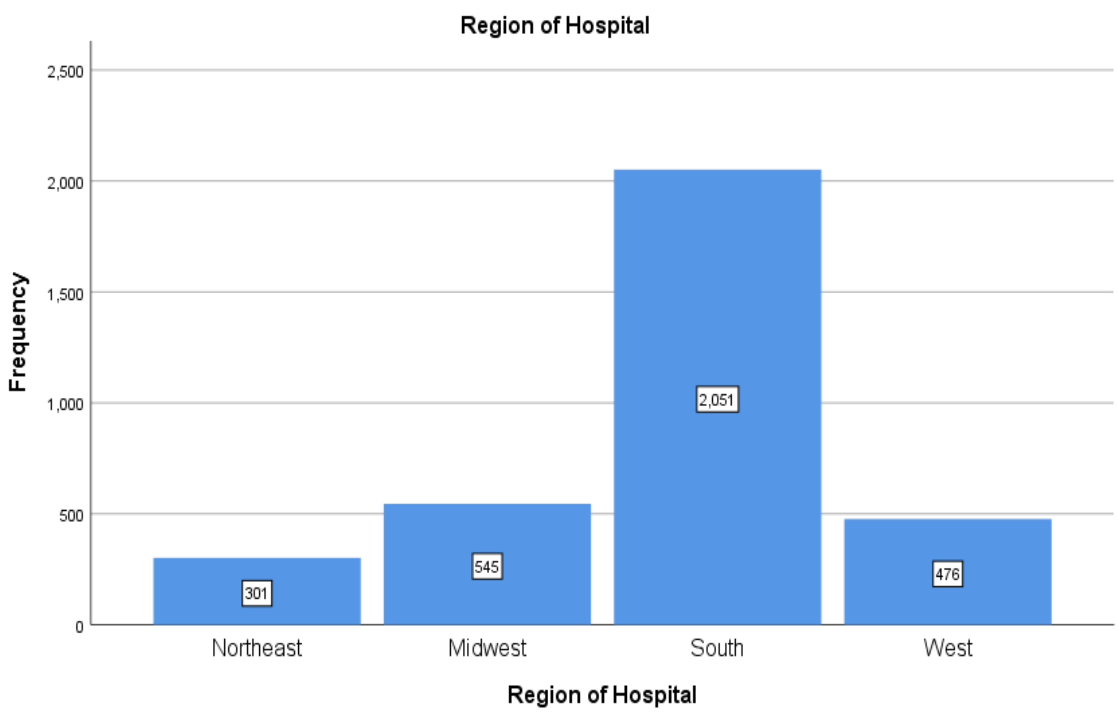

Figure 52 Region of Hospital for Heat Stress

4.6.9 Bivariate Pearson Correlation for Heat Stress Patients

The Bivariate Pearson Correlation shows significant correlation between indicator of sex and race and age groups and race with Heat Stress patients. There is a negative correlation between: indicator of sex and race, and age groups and race. Whereas one variable increases as the other variable decreases with the same magnitude. Table 95 below describes the correlation of age groups, indicator of sex, and race with Heat Stress patients.

Table 95 Bivariate Pearson Correlation for Heat Stress Patients

Correlations

		Age Groups	Indicator of Sex	Race (Uniform)
Age Groups	Pearson Correlation	1	.148**	-.137**
	Sig. (2-tailed)		.000	.000
	N	3373	3373	3143
Indicator of Sex	Pearson Correlation	.148**	1	-.002
	Sig. (2-tailed)	.000		.889
	N	3373	3373	3143
Race (Uniform)	Pearson Correlation	-.137**	-.002	1
	Sig. (2-tailed)	.000	.889	
	N	3143	3143	3143

**. Correlation is significant at the 0.01 level (2-tailed).

4.6.10 Chi-Square Test Race & Economic Status

The case processing summary counts 3,006 with 367 cases missing. Table 96 below describes the case summary.

Table 96 Case Processing Summary Race & Economic Status for Heat Stress

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Median Household Income	3006	89.1%	367	10.9%	3373	100.0%

The crosstabulation for race and economic status shows the expected count versus the actual count for each race and median household income quartiles 1 through 4 in Table 97 below.

Table 97 Race and Economic Status Crosstabulation for Heat Stress

Race (Uniform) * Median Household Income Crosstabulation

			Median Household Income Quartile for Patients				
			1	2	3	4	Total
Race (Uniform)	White	Count	615	535	385	276	1811
		Expected Count	742.2	492.8	337.4	238.6	1811.0
	Black	Count	395	150	76	49	670
		Expected Count	274.6	182.3	124.8	88.3	670.0
	Hispanic	Count	157	109	73	51	390
		Expected Count	159.8	106.1	72.7	51.4	390.0
	Asian/ Pacific	Count	8	7	3	6	24
		Expected Count	9.8	6.5	4.5	3.2	24.0
	Native American	Count	23	3	5	3	34
		Expected Count	13.9	9.3	6.3	4.5	34.0
	Other	Count	34	14	18	11	77
		Expected Count	31.6	21.0	14.3	10.1	77.0
Total		Count	1232	818	560	396	3006
		Expected Count	1232.0	818.0	560.0	396.0	3006.0

The Chi-Square Tests has a Pearson Chi-Square value of 151.029 and degrees of freedom (df) of 15 with significance equaling 0.000. See Table 98 below of Chi-Square Test.

Table 98 Chi-Square Tests for Heat Stress (Race & Economic Status)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	151.029[a]	15	.000
Likelihood Ratio	152.649	15	.000
Linear-by-Linear Association	17.558	1	.000
N of Valid Cases	3006		

a. 3 cells (12.5%) have expected count less than 5. The minimum expected count is 3.16.

The Cramer's V values of 0.129 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 99 below as shown.

Table 99 Symmetric Measure for Heat Stress (Race & Economic Status)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.129	.000
N of Valid Cases		3006	

4.6.11 Chi-Square Test Race & Region of Hospital

The case processing summary counts 3,143 with 230 cases missing. Table 100 below describes the case summary.

Table 100 Case Processing Summary Race & Region of Hospital for Heat Stress

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Region of Hospital	3143	93.2%	230	6.8%	3373	100.0%

The crosstabulation for race and region shows the expected count versus the actual count for each race and regions 1 through 4 in Table 101.

Table 101 Race and Region of Hospital Crosstabulation for Heat Stress

Race (Uniform) * Region of Hospital Crosstabulation

			Region of Hospital				Total
			1	2	3	4	
Race (Uniform)	White	Count	189	334	1119	231	1873
		Expected Count	176.4	264.0	1163.3	269.4	1873.0
	Black	Count	63	76	510	47	696
		Expected Count	65.5	98.1	432.3	100.1	696.0
	Hispanic	Count	26	15	241	144	426
		Expected Count	40.1	60.0	264.6	61.3	426.0
	Asian/ Pacific	Count	4	0	11	10	25
		Expected Count	2.4	3.5	15.5	3.6	25.0
	Native American	Count	0	3	25	10	38
		Expected Count	3.6	5.4	23.6	5.5	38.0
	Other	Count	14	15	46	10	85
		Expected Count	8.0	12.0	52.8	12.2	85.0
Total		Count	296	443	1952	452	3143
		Expected Count	296.0	443.0	1952.0	452.0	3143.0

The Chi-Square Tests has a Pearson Chi-Square value of 258.820 and degrees of freedom (df) of 15 with significance equaling 0.000. See Table 102 below of Chi-Square Test.

Table 102 Chi-Square Tests for Heat Stress (Race & Region)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	258.820[a]	15	.000
Likelihood Ratio	250.578	15	.000
Linear-by-Linear Association	31.826	1	.000
N of Valid Cases	3143		

a. 4 cells (16.7%) have expected count less than 5. The minimum expected count is 2.35.

The Cramer's V values of 0.166 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 103 below as shown.

Table 103 Symmetric Measure for Heat Stress (Race & Region)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.166	.000
N of Valid Cases		3143	

4.6.12 Multiple Linear Regression for Length of Stay and Total Charges

The Multiple Linear Regression method is used to find the predictors of length of hospital stay and total charges for heat stress patients. The Durbin Watson (DW) statistic yielded at 1.971 DW as shown in Table 104 below.

Table 104 Model Summary for Heat Stress (LOS)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.097[a]	.009	.009	4.708	1.971

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Length of Stay (Cleaned)

There is a significant relationship between dependent and independent variables.

The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 53.

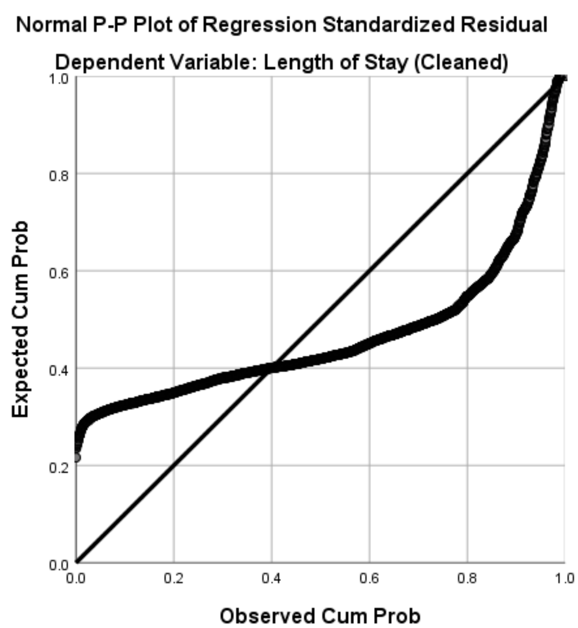

Figure 53 Normal P-P Plot of Regression Residual (LOS) for Heat Stress

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 54 below, the scatterplot shows perfect residual distribution.

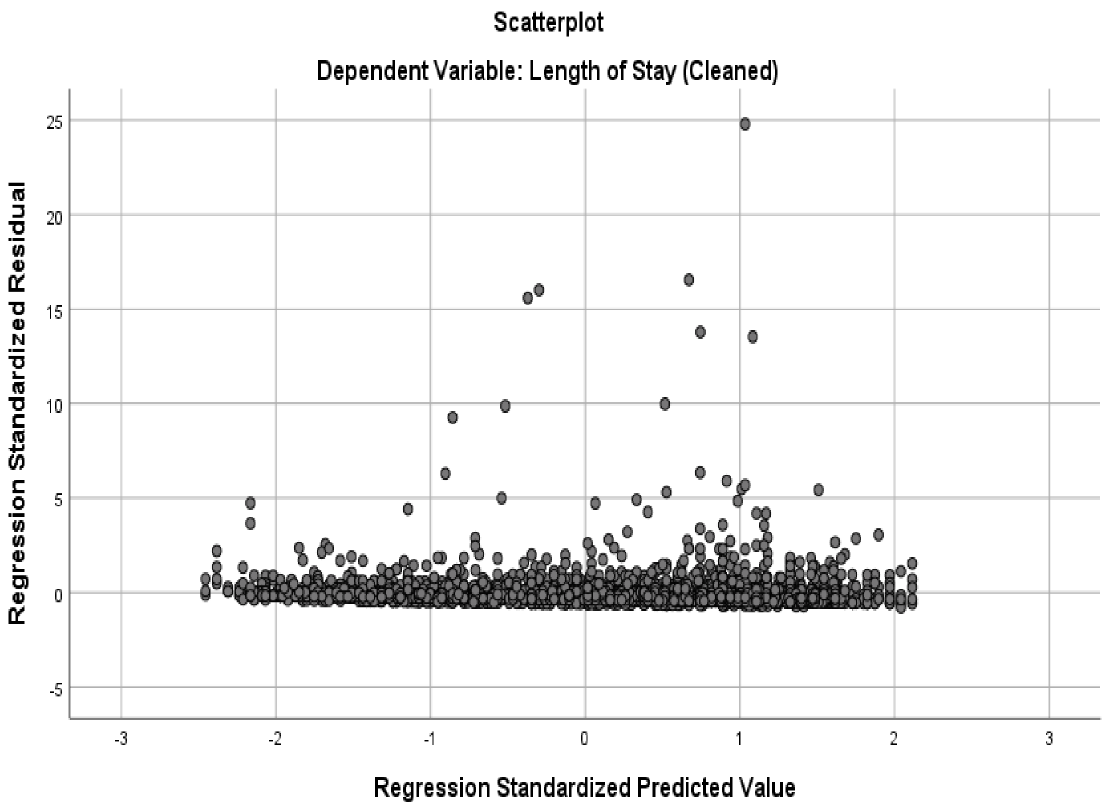

Figure 54 Scatterplot (LOS) for Heat Stress

After accepting all assumptions for length of stay, the final models for predictors for heat stress are shown in Table 105.

Table 105 Predictors for Length of Hospital Stay for Heat Stress Patients

Predictors	B	Std. Error	Beta	t	*Sig.	95.0% Confidence Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	1.468	0.342		4.290	0.000	0.797	2.140		
Age in Years at Admission	0.034	0.007	0.090	5.072	0.000	0.021	0.046	0.978	1.023
Indicator of Sex	0.230	0.234	0.017	0.983	0.326	-0.228	0.688	0.977	1.023
Economic Status	-0.111	0.078	-0.025	- 1.421	0.155	-0.265	0.042	0.999	1.001

Collinearity diagnostics is used to determine multicollinearity. The **Variance Inflation Factor (VIF)** must result less than 2 or near 1 as an ideal result. All variables resulted less than 2. Moreover, the data shows no multicollinearity. Economic status is the only variable in the regression model to predict length of stay with negative 0.111 days. Age in years was the only significant factor in the length of stay for heat stress patient. The length of hospital stay for heat stress= 1.468 (Constant) + 0.034 (Age in Years) + 0.230 (Indicator of Sex) – 0.111 (Economic Status).

The Durbin-Watson value for Total Charges yielded 1.901, which is close to the ideal Durbin Watson value of 2.0. Table 106 below displays the results.

Table 106 Model Summary for Heat Stress (TOTCHG)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.096[a]	.009	.008	49172.195	1.901

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Total Charges (Cleaned)

There is a significant relationship between dependent and independent variables.

The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 55.

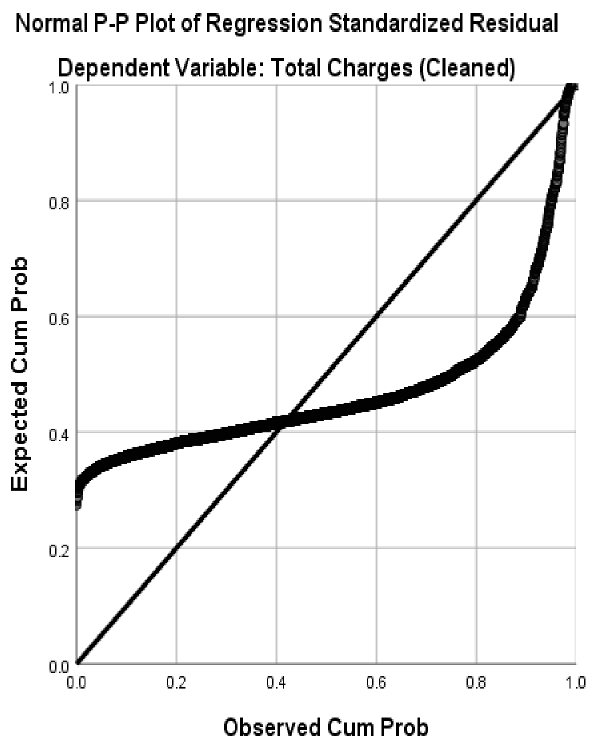

Figure 55 Normal P-P Plot of Regression Residual (TOTCHG) for Heat Stress

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 56, the scatterplot shows perfect residual distribution.

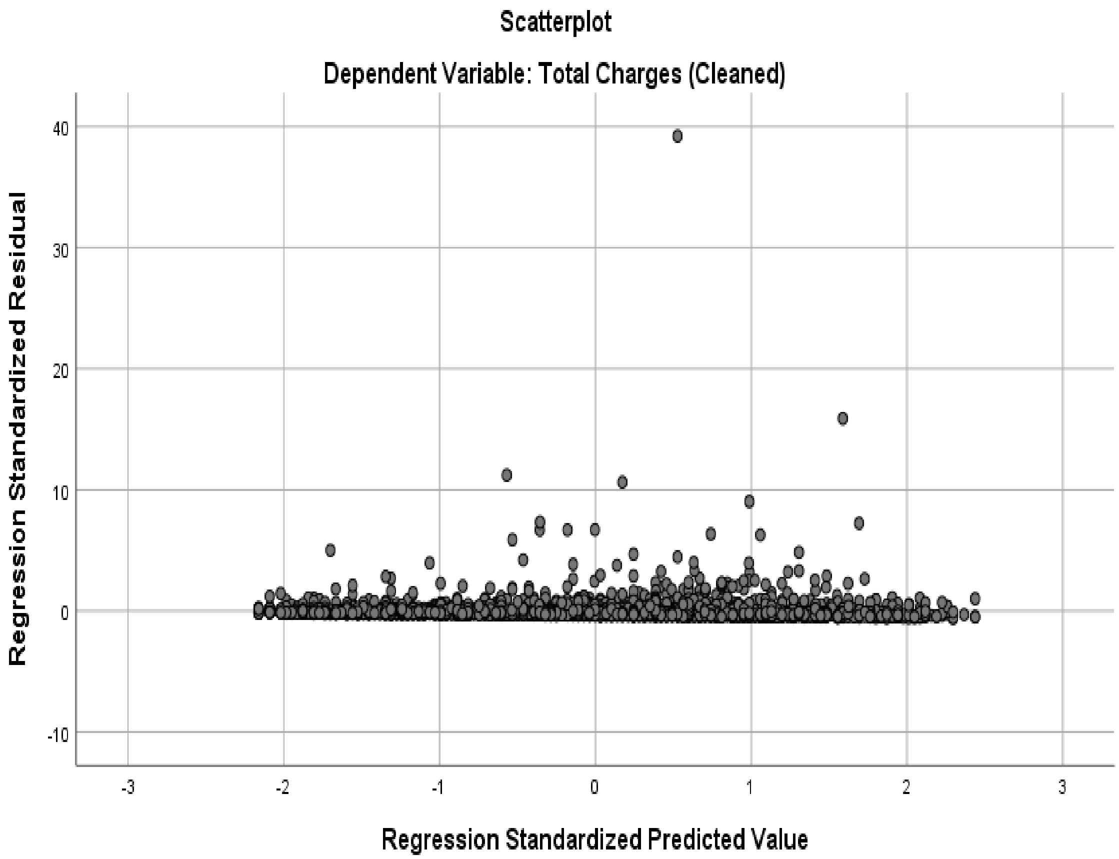

Figure 56 Scatterplot (TOTCHG) for Heat Stress

After accepting all assumptions for total charges, the final models for predictors for heat stress is shown in Table 107 below.

Table 107 Predictors for Total Charges for Heat Stress Patients

Predictors	B	Std. Error	Beta	t	*Sig.	95.0% Confidence Lower Bound	95.0% Confidence Upper Bound	Tolerance	VIF
(Constant)	3635.850	3595.612		1.011	0.312	-3414.093	10685.792		
Age in Years at Admission	336.160	69.382	0.086309	4.845	0.000	200.123	472.197	0.978	1.023
Indicator of Sex	3855.224	2453.452	0.027997	1.571	0.116	-955.276	8665.725	0.977	1.023
Economic Status	843.372	823.716	0.018	1.024	0.306	-771.694	2458.439	0.999	1.001

The VIF results must be less than 2 or near 1 as an ideal result. All variables resulted less than 2. Of the three independent factors, indicator of sex is the predictor with the highest effects on total charges for heat stress with $3,855.224. The factor that has significance for total charges was Age in Years at $336.160. The total charges of heat stress = 3,635.850 (Constant) + 336.160 (Age in Years) + 3,855.224 (Indicator of Sex) + 843.372 (Economic Status).

4.7.1 Age for Laceration of Upper Limbs

The patients were categorized into two age groups, where younger age was 18 to 30 years of age, and older age was 31 to 64 years of age. All other ages were excluded, because this range is the adult working age for work-related injuries[60,67,69]. The total amount of patients with ECODE1= "E8700" was 20,198 patients where younger aged 18-30 years (8.8%) and older aged 31-64 years (91.2%), respectively, as shown in Table 108 below.

Table 108 Laceration of Upper Limbs Age Groups

Age Groups	Frequency	Percent
18-30	1779	8.8%
31-64	18419	91.2%
Total	20198	100.0%

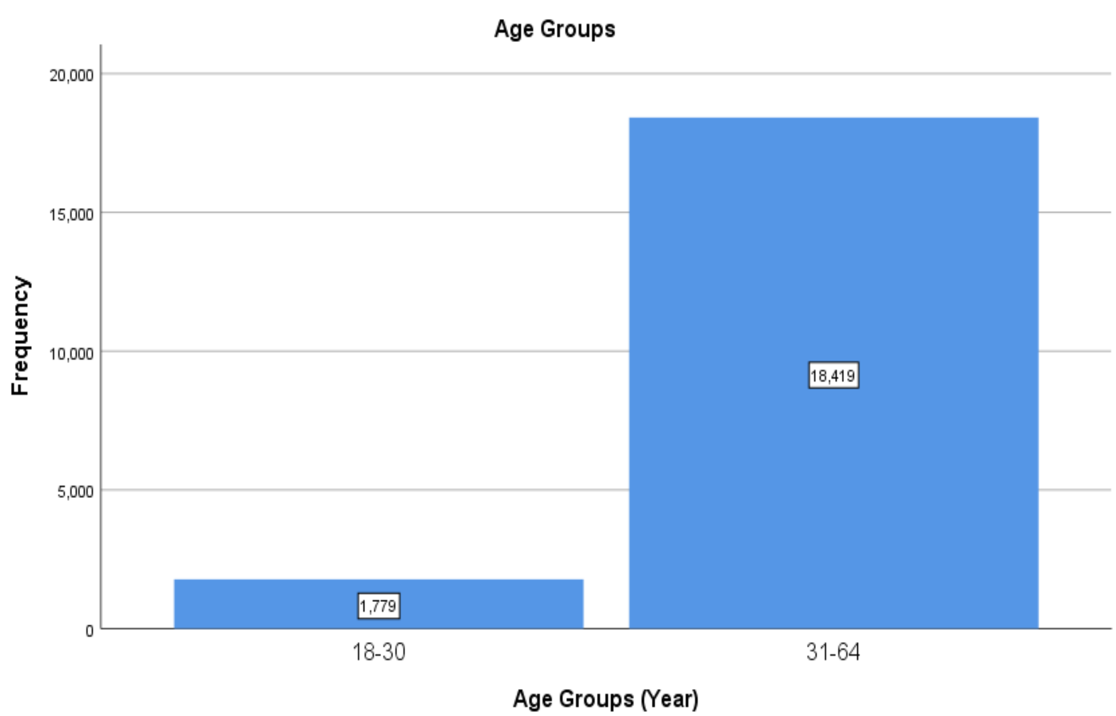

Figure 57 Age Groups of Laceration of Upper Limbs

4.7.2 Race for Laceration of Upper Limbs

White patients occupied the highest frequency for laceration of upper limbs at 60.5%, followed by Black patients at 11.6%, closely following Hispanic at 9.4%, and others as shown in Table 109.

Table 109 Laceration of Upper Limbs Race Groups

Race	Frequency	Percent
White	12224	60.5%
Black	2346	11.6%
Hispanic	1893	9.4%
Asian or Pacific Islander	392	1.9%
Native American	132	0.7%
Other	540	2.7%
Missing System	2671	13.2%
Total	20198	100.0%

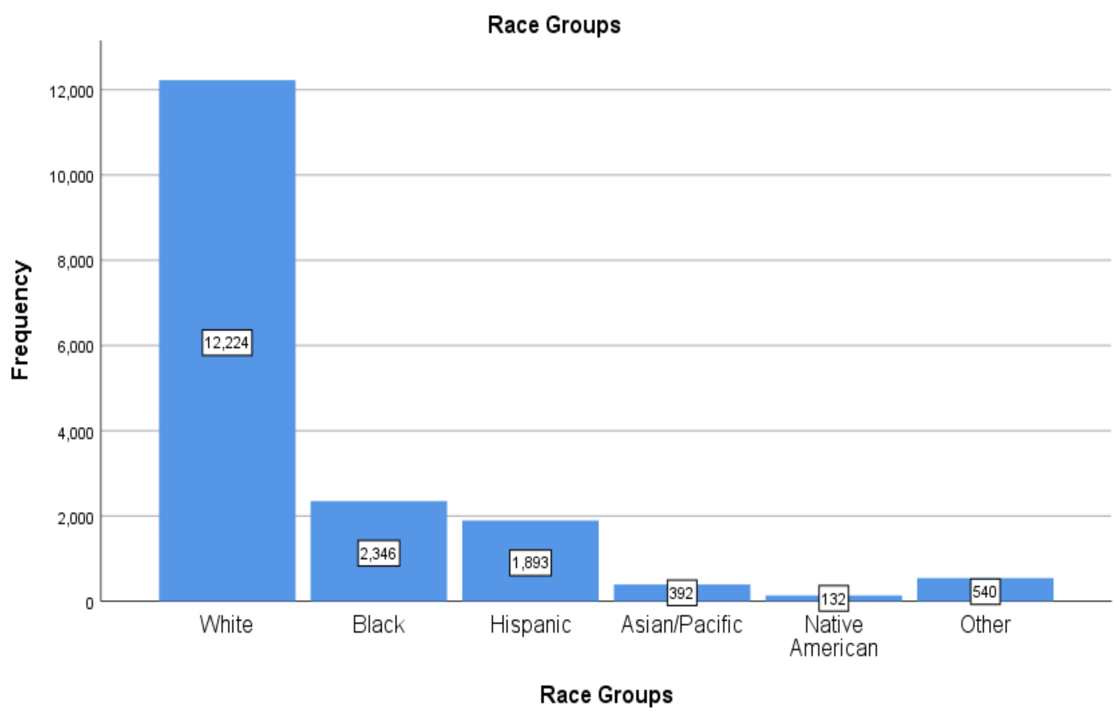

Figure 58 Frequency of Laceration of Upper Limbs Among Races

4.7.3 Gender for Laceration of Upper Limbs

Females showed higher frequency of laceration of upper limbs compared to males (70.1% vs 29.9%), as shown in Table 110.

Table 110 Frequency of Laceration of Upper Limbs between Genders

Genders	Frequency	Percent
Male	6027	29.9%
Female	14157	70.1%
Total	20184	100.0%

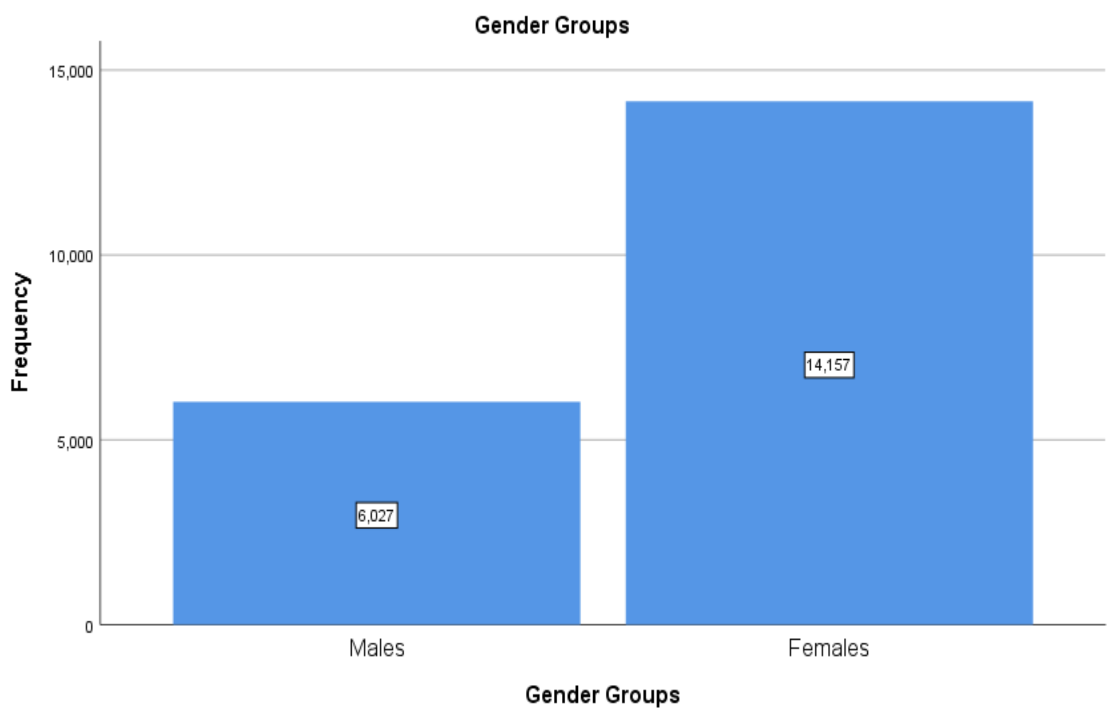

Figure 59 Frequency of Laceration of Upper Limbs Among Genders

4.7.4 Length of Stay and Total Charges of Laceration of Upper Limbs Patients

The mean for length of stay for patients with a laceration of upper limbs was 6.19 with a standard deviation (±SD) of ±8.837. The mean for total charges was $69,501.93 with ±SD of ±94,852.118 as shown in Table 111 below.

Table 111 Length of Stay and Total Charges of Laceration of Upper Limbs

Parameters	Mean	Median	±SD	Skewness	Kurtosis
Length of Hospital Stay (Days)	6.19	4.00	8.837	10.553	242.017
Total Costs ($)	69,501.93	41,543.00	94,852.118	6.357	72.217

4.7.5 Median Household Income

Four levels of median household income were observed in this study, which are 0-25th percentile, 26th to 50th percentile, 51st to 75th percentile, and 76th to 100th percentile. The percentages of median income for patients with laceration of upper limbs is the following: 26.3% (76th to 100th percentile), 25.8% (51st to 75th percentile), 25.2% (26th to 50th percentile), and 22.7% (0 to 25th percentile) respectively, as shown in Table 112. The 76th to 100th Percentile has the highest frequency for laceration of upper limbs patients.

Table 112 Median Household Income of Laceration of Upper Limbs Patients (Year 2011)

Levels of Household Income	Dollar Amount	Frequency	Percent
76th to 100th Percentile	$ 1 to $38,999	5177	26.3%
51st to 75th Percentile	$39,000 to $47,999	5090	25.8%
26th to 50th Percentile	$48,000 to $63,999	4971	25.2%
0 to 25th Percentile	$64,000 +	4465	22.7%
Total		19703	97.5%
Missing System		495	2.5%
Total Cumulation		20198	100.0%

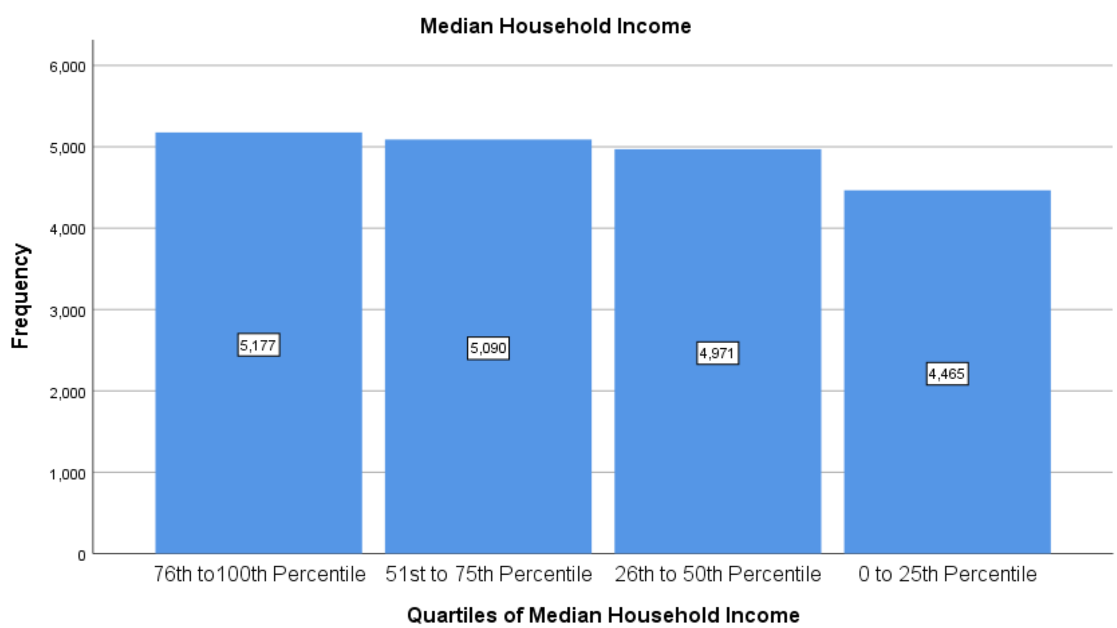

Figure 60 Median Household Income of Laceration of Upper Limbs Patients

4.7.6 Admission Day is a Weekend for Laceration of Upper Limbs Patients

The admission of the patient was admitted to the weekday at 93.0% versus the weekend at 7.0% respectively, as shown in Table 113.

Table 113 Admission Day is a Weekend for Laceration of Upper Limbs

Admission Day is a Weekend	Frequency	Percent
Weekday	18780	93.0%
Weekend	1418	7.0%
Total	20198	100.0%

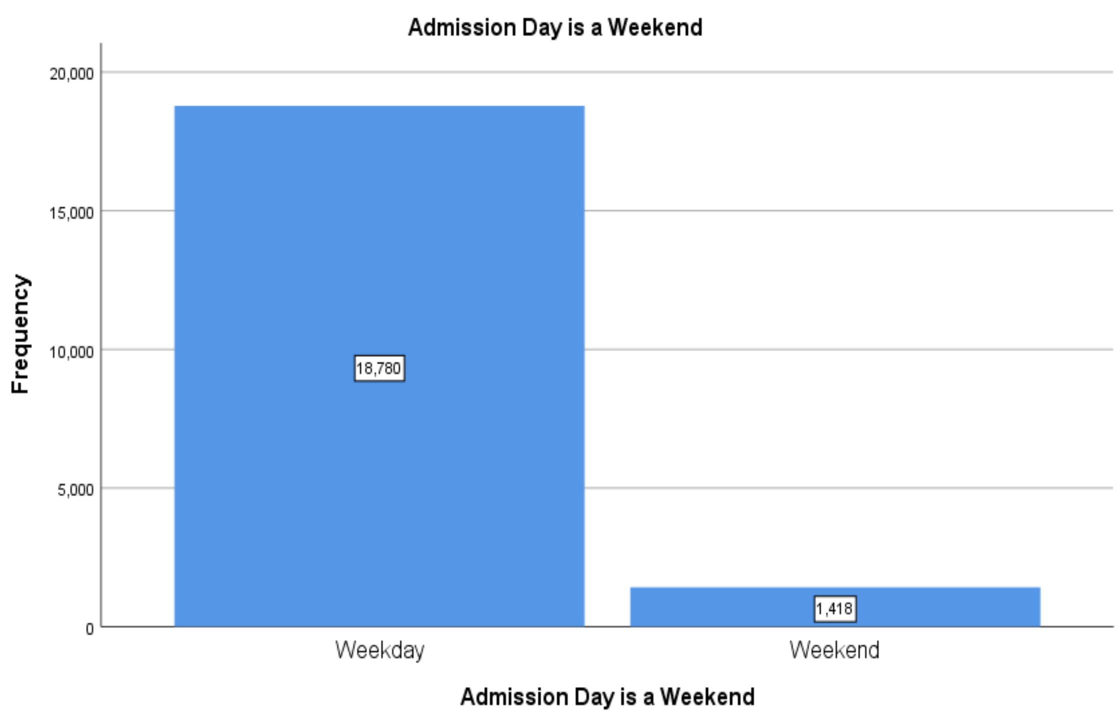

Figure 61 Admission Day is a Weekend for Laceration of Upper Limbs

4.7.7 Admission Month for Laceration of Upper Limbs Patients

The month of admission for laceration of upper limbs has more injuries during the month of March with 1,660 patients (9.0%) and February has the least patients with 1,407 (7.6%). Table 114 below describes the frequencies of injury per month.

Table 114 Admission Month for Laceration of Upper Limbs

Admission Month	Frequency	Percent
January	1585	8.6%
February	1407	7.6%
March	1660	9.0%
April	1570	8.5%
May	1492	8.1%
June	1630	8.8%
July	1536	8.3%
August	1528	8.3%
September	1485	8.0%
October	1545	8.3%
November	1488	8.0%
December	1584	8.6%
Total	18510	100.0%
Missing System	1688	9.1%
Total Cumulation	20198	100.0%

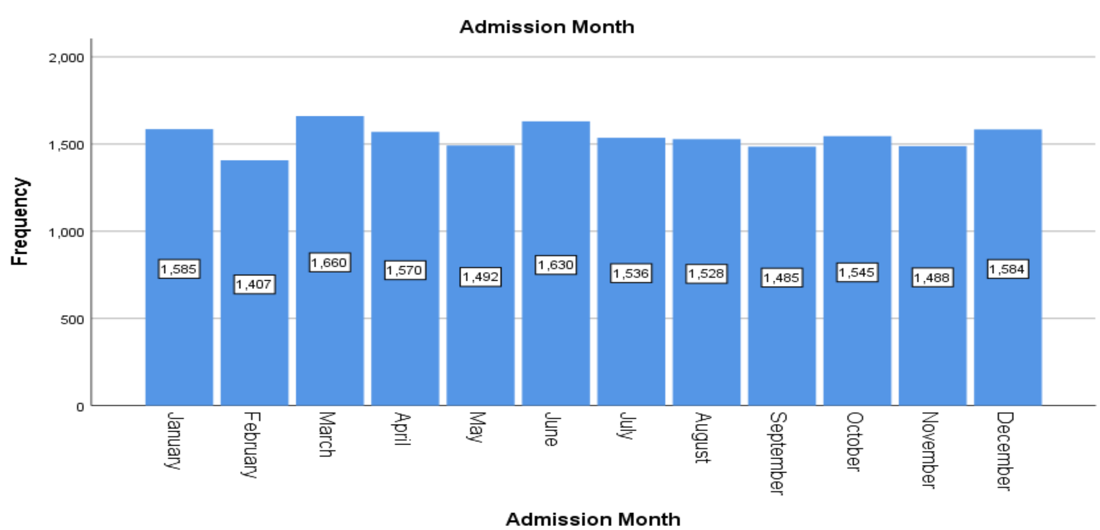

Figure 62 Month of Admission for Laceration of Upper Limbs

4.7.8 Region of Hospital for Laceration of Upper Limbs Patients

The region with the highest and lowest frequencies is the South at 39.3% (7,928 patients) versus the Northeast at 17.0% (3,440 patients). Table 115 below describes all the region frequencies.

Table 115 Region of Hospital for Laceration of Upper Limbs

Region of Hospital	Frequency	Percent
Northeast	3440	17.0%
Midwest	4702	23.3%
South	7928	39.3%
West	4128	20.4%
Total	20198	100.0%

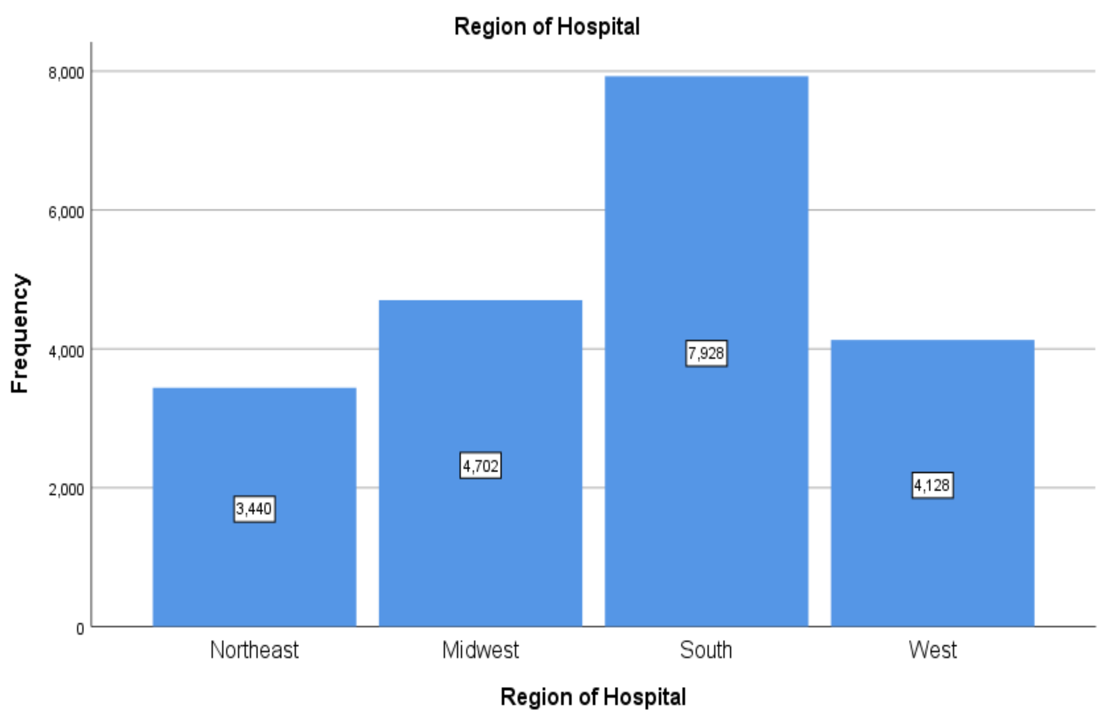

Figure 63 Region of Hospital for Laceration of Upper Limbs

4.7.9 Bivariate Pearson Correlation for Laceration of Upper Limbs Patients

The Bivariate Pearson Correlation shows significant correlation between indicator of sex and race and indicator of sex and age groups. Also, correlation with age groups and race with laceration of upper limbs patients. There is a negative correlation between: age groups and indicator of sex, age groups and race, and positive correlation between indicator of sex and race. Moreover, if one variable increases, the other variable decreases with the same magnitude with negative correlation. Positive correlation is a relationship between two variables in which both variables move in tandem or in the same direction as both variables increase or both variables decrease. Table 116 below describes the correlation of age, indicator of sex, and race with laceration of upper limbs patients.

Table 116 Bivariate Pearson Correlation for Laceration of Upper Limbs Patients

Correlations

		Age Groups	Indicator of Sex	Race (Uniform)
Age Groups	Pearson Correlation	1	-.162**	-.109**
	Sig. (2-tailed)		.000	.000
	N	20198	20184	17527
Indicator of Sex	Pearson Correlation	-.162**	1	.038**
	Sig. (2-tailed)	.000		.000
	N	20184	20184	17526
Race (Uniform)	Pearson Correlation	-.109**	.038**	1
	Sig. (2-tailed)	.000	.000	
	N	17527	17526	17527

**. Correlation is significant at the 0.01 level (2-tailed).

4.7.10 Chi-Square Test Race & Economic Status

The case processing summary counts 17,076 with 3,122 cases missing. Table 117 below describes the case summary.

Table 117 Case Processing Summary Race & Economic Status for Laceration of Upper Limbs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Median Household Income	17076	84.5%	3122	15.5%	20198	100.0%

The crosstabulation for race and economic status shows the expected count versus the actual count for each race and median household income quartiles 1 through 4 in Table 118 below.

Table 118 Race and Economic Status Crosstabulation

Race (Uniform) * Median Household Income Crosstabulation

			Median Household Income Quartile for Patients				
			1	2	3	4	Total
Race (Uniform)	White	Count	2658	3096	3074	3135	11963
		Expected Count	3165.9	2962.7	2976.0	2858.3	11963.0
	Black	Count	1004	458	454	344	2260
		Expected Count	598.1	559.7	562.2	540.0	2260.0
	Hispanic	Count	646	439	476	278	1839
		Expected Count	486.7	455.4	457.5	439.4	1839.0
	Asian/ Pacific	Count	43	59	101	179	382
		Expected Count	101.1	94.6	95.0	91.3	382.0
	Native American	Count	48	38	20	16	122
		Expected Count	32.3	30.2	30.3	29.1	122.0
	Other	Count	120	139	123	128	510
		Expected Count	135.0	126.3	126.9	121.9	510.0
Total		Count	4519	4229	4248	4080	17076
		Expected Count	4519.0	4229.0	4248.0	4080.0	17076.0

The Chi-Square Tests has a Pearson Chi-Square value of 770.153 and degrees of freedom (df) of 15 with significance equaling 0.000. See Table 119 below of Chi-Square Test.

Table 119 Chi-Square Tests for Laceration of Upper Limbs (Race & Economic Status)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	770.153[a]	15	0.000
Likelihood Ratio	737.453	15	0.000
Linear-by-Linear Association	53.350	1	0.000
N of Valid Cases	17076		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 29.15.

The Cramer's V values of 0.123 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 120 below as shown.

Table 120 Symmetric Measure for Laceration of Upper Limbs (Race & Economic Status)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.123	.000
N of Valid Cases		17076	

4.7.11 Chi-Square Test Race & Region of Hospital

The case processing summary counts 17,527 with 2,671 cases missing. Table 121 below describes the case summary.

Table 121 Case Processing Summary Race & Region of Hospital for Laceration of Upper Limbs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Region of Hospital	17527	86.8%	2671	13.2%	20198	100.0%

The crosstabulation for race and region shows the expected count versus the actual count for each race and regions 1 through 4 in Table 122.

Table 122 Race and Region of Hospital Crosstabulation for Laceration of Upper Limbs

Race (Uniform) * Region of Hospital Crosstabulation

			Region of Hospital				
			1	2	3	4	Total
Race (Uniform)	White	Count	2543	2314	4809	2558	12224
		Expected Count	2355.9	2056.0	5104.6	2707.5	12224.0
	Black	Count	421	353	1366	206	2346
		Expected Count	452.1	394.6	979.7	519.6	2346.0
	Hispanic	Count	214	85	819	775	1893
		Expected Count	364.8	318.4	790.5	419.3	1893.0
	Asian/ Pacific	Count	65	28	96	203	392
		Expected Count	75.6	65.9	163.7	86.8	392.0
	Native American	Count	3	35	57	37	132
		Expected Count	25.4	22.2	55.1	29.2	132.0
	Other	Count	132	133	172	103	540
		Expected Count	104.1	90.8	225.5	119.6	540.0
Total		Count	3378	2948	7319	3882	17527
		Expected Count	3378.0	2948.0	7319.0	3882.0	17527.0

The Chi-Square Tests has a Pearson Chi-Square value of 1,235.153 and degrees of freedom (df) of 15 with significance equaling 0.000. See Table 123 below of Chi-Square Test.

Table 123 Chi-Square Tests for Laceration of Upper Limbs (Race & Region)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1235.153[a]	15	0.000
Likelihood Ratio	1272.561	15	0.000
Linear-by-Linear Association	118.782	1	0.000
N of Valid Cases	17527		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 22.20.

The Cramer's V values of 0.153 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 124 below as shown.

Table 124 Symmetric Measure for Laceration of Upper Limbs (Race & Region)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.153	.000
N of Valid Cases		17527	

4.7.12 Multiple Linear Regression for Length of Stay and Total Charges

The Multiple Linear Regression method is used to find the predictors of length of hospital stay and total charges for laceration of upper limbs patients. The Durbin Watson (DW) statistic yielded at 1.910 DW as shown in Table 125 below.

Table 125 Model Summary for Laceration of Upper Limbs (LOS)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.118[a]	.014	.014	8.777	1.910

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Length of stay (cleaned)

There is a significant relationship between dependent and independent variables.

The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 64.

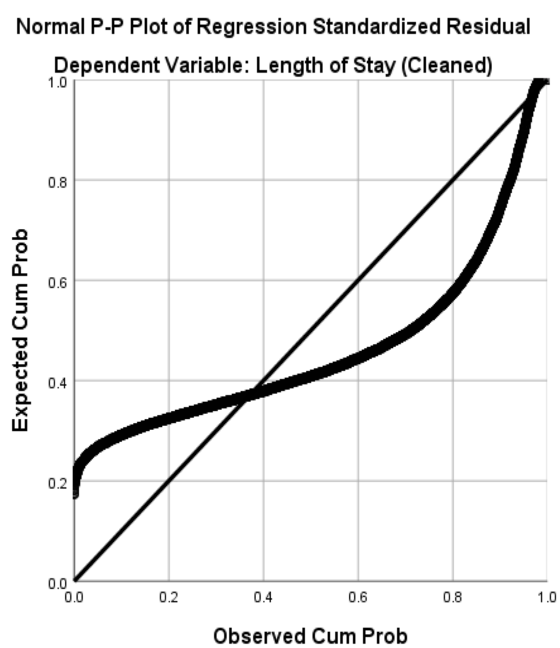

Figure 64 Normal P-P Plot of Regression Residual (LOS) Laceration of Upper Limbs

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 65 below, the scatterplot shows perfect residual distribution.

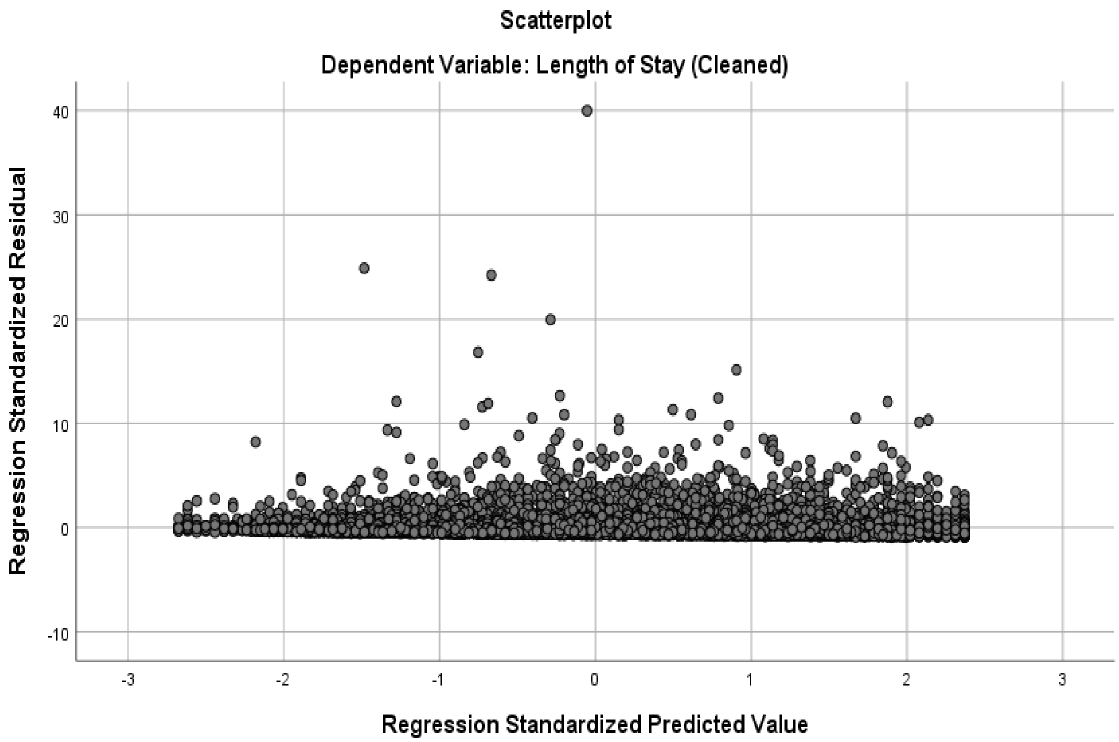

Figure 65 Scatterplot (LOS) for Laceration of Upper Limbs

After accepting all assumptions for length of stay, the final models for predictors for laceration of the upper limbs are shown in Table 126.

Table 126 Predictors for Length of Hospital Stay for Laceration of Upper Limbs Patients

						95.0% Confidence			
Predictors	B	Std. Error	Beta	t	*Sig.	Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	5.167	0.332		15.550	0.000	4.515	5.818		
Age in Years at Admission	0.061	0.006	0.076	10.624	0.000	0.049	0.072	0.971	1.030
Indicator of Sex	-1.280	0.139	-0.066	-9.244	0.000	-1.552	-1.009	0.974	1.027
Economic Status	-0.393	0.057	-0.049	-6.942	0.000	-0.504	-0.282	0.997	1.003

Collinearity diagnostics is used to determine multicollinearity. The **Variance Inflation Factor (VIF)** must result less than 2 or near 1 as an ideal result. All variables resulted less than 2. Moreover, the data shows no multicollinearity. All three variables show significance in the regression model to predict length of stay with Age in Years positively at 0.061 days, and indicator of sex and economic status negatively at 1.280 and 0.393 days, respectively. The length of hospital stay for laceration of upper limbs = 5.167 (Constant) + 0.061 (Age in Years) – 1.280 (Indicator of Sex) – 0.393 (Economic Status).

The Durbin-Watson value for Total Charges yielded 1.593, which is approaching the ideal Durbin Watson value of 2.0. Table 127 below displays the results.

Table 127 Model Summary for Laceration of Upper Limbs (TOTCHG)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.159[a]	.025	.025	93653.185	1.593

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Total charges (Cleaned)

There is a significant relationship between dependent and independent variables.

The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 66.

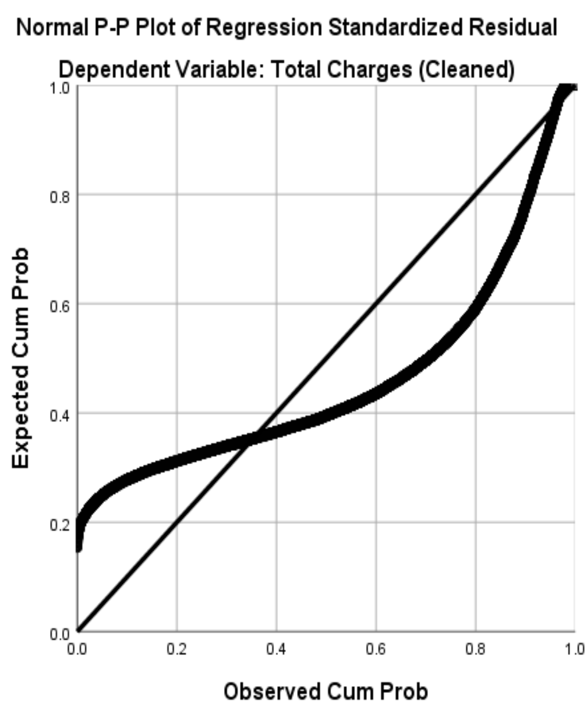

Figure 66 Normal P-P Plot of Regression Residual (TOTCHG) Laceration of Upper Limbs

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 67, the scatterplot shows perfect residual distribution.

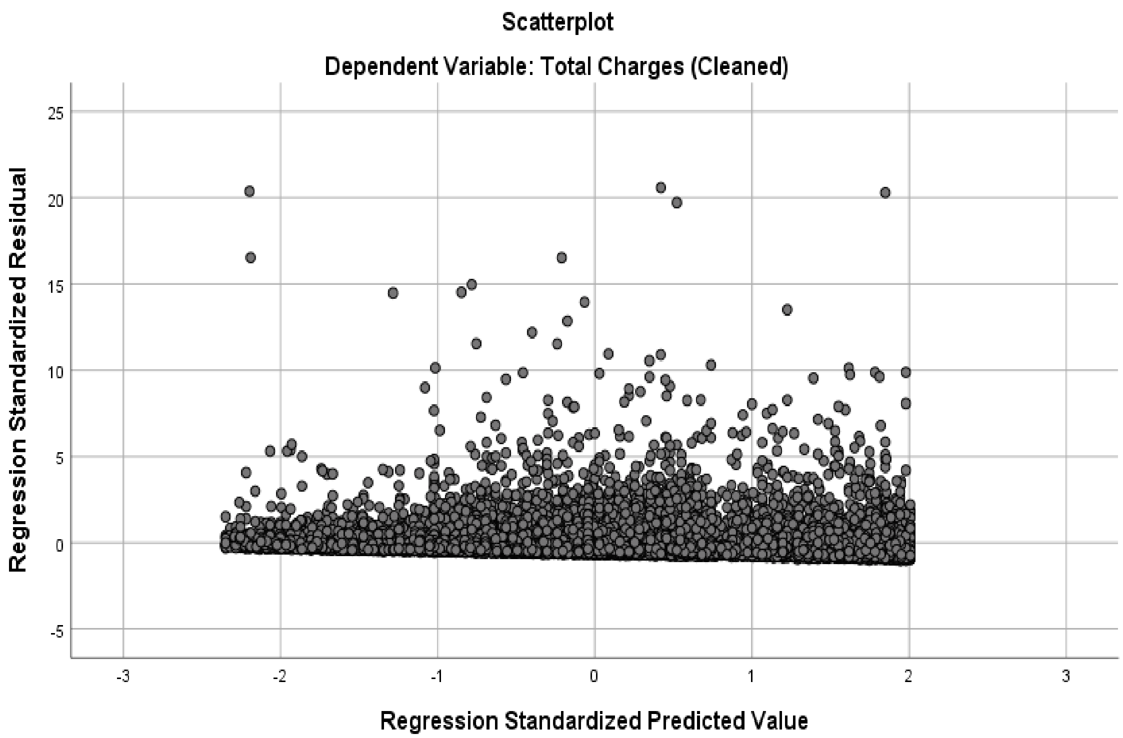

Figure 67 Scatterplot (TOTCHG) for Laceration of Upper Limbs

After accepting all assumptions for total charges, the final models for predictors for laceration of upper limbs is shown in Table 128 below.

Table 128 Predictors for Total Charges for Laceration of Upper Limbs Patients

Predictors	B	Std. Error	Beta	t	*Sig.	95.0% Confidence Lower Bound	95.0% Confidence Upper Bound	Tolerance	VIF
(Constant)	37232.807	3571.106		10.426	0.000	30233.131	44232.484		
Age in Years at Admission	984.045	61.290	0.115489	16.056	0.000	863.912	1104.179	0.971	1.030
Indicator of Sex	-19124.523	1488.743	-0.09227	-12.846	0.000	-22042.588	-16206.458	0.974	1.027
Economic Status	-437.295	608.145	-0.005	-0.719	0.472	-1629.312	754.723	0.997	1.003

The VIF results must be less than 2 or near 1 as an ideal result. All variables resulted less than 2. Of the three independent factors, age in years is the predictor with the highest effects on total charges for laceration of upper limbs with $984.045. The two factors related to reduction of total charges were indicator of sex and economic status, which are negative $19,124.523 and $437.295, respectively. Age in years and indicator of sex were two factors that are significant in the effect of the total charges of patients with laceration of upper limbs. The total charges of laceration of upper limbs = 37,232.807 (Constant) + 984.045 (Age in Years) -19,124.523 (Indicator of Sex) – 437.295 (Economic Status).

4.8.1 Age for Machine Accidents

The patients were categorized into two age groups, where younger age was 18 to 30 years of age, and older age was 31 to 64 years of age. All other ages were excluded, because this range is the adult working age for work-related injuries[60,67,69]. The total amount of patients with ECODE1= "E9190" was 752 patients where younger aged 18-30 years (17.8%) and older aged 31-64 years (82.2%), respectively, as shown in Table 129 below.

Table 129 Machine Accidents Age Groups

Age Groups	Frequency	Percent
18-30	134	17.8%
31-64	618	82.2%
Total	752	100.0%

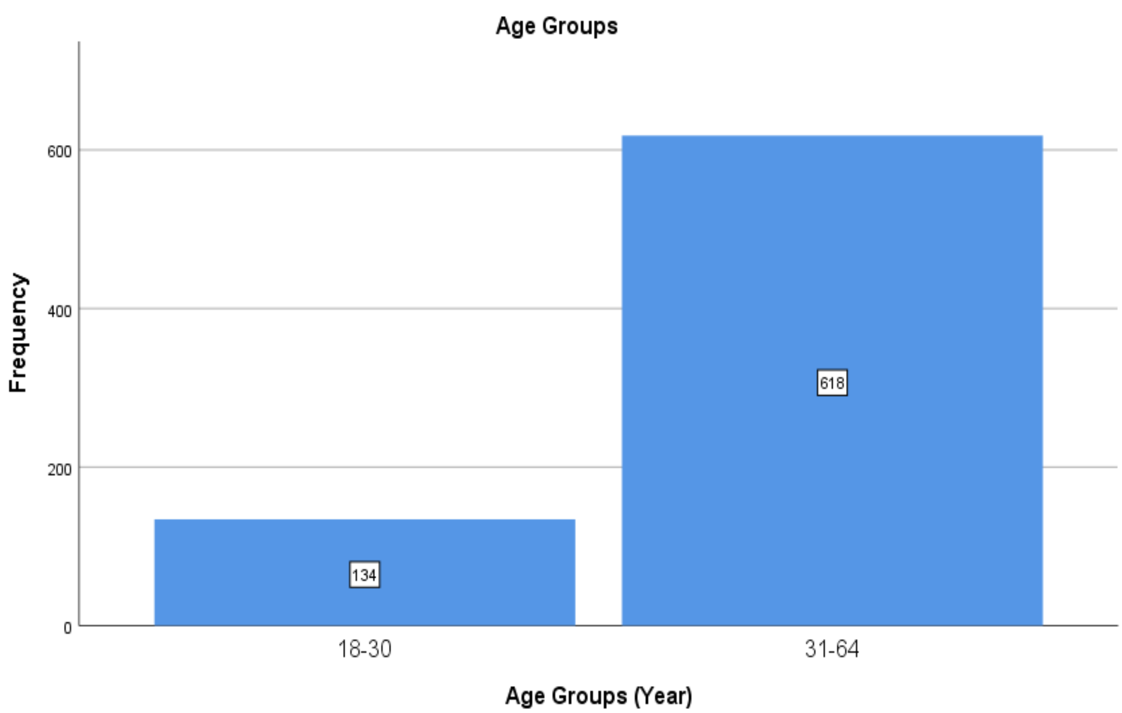

Figure 68 Age Groups of Machine Accidents

4.8.2 Race for Machine Accidents

White patients occupied the highest frequency of machine accidents at 61.6%, followed by Hispanic patients at 13.8%, next highest is Black at 3.1%, and others as shown in Table 130.

Table 130 Patients Race Groups

Race	Frequency	Percent
White	463	61.6%
Black	23	3.1%
Hispanic	104	13.8%
Asian or Pacific Islander	4	0.5%
Native American	9	1.2%
Other	17	2.3%
Missing System	132	17.6%
Total	752	100.0%

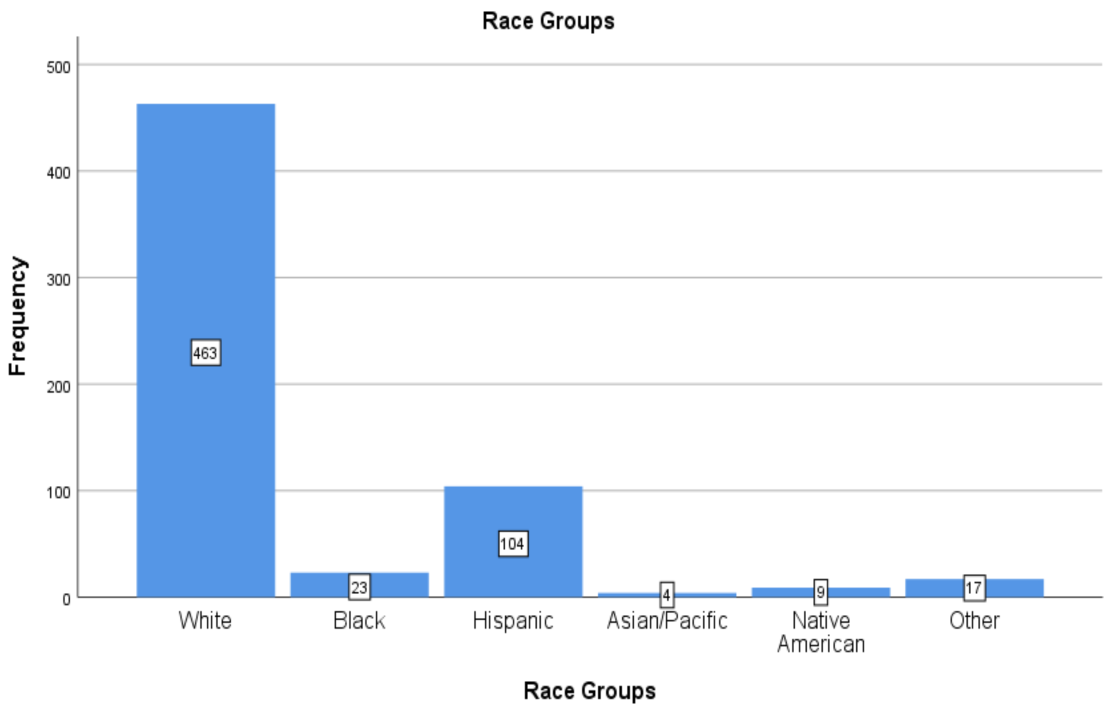

Figure 69 Frequency of Machine Accidents Among Races

4.8.3 Gender for Machine Accidents

Males showed higher frequency of machine accidents compared to females (92.1% vs 7.9%), as shown in Table 131.

Table 131 Frequency of Machine Accidents between Genders

Genders	Frequency	Percent
Male	689	92.1%
Female	59	7.9%
Total	748	100.0%

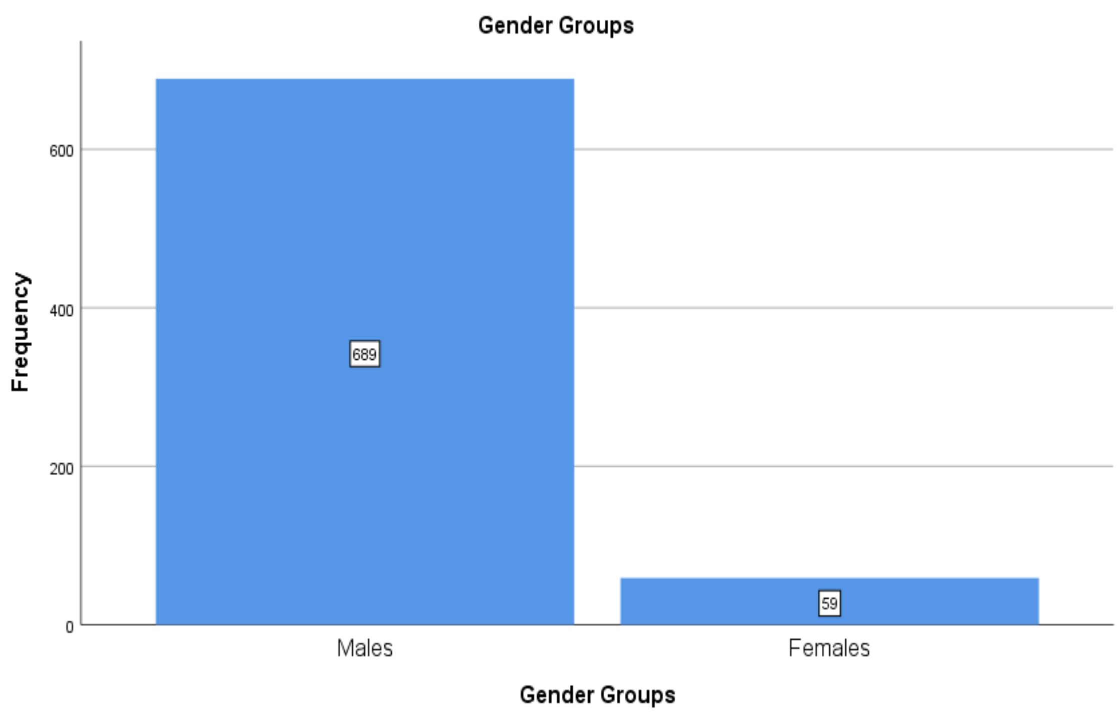

Figure 70 Frequency of Machine Accidents Among Genders

4.8.4 Length of Stay and Total Charges of Machine Accidents Patients

The mean for length of stay for patients with machine accidents was 5.43 with a standard deviation (±SD) of ±8.201. The mean for total charges was $49,603.37 with ±SD of ±62,641.224 as shown in Table 132 below.

Table 132 Length of Stay and Total Charges of Machine Accidents

Parameters	Mean	Median	±SD	Skewness	Kurtosis
Length of Hospital Stay (Days)	5.43	3.00	8.201	7.658	97.690
Total Costs ($)	49,603.37	26,596.00	62,641.224	2.952	10.269

4.8.5 Median Household Income

Four levels of median household income were observed in this study, which are 0-25th percentile, 26th to 50th percentile, 51st to 75th percentile, and 76th to 100th percentile. The percentages of median income for patients with machine accidents is the following: 37.7% (76th to 100th percentile), 33.9% (51st to 75th percentile), 19.7% (26th to 50th percentile), and 8.6% (0 to 25th percentile) respectively, as shown in Table 133. The 76th to 100th Percentile has the highest frequency for machine accidents patients.

Table 133 Median Household Income of Machine Accidents Patients (Year 2011)

Levels of Household Income	Dollar Amount	Frequency	Percent
76th to 100th Percentile	$ 1 to $38,999	279	37.7%
51st to 75th Percentile	$39,000 to $47,999	251	33.9%
26th to 50th Percentile	$48,000 to $63,999	146	19.7%
0 to 25th Percentile	$64,000 +	64	8.6%
Total		740	98.4%
Missing System		12	1.6%
Total Cumulation		752	100.0%

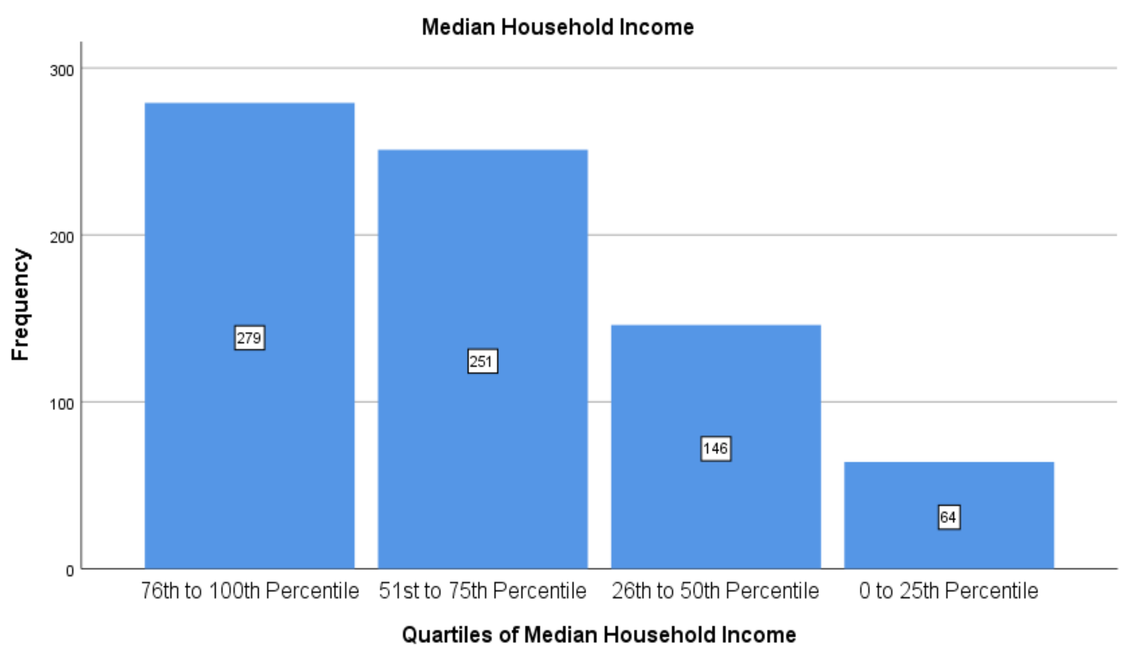

Figure 71 Median Household Income of Machine Accidents Patients

4.8.6 Admission Day is a Weekend for Machine Accidents Patients

The admission of the patient was admitted to the weekday at 75.4% versus the weekend at 24.6% respectively, as shown in Table 134.

Table 134 Admission Day is a Weekend for Machine Accidents

Admission Day is a Weekend	Frequency	Percent
Weekday	567	75.4%
Weekend	185	24.6%
Total	752	100.0%

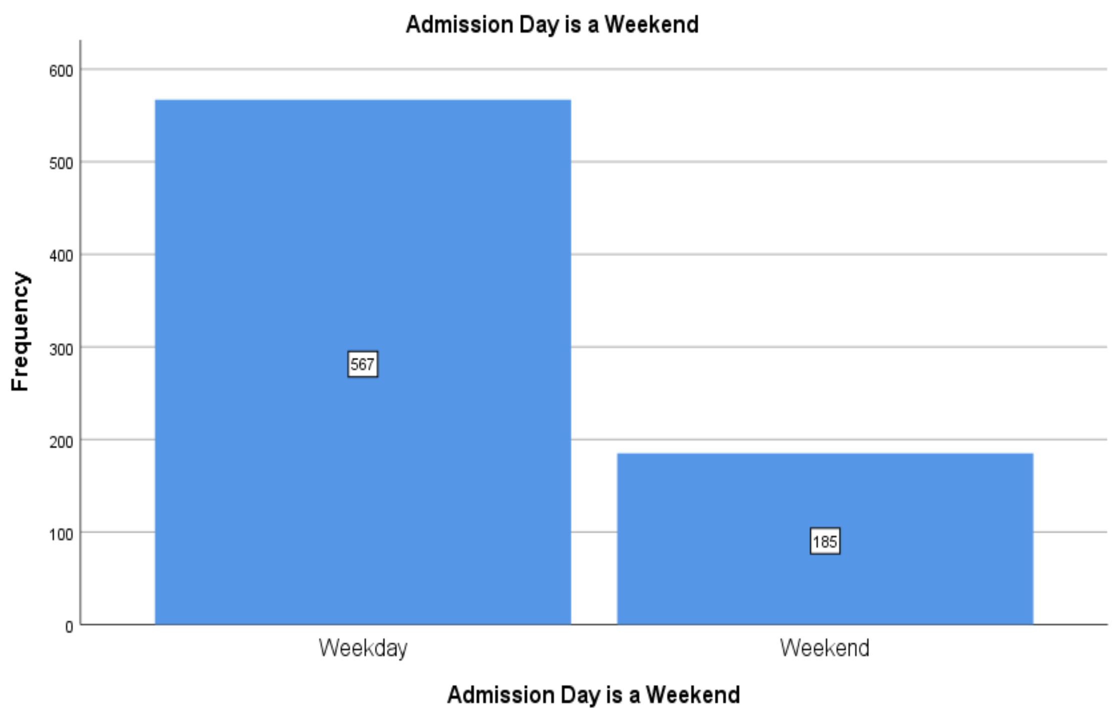

Figure 72 Admission Day is a Weekend for Machine Accidents

4.8.7 Admission Month for Machine Accidents Patients

The month of admission for machine accidents has more injuries during the month of September with 87 patients (12.0%) and February has the least patients with 22 (3.0%). Table 135 below describes the frequencies of injury per month.

Table 135 Admission Month for Machine Accidents

Admission Month	Frequency	Percent
January	38	5.3%
February	22	3.0%
March	37	5.1%
April	63	8.7%
May	70	9.7%
June	64	8.9%
July	74	10.2%
August	80	11.1%
September	87	12.0%
October	82	11.3%
November	68	9.4%
December	38	5.3%
Total	723	100.0%
Missing System	29	4.0%
Total Cumulation	752	100.0%

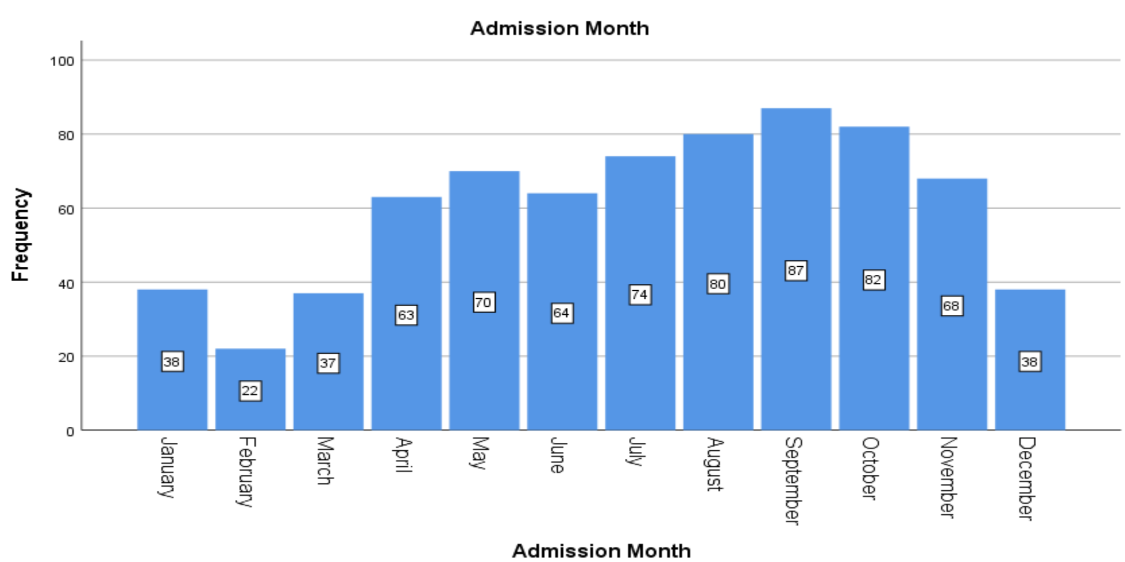

Figure 73 Month of Admission for Machine Accidents

4.8.8 Region of Hospital for Machine Accidents Patients

The region with the highest and lowest frequencies is the South at 41.6% (313 patients) versus the West at 13.7% (103 patients). Table 136 below describes all the region frequencies.

Table 136 Region of Hospital for Machine Accidents

Region of Hospital	Frequency	Percent
Northeast	120	16.0%
Midwest	216	28.7%
South	313	41.6%
West	103	13.7%
Total	752	100.0%

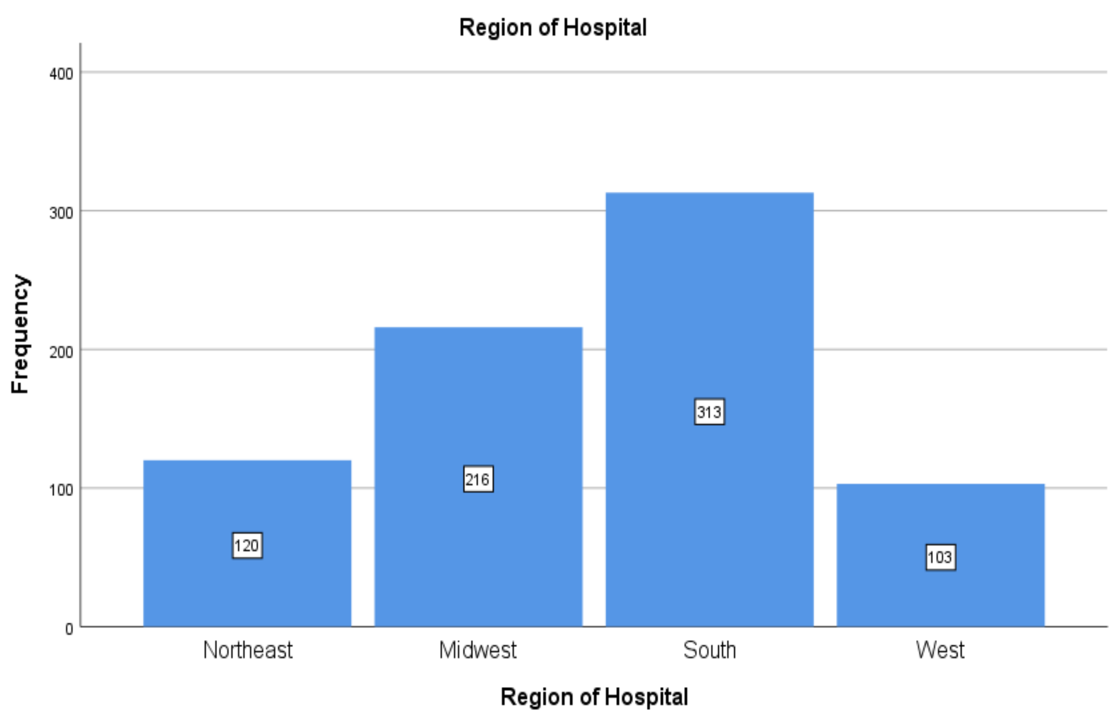

Figure 74 Region of Hospital for Machine Accidents

4.8.9 Bivariate Pearson Correlation for Machine Accidents Patients

The Bivariate Pearson Correlation shows significant correlation between indicator of sex and age groups and indicator of sex and race, and age groups and race with machine accidents. Indicator of sex and race and age groups and race have negative correlations, where one variable increases as the other variable decreases with the same magnitude. Indicator of sex and age groups has a positive correlation where both variables move in the same direction, as one increases the other increases or vice versa as one decreases the other decreases. Table 137 below describes the correlation of age groups, indicator of sex, and race with machine accidents.

Table 137 Bivariate Pearson Correlation for Machine Accidents Patients

Correlations

		Age Groups	Indicator of Sex	Race (Uniform)
Age Groups	Pearson Correlation	1	.022	-.205**
	Sig. (2-tailed)		.541	.000
	N	752	748	620
Indicator of Sex	Pearson Correlation	.022	1	-.073
	Sig. (2-tailed)	.541		.069
	N	748	748	620
Race (Uniform)	Pearson Correlation	-.205**	-.073	1
	Sig. (2-tailed)	.000	.069	
	N	620	620	620

**. Correlation is significant at the 0.01 level (2-tailed).

4.8.10 Chi-Square Test Race & Economic Status

The case processing summary counts 608 with 144 cases missing. Table 138 below describes the case summary.

Table 138 Case Processing Summary Race & Economic Status for Machine Accidents

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Median Household Income	608	80.9%	144	19.1%	752	100.0%

The crosstabulation for race and economic status shows the expected count versus the actual count for each race and median household income quartiles 1 through 4 in Table 139 below.

Table 139 Race and Economic Status Crosstabulation for Machine Accidents

Race (Uniform) * Median Household Income Crosstabulation

			Median Household Income Quartile for Patients				
			1	2	3	4	Total
Race (Uniform)	White	Count	162	168	82	44	456
		Expected Count	173.3	152.3	89.3	41.3	456.0
	Black	Count	15	3	4	0	22
		Expected Count	8.4	7.3	4.3	2.0	22.0
	Hispanic	Count	42	26	26	7	101
		Expected Count	38.4	33.7	19.8	9.1	101.0
	Asian/ Pacific	Count	0	0	2	2	4
		Expected Count	1.5	1.3	0.8	0.4	4.0
	Native American	Count	4	3	0	2	9
		Expected Count	3.4	3.0	1.8	0.8	9.0
	Other	Count	8	3	5	0	16
		Expected Count	6.1	5.3	3.1	1.4	16.0
Total		Count	231	203	119	55	608
		Expected Count	231.0	203.0	119.0	55.0	608.0

The Chi-Square Tests has a Pearson Chi-Square value of 37.514 and degrees of freedom (df) of 15 with significance equaling 0.001. See Table 140 below of Chi-Square Test.

Table 140 Chi-Square Tests for Machine Accidents (Race & Economic Status)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	37.514[a]	15	.001
Likelihood Ratio	40.312	15	.000
Linear-by-Linear Association	.156	1	.693
N of Valid Cases	608		

a. 12 cells (50.0%) have expected count less than 5. The minimum expected count is .36.

The Cramer’s V values of 0.143 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 141 below as shown.

Table 141 Symmetric Measure for Machine Accidents (Race & Economic Status)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer’s V	.143	.001
N of Valid Cases		608	

4.8.11 Chi-Square Test Race & Region of Hospital

The case processing summary counts 620 with 132 cases missing. Table 142 below describes the case summary.

Table 142 Case Processing Summary Race & Region of Hospital for Machine Accidents

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Region of Hospital	620	82.4%	132	17.6%	752	100.0%

The crosstabulation for race and region shows the expected count versus the actual count for each race and regions 1 through 4 in Table 143.

Table 143 Race and Region of Hospital Crosstabulation for Machine Accidents

Race (Uniform) * Region of Hospital Crosstabulation

			Region of Hospital				
			1	2	3	4	Total
Race (Uniform)	White	Count	105	128	200	30	463
		Expected Count	82.9	109.8	210.6	59.7	463.0
	Black	Count	1	0	22	0	23
		Expected Count	4.1	5.5	10.5	3.0	23.0
	Hispanic	Count	3	8	46	47	104
		Expected Count	18.6	24.7	47.3	13.4	104.0
	Asian/ Pacific	Count	1	1	0	2	4
		Expected Count	0.7	0.9	1.8	0.5	4.0
	Native American	Count	0	6	3	0	9
		Expected Count	1.6	2.1	4.1	1.2	9.0
	Other	Count	1	4	11	1	17
		Expected Count	3.0	4.0	7.7	2.2	17.0
Total		Count	111	147	282	80	620
		Expected Count	111.0	147.0	282.0	80.0	620.0

The Chi-Square Tests has a Pearson Chi-Square value of 175.867 and degrees of freedom (df) of 15 with significance equaling 0.000. See Table 144 below of Chi-Square Test.

Table 144 Chi-Square Tests for Machine Accidents (Race & Region)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	175.867[a]	15	.000
Likelihood Ratio	163.796	15	.000
Linear-by-Linear Association	45.881	1	.000
N of Valid Cases	620		

a. 13 cells (54.2%) have expected count less than 5. The minimum expected count is .52.

The Cramer's V values of 0.307 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 145 below as shown.

Table 145 Symmetric Measure for Machine Accidents (Race & Region)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.307	.000
N of Valid Cases		620	

4.8.12 Multiple Linear Regression for Length of Stay and Total Charges

The Multiple Linear Regression method is used to find the predictors of length of hospital stay and total charges for machine accidents patients. The Durbin Watson (DW) statistic yielded at 1.843 DW as shown in Table 146 below.

Table 146 Model Summary for Machine Accidents (LOS)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.070[a]	0.005	0.001	8.198	1.843

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Length of stay (Cleaned)

There is a significant relationship between dependent and independent variables.

The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 75.

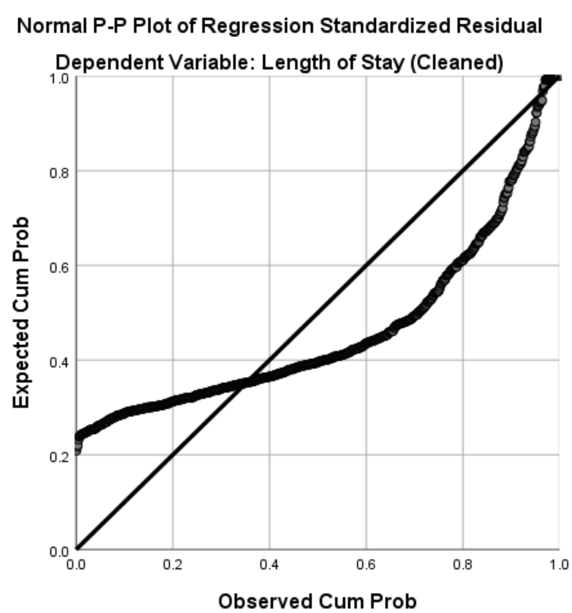

Figure 75 Normal P-P Plot of Regression Residual (LOS) for Machine Accidents

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 76 below, the scatterplot shows perfect residual distribution.

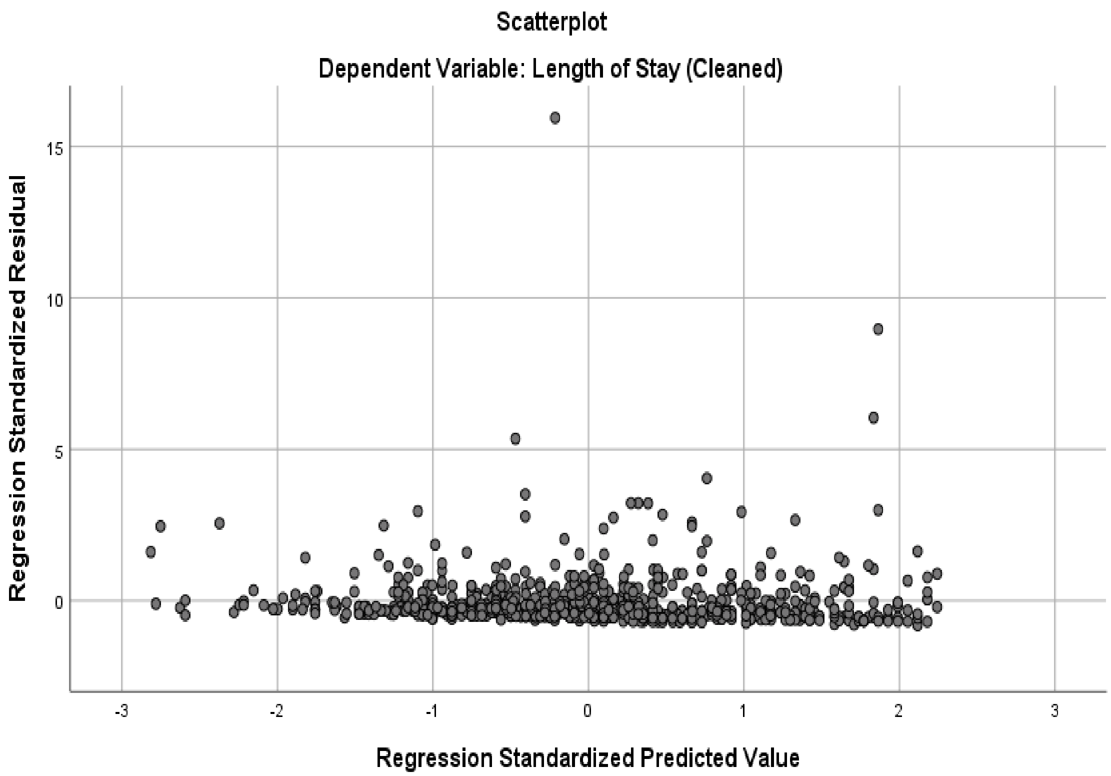

Figure 76 Scatterplot (LOS) for Machine Accidents

After accepting all assumptions for length of stay, the final models for predictors for machine accidents are shown in Table 147.

Table 147 Predictors for Length of Hospital Stay for Machine Accidents Patients

Predictors	B	Std. Error	Beta	t	*Sig.	95.0% Confidence Lower Bound	95.0% Confidence Upper Bound	Tolerance	VIF
(Constant)	7.601	1.251		6.077	0.000	5.145	10.056		
Age in Years at Admission	-0.036	0.023	-0.058	-1.581	0.114	-0.081	0.009	0.999	1.001
Indicator of Sex	-0.804	1.122	-0.026	-0.717	0.474	-3.007	1.398	0.999	1.001
Economic Status	-0.234	0.315	-0.027	-0.744	0.457	-0.853	0.384	0.999	1.001

Collinearity diagnostics is used to determine multicollinearity. The **Variance Inflation Factor (VIF)** must result less than 2 or near 1 as an ideal result. All variables resulted less than 2. Moreover, the data shows no multicollinearity. All three variables in the regression model predict length of stay with negative 0.036, 0.804, and 0.234 days, respectively. The length of hospital stay for machine accidents = 7.601 (Constant) - 0.036 (Age in Years) – 0.804 (Indicator of Sex) – 0.234 (Economic Status).

The Durbin-Watson value for Total Charges yielded 1.763, which is close to the ideal Durbin Watson value of 2.0. Table 148 below displays the results.

Table 148 Model Summary for Machine Accidents (TOTCHG)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.060[a]	0.004	0.000	62655.406	1.763

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Total Charges (Cleaned)

There is a significant relationship between dependent and independent variables.

The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 77.

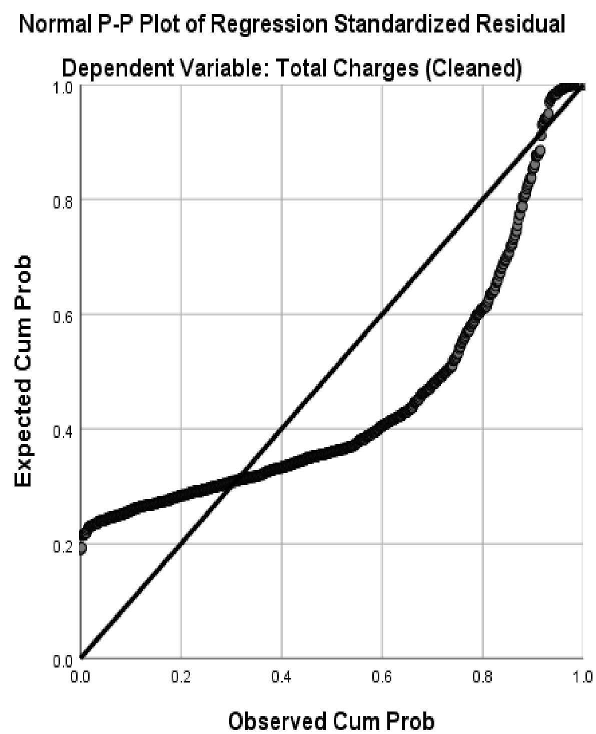

Figure 77 Normal P-P Plot of Regression Residual (TOTCHG) for Machine Accidents

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 78, the scatterplot shows perfect residual distribution.

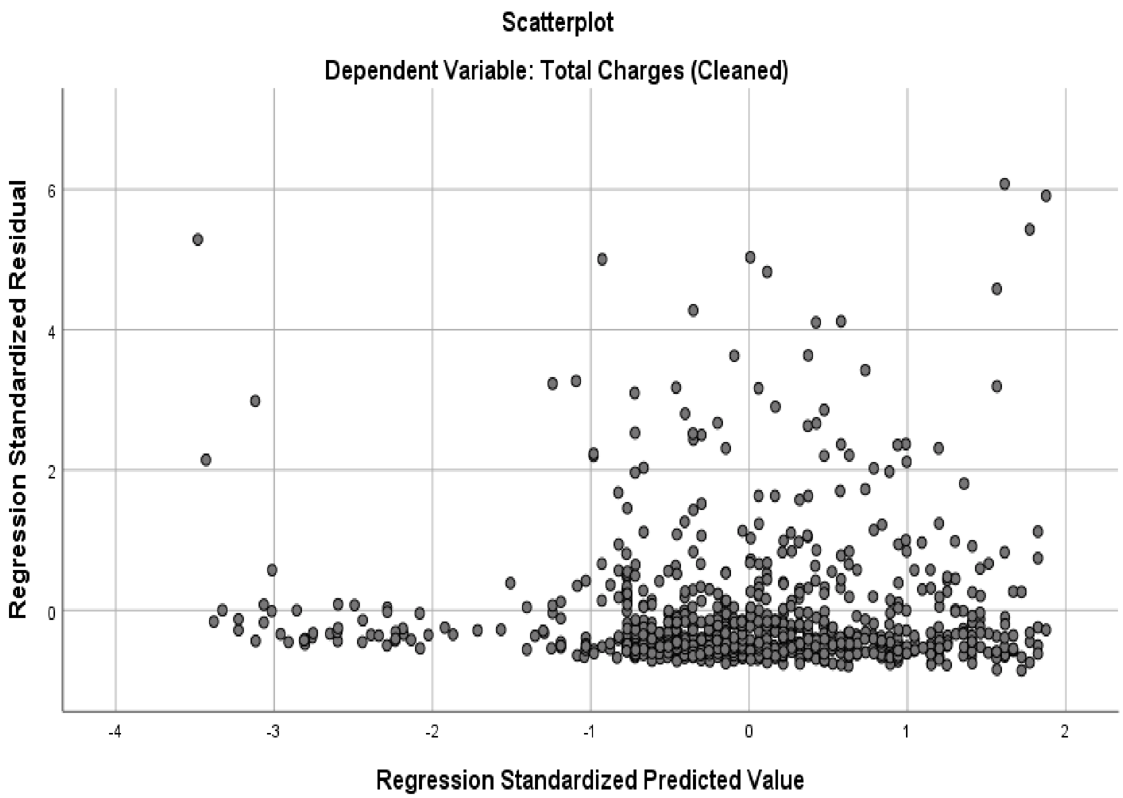

Figure 78 Scatterplot (TOTCHG) for Machine Accidents

After accepting all assumptions for total charges, the final models for predictors for machine accidents is shown in Table 149 below.

Table 149 Predictors for Total Charges for Machine Accidents Patients

Predictors	B	Std. Error	Beta	t	*Sig.	95.0% Confidence Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	61188.449	9558.642		6.401	0.000	42422.827	79954.071		
Age in Years at Admission	-195.555	174.938	-0.04125	-1.118	0.264	-538.995	147.885	0.999	1.001
Indicator of Sex	-9443.570	8573.792	-0.04066	-1.101	0.271	-26275.725	7388.585	0.999	1.001
Economic Status	-987.435	2408.533	-0.015	-0.410	0.682	-5715.890	3741.020	0.999	1.001

The VIF results must be less than 2 or near 1 as an ideal result. All variables resulted less than 2. Of the three independent factors, indicator of sex is the predictor with the highest effects on total charges for machine accidents with negative $9,443.57. All factors reduced the total charges for machine accidents patience where age in years $195.555 and economic status $987.435 both were negative. The total charges of machine accidents = 61,188.449 (Constant) - 195.555 (Age in Years) - 9,443.570 (Indicator of Sex) – 987.435 (Economic Status).

4.9.1 Age for Overexertion

The patients were categorized into two age groups, where younger age was 18 to 30 years of age, and older age was 31 to 64 years of age. All other ages were excluded, because this range is the adult working age for work-related injuries[60,67,69]. The total amount of patients with ECODE1= "E9270" was 5,144 patients where younger aged 18-30 years (17.7%) and older aged 31-64 years (82.3%), respectively, as shown in Table 150 below.

Table 150. Overexertion Age Groups

Age Groups	Frequency	Percent
18-30	913	17.7%
31-64	4231	82.3%
Total	5144	100.0%

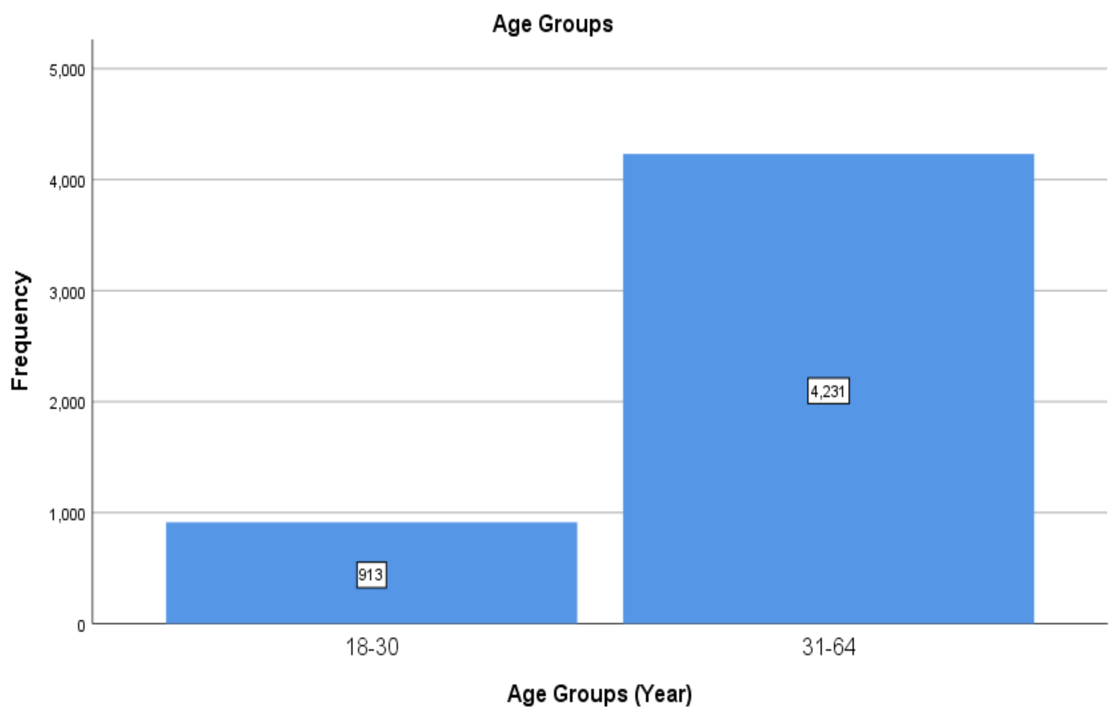

Figure 79 Age Groups of Overexertion

4.9.2 Race for Overexertion

White patients occupied the highest frequency for overexertion at 63.6%, followed by Black patients at 11.7%, closely following Hispanic at 9.8%, and others as shown in Table 151.

Table 151 Overexertion Race Groups

Race	Frequency	Percent
White	3274	63.6%
Black	603	11.7%
Hispanic	505	9.8%
Asian or Pacific Islander	90	1.7%
Native American	40	0.8%
Other	125	2.4%
Missing System	507	9.9%
Total	5144	100.0%

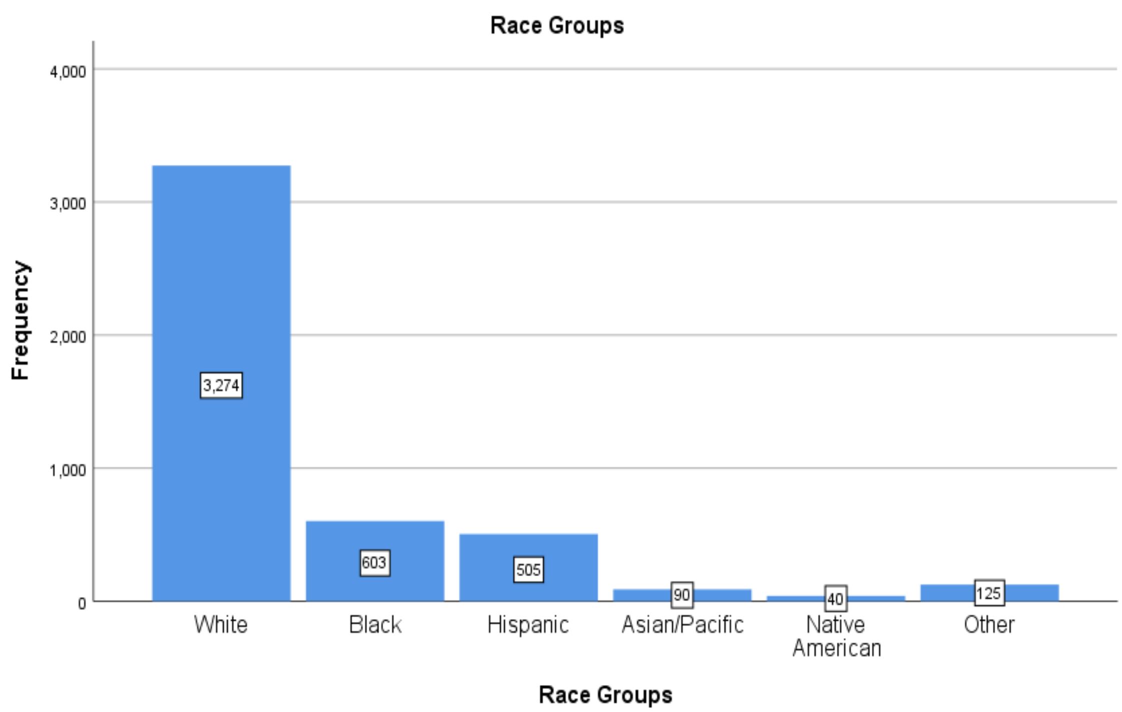

Figure 80 Frequency of Overexertion Among Races

4.9.3 Gender for Overexertion

Males showed higher frequency of overexertion compared to females (58.2% vs 41.8%), as shown in Table 152.

Table 152 Frequency of Overexertion between Genders

Genders	Frequency	Percent
Male	2978	58.2%
Female	2142	41.8%
Total	5120	100.0%

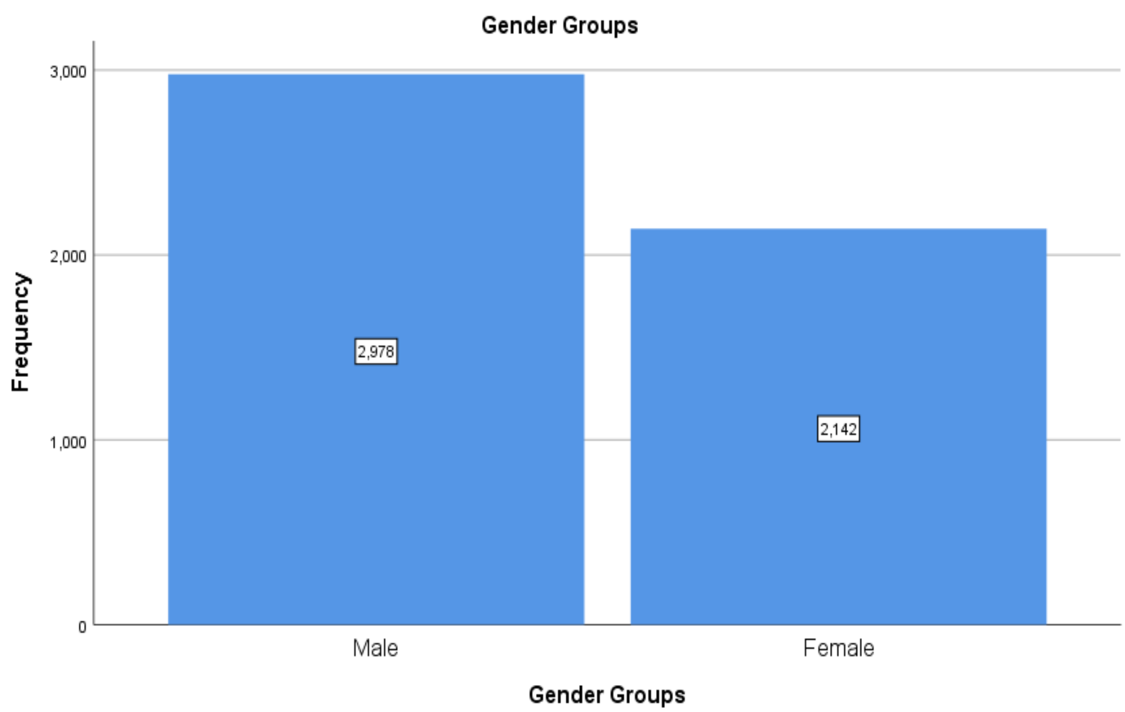

Figure 81 Frequency of Overexertion Among Genders

4.9.4 Length of Stay and Total Charges of Overexertion Patients

The mean for length of stay for patients with overexertion was 3.47 with a standard deviation (±SD) of ±4.743. The mean for total charges was $32,904.47 with ±SD of ±42,264.185 as shown in Table 153 below.

Table 153 Length of Stay and Total Charges of Overexertion

Parameters	Mean	Median	±SD	Skewness	Kurtosis
Length of Hospital Stay (Days)	3.47	2.00	4.743	8.233	133.275
Total Costs ($)	32,904.47	21,998.00	42,264.185	7.550	112.874

4.9.5 Median Household Income

Four levels of median household income were observed in this study, which are 0-25th percentile, 26th to 50th percentile, 51st to 75th percentile, and 76th to 100th percentile. The percentages of median income for patients with overexertion is the following: 25.3% (76th to 100th percentile), 24.9% (51st to 75th percentile), 25.3% (26th to 50th percentile), and 24.5% (0 to 25th percentile) respectively, as shown in Table 154. The 76th to 100th & 26th to 50th Percentiles tie for the highest frequency for overexertion patients.

Table 154 Median Household Income of Overexertion Patients (Year 2011)

Levels of Household Income	Dollar Amount	Frequency	Percent
76th to 100th Percentile	$ 1 to $38,999	1267	25.3%
51st to 75th Percentile	$39,000 to $47,999	1246	24.9%
26th to 50th Percentile	$48,000 to $63,999	1267	25.3%
0 to 25th Percentile	$64,000 +	1226	24.5%
Total		5006	97.3%
Missing System		138	2.7%
Total Cumulation		5144	100.0%

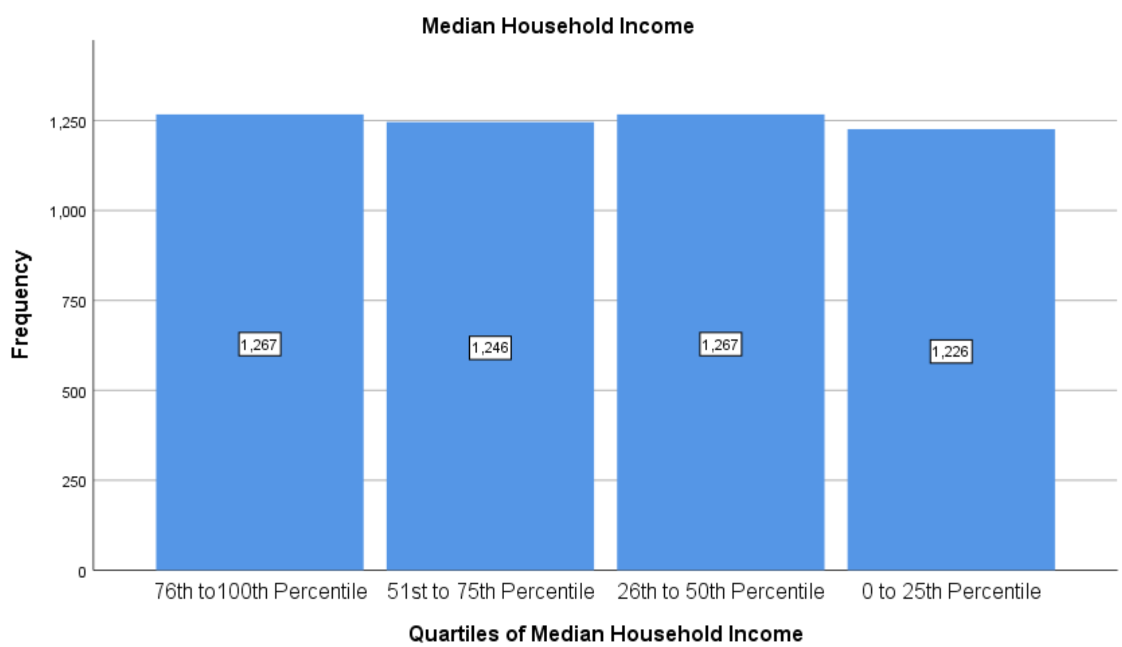

Figure 82 Median Household Income of Overexertion Patients

4.9.6 Admission Day is a Weekend for Overexertion Patients

The admission of the patient was admitted to the weekday at 74.8% versus the weekend at 25.2% respectively, as shown in Table 155.

Table 155 Admission Day is a Weekend for Overexertion

Admission Day is a Weekend	Frequency	Percent
Weekday	3847	74.8%
Weekend	1297	25.2%
Total	5144	100.0%

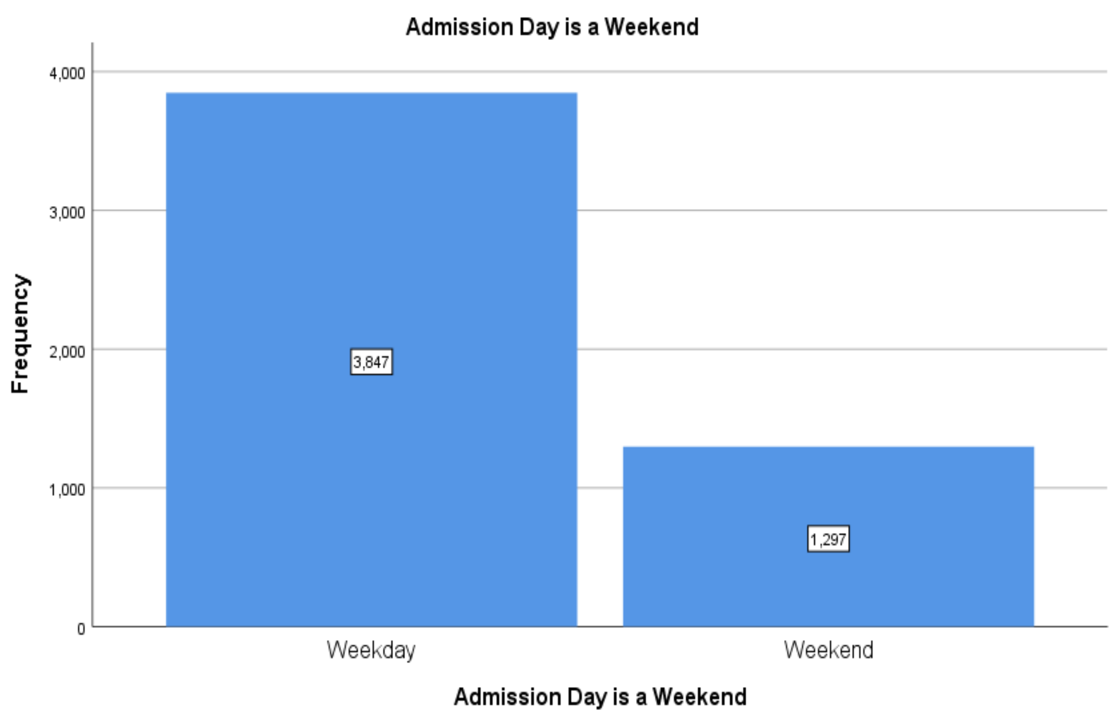

Figure 83 Admission Day is a Weekend for Overexertion

4.9.7 Admission Month for Overexertion Patients

The month of admission for overexertion has more injuries during the month of October with 541 patients (11.6%) and February has the least patients with 299 (6.4%). Table 156 below describes the frequencies of injury per month.

Table 156 Admission Month for Overexertion

Admission Month	Frequency	Percent
January	316	6.8%
February	299	6.4%
March	318	6.8%
April	361	7.7%
May	373	8.0%
June	387	8.3%
July	372	8.0%
August	385	8.3%
September	354	7.6%
October	541	11.6%
November	523	11.2%
December	436	9.3%
Total	4665	100.0%
Missing System	479	10.3%
Total Cumulation	5144	100.0%

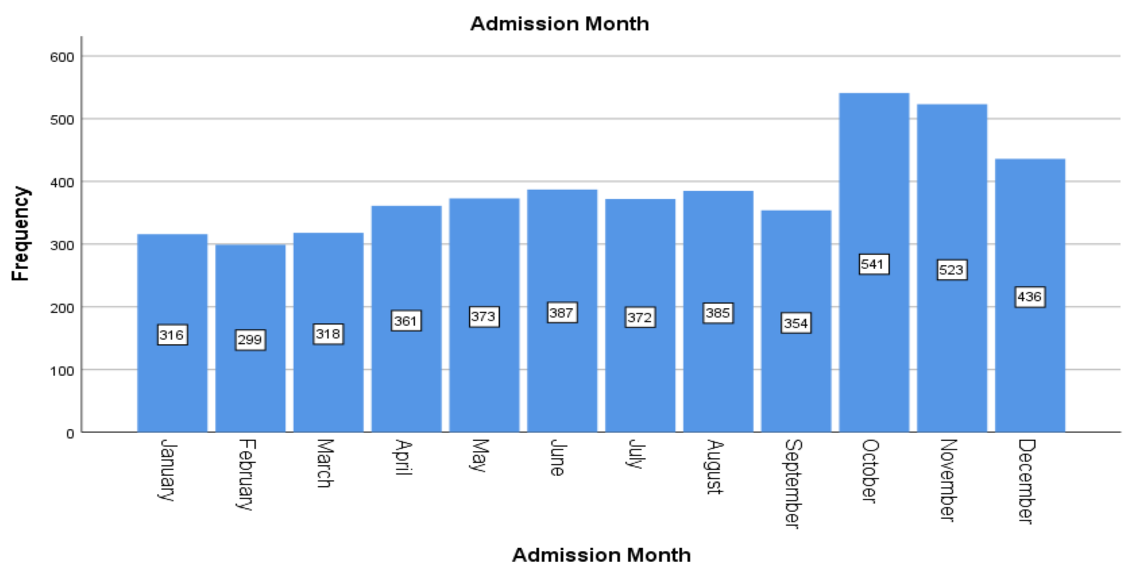

Figure 84 Month of Admission for Overexertion

4.9.8 Region of Hospital for Overexertion Patients

The region with the highest and lowest frequencies is the South at 32.5% (1,672 patients) versus the Midwest at 20.2% (1,039 patients). Table 157 below describes all the region frequencies.

Table 157 Region of Hospital for Overexertion

Region of Hospital	Frequency	Percent
Northeast	1171	22.8%
Midwest	1039	20.2%
South	1672	32.5%
West	1262	24.5%
Total	5144	100.0%

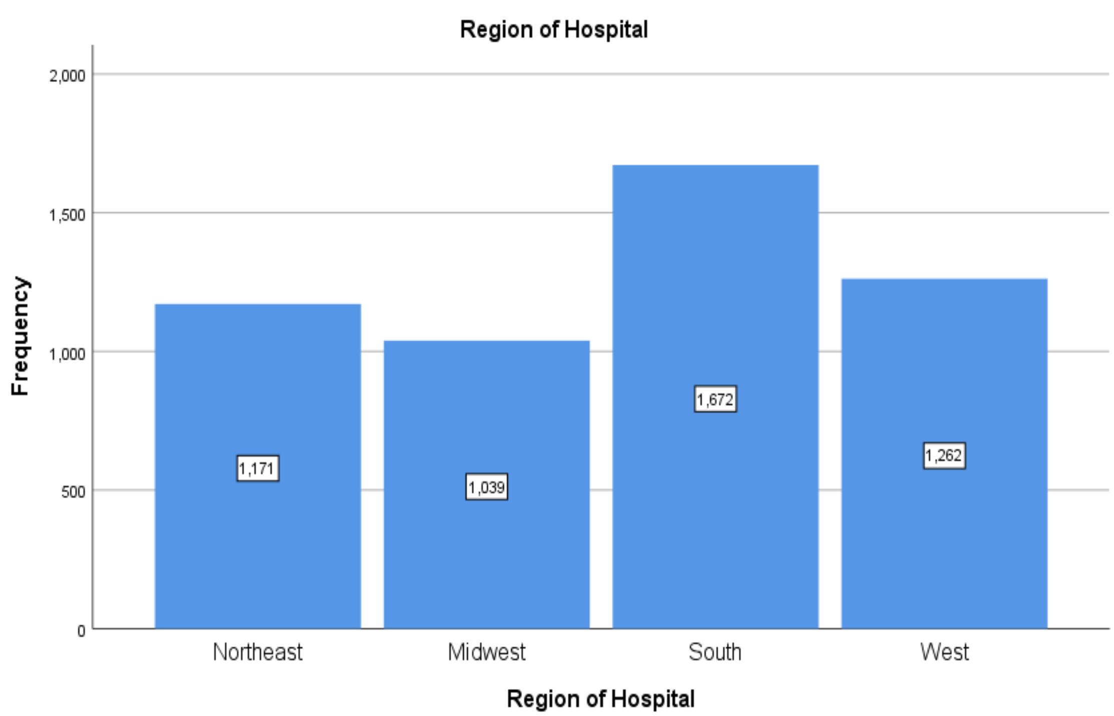

Figure 85 Region of Hospital for Overexertion

4.9.9 Bivariate Pearson Correlation for Overexertion Patients

The Bivariate Pearson Correlation shows significant correlation between indicator of sex and race and age groups and race. There is a negative correlation between: age groups and race, and indicator of sex and race. Whereas one variable increases as the other variable decreases with the same magnitude. Table 158 below describes the correlation of age, indicator of sex, and race with overexertion patients.

Table 158 Bivariate Pearson Correlation for Overexertion Patients

Correlations

		Age Groups	Indicator of Sex	Race (Uniform)
Age Groups	Pearson Correlation	1	.150**	-.147**
	Sig. (2-tailed)		.000	.000
	N	5144	5120	4637
Indicator of Sex	Pearson Correlation	.150**	1	-.048**
	Sig. (2-tailed)	.000		.001
	N	5120	5120	4637
Race (Uniform)	Pearson Correlation	-.147**	-.048**	1
	Sig. (2-tailed)	.000	.001	
	N	4637	4637	4637

**. Correlation is significant at the 0.01 level (2-tailed).

4.9.10 Chi-Square Test Race & Economic Status

The case processing summary counts 4,512 with 632 cases missing. Table 159 below describes the case summary.

Table 159 Case Processing Summary Race & Economic Status for Overexertion

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Median Household Income	4512	87.7%	632	12.3%	5144	100.0%

The crosstabulation for race and economic status shows the expected count versus the actual count for each race and median household income quartiles 1 through 4 in Table 160 below.

Table 160 Race and Economic Status Crosstabulation for Overexertion

Race (Uniform) * Median Household Income Crosstabulation

			Median Household Income Quartile for Patients				Total
			1	2	3	4	
Race (Uniform)	White	Count	648	818	860	877	3203
		Expected Count	805.0	791.5	807.1	799.3	3203.0
	Black	Count	272	112	108	88	580
		Expected Count	145.8	143.3	146.2	144.7	580.0
	Hispanic	Count	147	127	119	94	487
		Expected Count	122.4	120.3	122.7	121.5	487.0
	Asian/ Pacific	Count	14	16	22	36	88
		Expected Count	22.1	21.7	22.2	22.0	88.0
	Native American	Count	17	14	4	1	36
		Expected Count	9.0	8.9	9.1	9.0	36.0
	Other	Count	36	28	24	30	118
		Expected Count	29.7	29.2	29.7	29.4	118.0
Total		Count	1134	1115	1137	1126	4512
		Expected Count	1134.0	1115.0	1137.0	1126.0	4512.0

The Chi-Square Tests has a Pearson Chi-Square value of 238.383 and degrees of freedom (df) of 15 with significance equaling 0.000. See Table 161 below of Chi-Square Test.

Table 161 Chi-Square Tests for Overexertion (Race & Economic Status)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	238.383[a]	15	.000
Likelihood Ratio	225.771	15	.000
Linear-by-Linear Association	38.066	1	.000
N of Valid Cases	4512		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.90.

The Cramer's V values of 0.133 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 162 below as shown.

Table 162 Symmetric Measure for Overexertion (Race & Economic Status)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.133	.000
N of Valid Cases		4512	

4.9.11 Chi-Square Test Race & Region of Hospital

The case processing summary counts 4,637 with 507 cases missing. Table 163 below describes the case summary.

Table 163 Case Processing Summary Race & Region of Hospital for Overexertion

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Region of Hospital	4637	90.1%	507	9.9%	5144	100.0%

The crosstabulation for race and region shows the expected count versus the actual count for each race and regions 1 through 4 in Table 164.

Table 164 Race and Region of Hospital Crosstabulation for Overexertion

Race (Uniform) * Region of Hospital Crosstabulation

			Region of Hospital				
			1	2	3	4	Total
Race (Uniform)	White	Count	809	578	1108	779	3274
		Expected Count	816.2	521.1	1129.0	807.7	3274.0
	Black	Count	186	89	257	71	603
		Expected Count	150.3	96.0	207.9	148.8	603.0
	Hispanic	Count	93	31	176	205	505
		Expected Count	125.9	80.4	174.1	124.6	505.0
	Asian/ Pacific	Count	19	4	18	49	90
		Expected Count	22.4	14.3	31.0	22.2	90.0
	Native American	Count	4	11	6	19	40
		Expected Count	10.0	6.4	13.8	9.9	40.0
	Other	Count	45	25	34	21	125
		Expected Count	31.2	19.9	43.1	30.8	125.0
Total		Count	1156	738	1599	1144	4637
		Expected Count	1156.0	738.0	1599.0	1144.0	4637.0

The Chi-Square Tests has a Pearson Chi-Square value of 237.838 and degrees of freedom (df) of 15 with significance equaling 0.000. See Table 165 below of Chi-Square Test.

Table 165 Chi-Square Tests for Overexertion (Race & Region)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	237.838[a]	15	.000
Likelihood Ratio	242.936	15	.000
Linear-by-Linear Association	7.811	1	.005
N of Valid Cases	4637		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.37.

The Cramer's V values of 0.131 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 166 below as shown.

Table 166 Symmetric Measure for Overexertion (Race & Region)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.131	.000
N of Valid Cases		4637	

4.9.12 Multiple Linear Regression for Length of Stay and Total Charges

The Multiple Linear Regression method is used to find the predictors of length of hospital stay and total charges for overexertion patients. The Durbin Watson (DW) statistic yielded at 1.865 DW as shown in Table 167 below.

Table 167 Model Summary for Overexertion (LOS)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.100[a]	0.010	0.009	4.772	1.865

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Length of stay (Cleaned)

There is a significant relationship between dependent and independent variables.

The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 86.

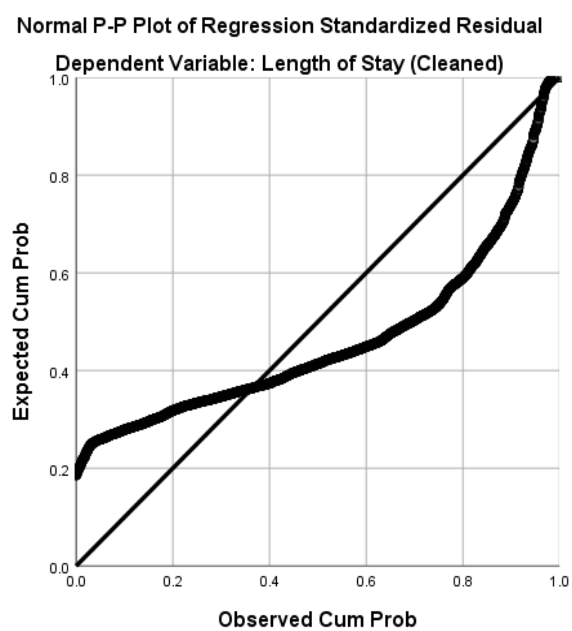

Figure 86 Normal P-P Plot of Regression Residual (LOS) for Overexertion

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 87 below, the scatterplot shows perfect residual distribution.

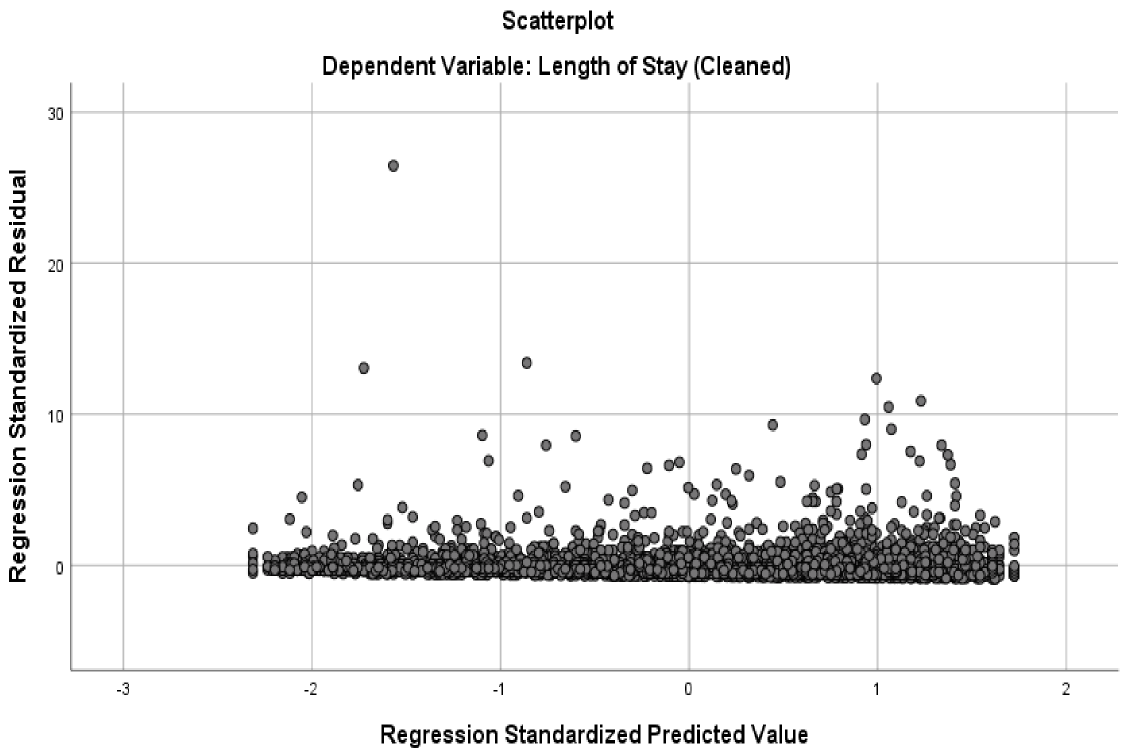

Figure 87 Scatterplot (LOS) for Overexertion

After accepting all assumptions for length of stay, the final models for predictors for overexertion are shown in Table 168.

Table 168 Predictors for Length of Hospital Stay for Overexertion Patients

Predictors	B	Std. Error	Beta	t	*Sig.	95.0% Confidence Lower Bound	95.0% Confidence Upper Bound	Tolerance	VIF
(Constant)	1.944	0.288		6.754	0.000	1.380	2.508		
Age in Years at Admission	0.038	0.005	0.100	7.039	0.000	0.027	0.048	0.976	1.024
Indicator of Sex	-0.056	0.139	-0.006	-0.405	0.686	-0.328	0.216	0.976	1.024
Economic Status	-0.049	0.061	-0.011	-0.812	0.417	-0.168	0.070	1.000	1.000

Collinearity diagnostics is used to determine multicollinearity. The **Variance Inflation Factor (VIF)** must result less than 2 or near 1 as an ideal result. All variables resulted less than 2. Moreover, the data shows no multicollinearity. Age in years was the only significant factor in the length of stay for overexertion patient with 0.038 days. The length of hospital stay for overexertion = 1.944 (Constant) + 0.038 (Age in Years) – 0.056 (Indicator of Sex) – 0.049 (Economic Status).

The Durbin-Watson value for Total Charges yielded 1.773, which is close to the ideal Durbin Watson value of 2.0. Table 169 below displays the results.

Table 169 Model Summary for Overexertion (TOTCHG)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.081[a]	0.007	0.006	42522.999	1.773

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Total Charges (Cleaned)

There is a significant relationship between dependent and independent variables.

The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 88.

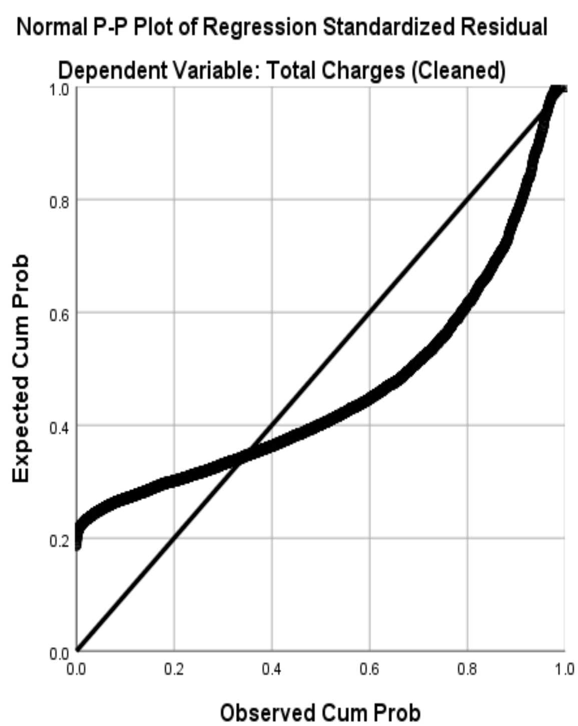

Figure 88 Normal P-P Plot of Regression Residual (TOTCHG) for Overexertion

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 89, the scatterplot shows perfect residual distribution.

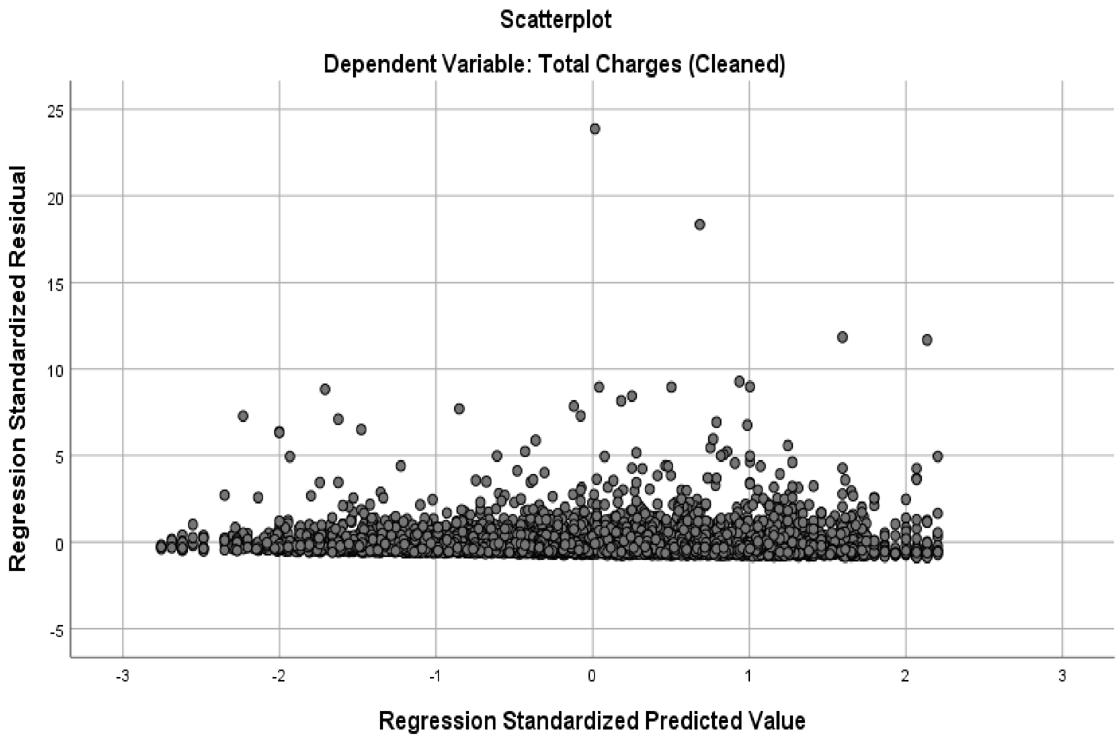

Figure 89 Scatterplot (TOTCHG) for Overexertion

After accepting all assumptions for total charges, the final models for predictors for overexertion is shown in Table 170 below.

Table 170 Predictors for Total Charges for Overexertion Patients

Predictors	B	Std. Error	Beta	t	*Sig.	95.0% Confidence Lower Bound	95.0% Confidence Upper Bound	Tolerance	VIF
(Constant)	19398.059	2581.784		7.513	0.000	14336.606	24459.512		
Age in Years at Admission	232.631	48.154	0.069618	4.831	0.000	138.227	327.034	0.976	1.025
Indicator of Sex	-1667.413	1246.077	-0.01929	-1.338	0.181	-4110.283	775.457	0.976	1.025
Economic Status	1568.457	544.251	0.041	2.882	0.004	501.482	2635.432	1.000	1.000

The VIF results must be less than 2 or near 1 as an ideal result. All variables resulted less than 2. Of the three independent factors, economic status is the predictor with the highest effects on total charges for overexertion with $1,568.457. The factor related to the reduction of total charges was indicator of sex, which is negative $1,667.413. Age in years and economic status were significant variables that effect the total charges of patients with overexertion. The total charges of overexertion = 19,398.059 (Constant) + 232.631 (Age in Years) – 1,667.413 (Indicator of Sex) + 1,568.457 (Economic Status).

4.10.1 Age for Sprains/Strains

The patients were categorized into two age groups, where younger age was 18 to 30 years of age, and older age was 31 to 64 years of age. All other ages were excluded, because this range is the adult working age for work-related injuries[60,67,69]. The total amount of patients with ECODE1= "E8489" was 15,307 patients where younger aged 18-30 years (14.7%) and older aged 31-64 years (85.3%), respectively, as shown in Table 171 below.

Table 171 Sprains/Strains Age Groups

Age Groups	Frequency	Percent
18-30	2254	14.7%
31-64	13053	85.3%
Total	15307	100.0%

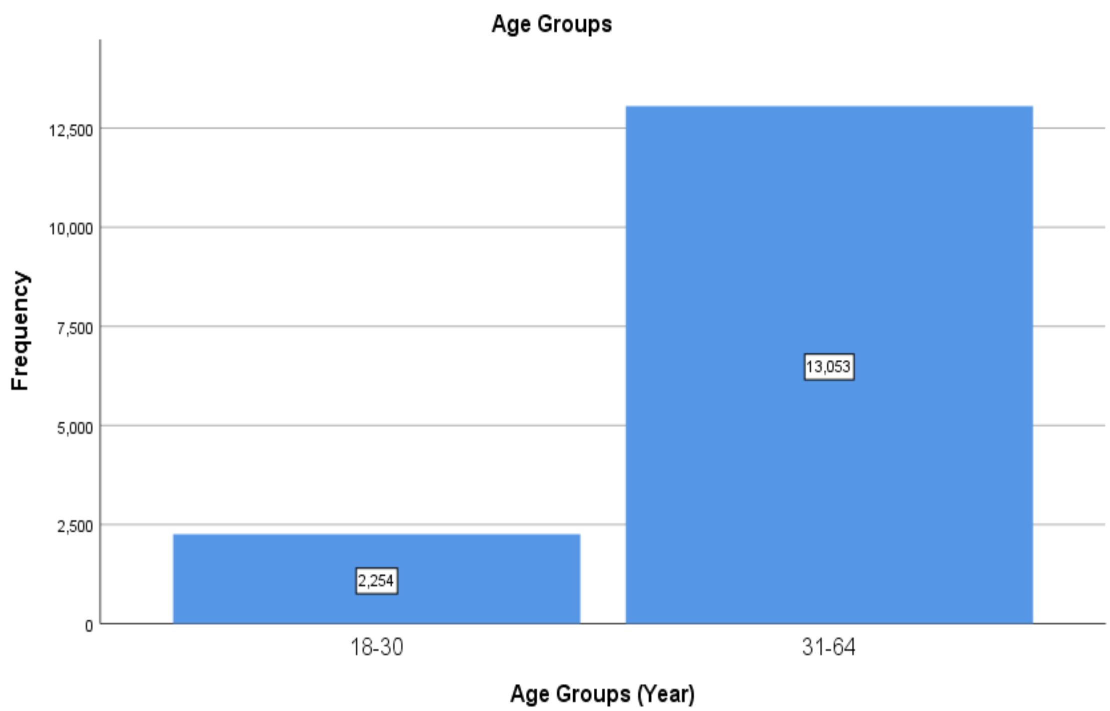

Figure 90 Age Groups of Sprains/Strains

4.10.2 Race for Sprains/Strains

White patients occupied the highest frequency for sprains/strains at 57.1%, followed by Black patients at 14.2%, closely following Hispanic at 8.9%, and others as shown in Table 172.

Table 172 Sprains/Strains Race Groups

Race	Frequency	Percent
White	8737	57.1%
Black	2179	14.2%
Hispanic	1357	8.9%
Asian or Pacific Islander	128	0.8%
Native American	201	1.3%
Other	392	2.6%
Missing System	2313	15.1%
Total	15307	100.0%

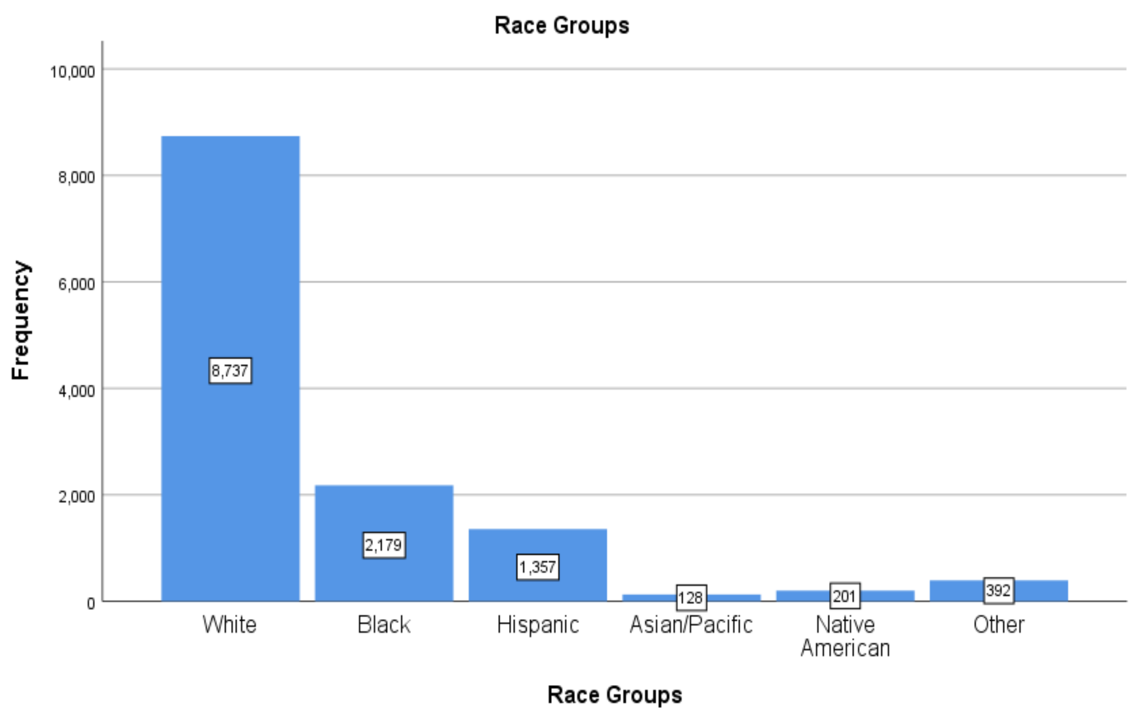

Figure 91 Frequency of Sprains/Strains Among Races

4.10.3 Gender for Sprains/Strains

Females showed higher frequency of sprains/strains compared to males (53.3% vs 46.7%), as shown in Table 173.

Table 173 Frequency of Sprains/Strains between Genders

Genders	Frequency	Percent
Male	7145	46.7%
Female	8156	53.3%
Total	15301	100.0%

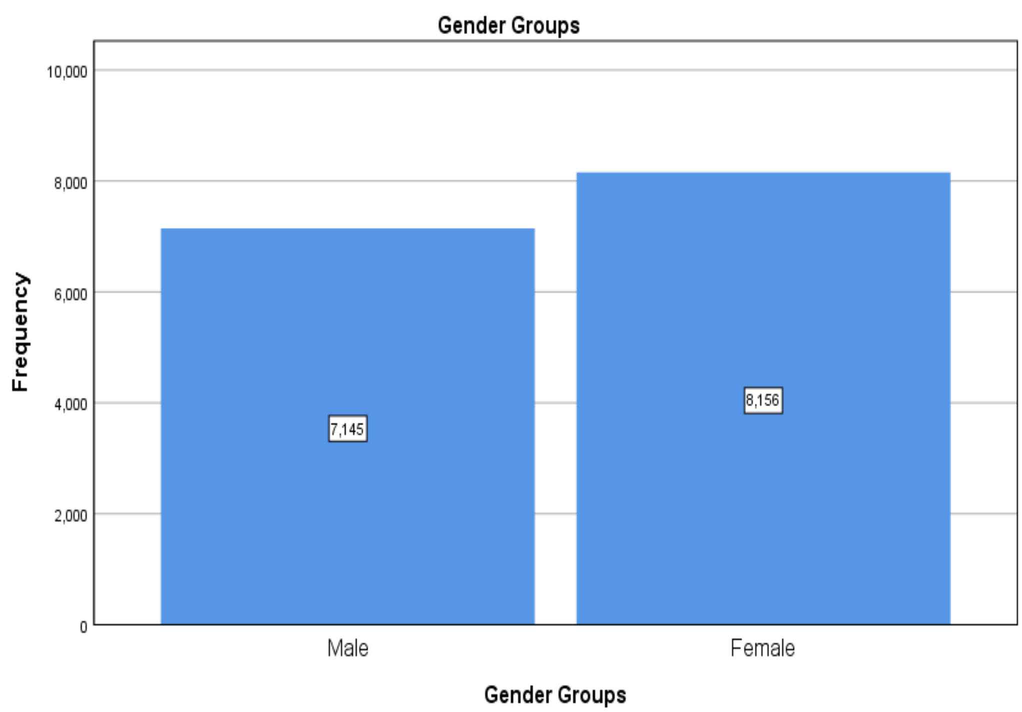

Figure 92 Frequency of Sprains/Strains Among Genders

4.10.4 Length of Stay and Total Charges of Sprains/Strains Patients

The mean for length of stay for patients with sprains/strains was 4.52 with a standard deviation (±SD) of ±6.077. The mean for total charges was $35,141.71 with ±SD of ±51,445.173 as shown in Table 174 below.

Table 174 Length of Stay and Total Charges of Sprains/Strains

Parameters	Mean	Median	±SD	Skewness	Kurtosis
Length of Hospital Stay (Days)	4.52	3.00	6.077	10.192	231.080
Total Costs ($)	35,141.71	20,929.50	51,445.173	8.209	129.068

4.10.5 Median Household Income

Four levels of median household income were observed in this study, which are 0-25th percentile, 26th to 50th percentile, 51st to 75th percentile, and 76th to 100th percentile. The percentages of median income for patients with sprains/strains is the following: 36.8% (76th to 100th percentile), 28.0% (51st to 75th percentile), 21.4% (26th to 50th percentile), and 13.8% (0 to 25th percentile) respectively, as shown in Table 175. The 76th to 100th Percentile has the highest frequency for sprains/strains patients.

Table 175 Median Household Income of Sprains/Strains Patients (Year 2011)

Levels of Household Income	Dollar Amount	Frequency	Percent
76th to 100th Percentile	$ 1 to $38,999	5538	36.8%
51st to 75th Percentile	$39,000 to $47,999	4210	28.0%
26th to 50th Percentile	$48,000 to $63,999	3214	21.4%
0 to 25th Percentile	$64,000 +	2076	13.8%
Total		15038	98.2%
Missing System		269	1.8%
Total Cumulation		15307	100.0%

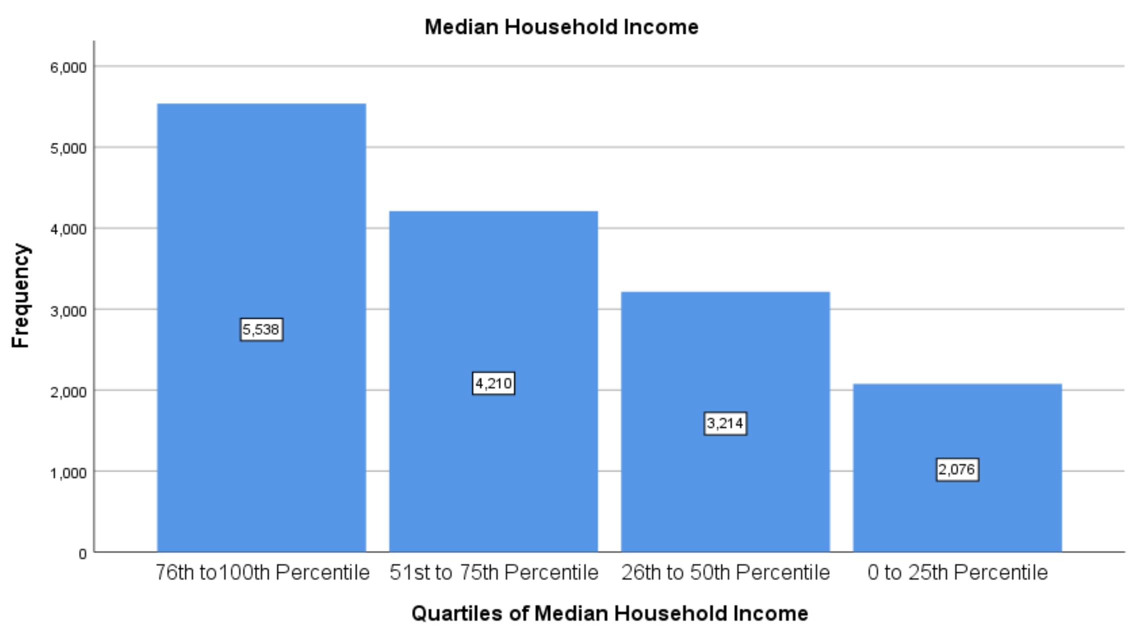

Figure 93 Median Household Income of Sprains/Strains Patients

4.10.6 Admission Day is a Weekend for Sprains/Strains Patients

The admission of the patient was admitted to the weekday at 75.1% versus the weekend at 24.9% respectively, as shown in Table 176.

Table 176 Admission Day is a Weekend for Sprains/Strains

Admission Day is a Weekend	Frequency	Percent
Weekday	11493	75.1%
Weekend	3814	24.9%
Total	15307	100.0%

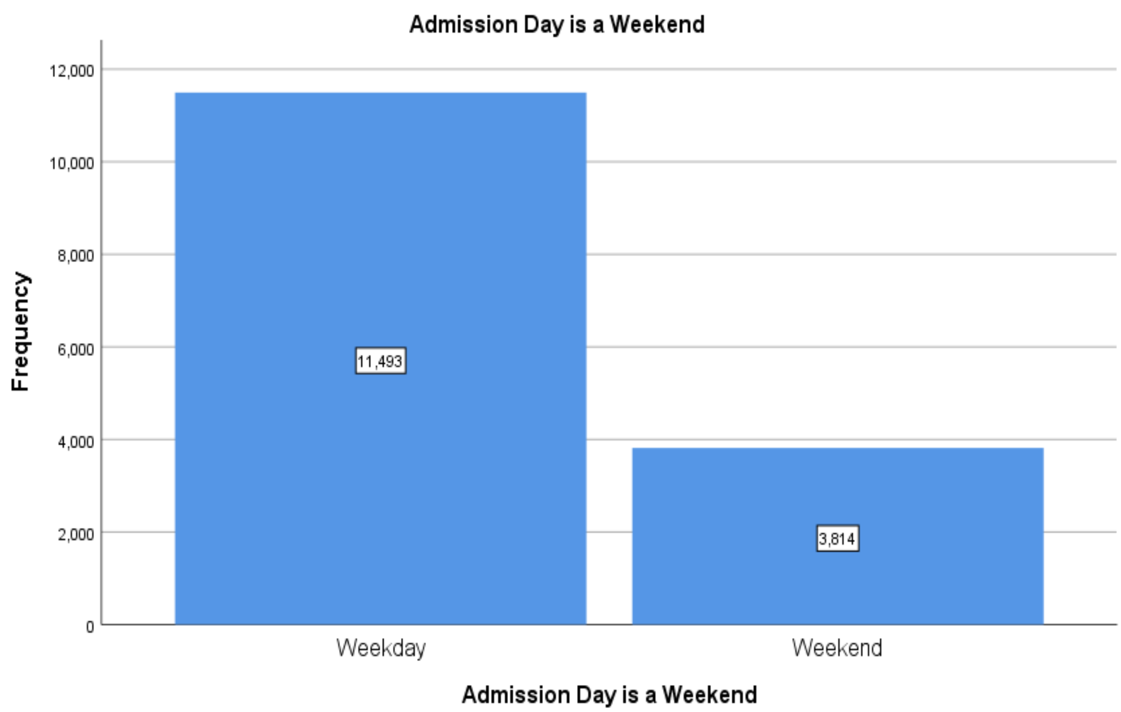

Figure 94 Admission Day is a Weekend for Sprains/Strains

4.10.7 Admission Month for Sprains/Strains Patients

The month of admission for sprains/strains has more injuries during the month of July with 1,441 patients (9.8%) and April has the least patients with 966 (6.6%). Table 177 below describes the frequencies of injury per month.

Table 177 Admission Month for Sprains/Strains

Admission Month	Frequency	Percent
January	1232	8.4%
February	1046	7.1%
March	1089	7.4%
April	966	6.6%
May	1159	7.9%
June	1132	7.7%
July	1441	9.8%
August	1355	9.3%
September	1253	8.6%
October	1362	9.3%
November	1284	8.8%
December	1317	9.0%
Total	14636	100.0%
Missing System	671	4.6%
Total Cumulation	15307	100.0%

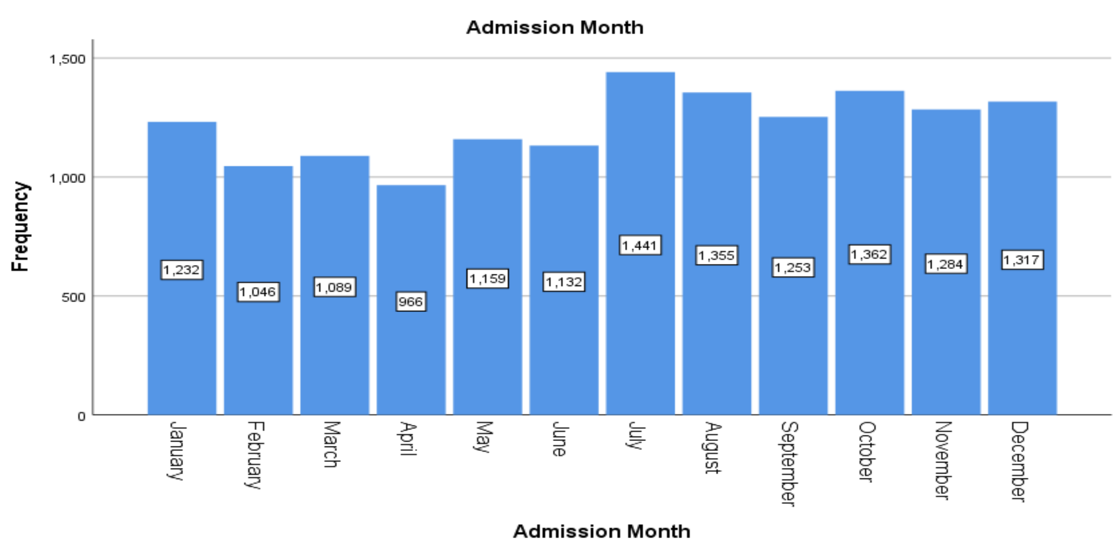

Figure 95 Month of Admission for Sprains/Strains

4.10.8 Region of Hospital for Sprains/Strains Patients

The region with the highest and lowest frequencies is the South at 51.4% (7,866 patients) versus the Northeast at 11.6% (1,773 patients). Table 178 below describes all the region frequencies.

Table 178 Region of Hospital for Sprains/Strains

Region of Hospital	Frequency	Percent
Northeast	1773	11.6%
Midwest	3759	24.6%
South	7866	51.4%
West	1909	12.5%
Total	15307	100.0%

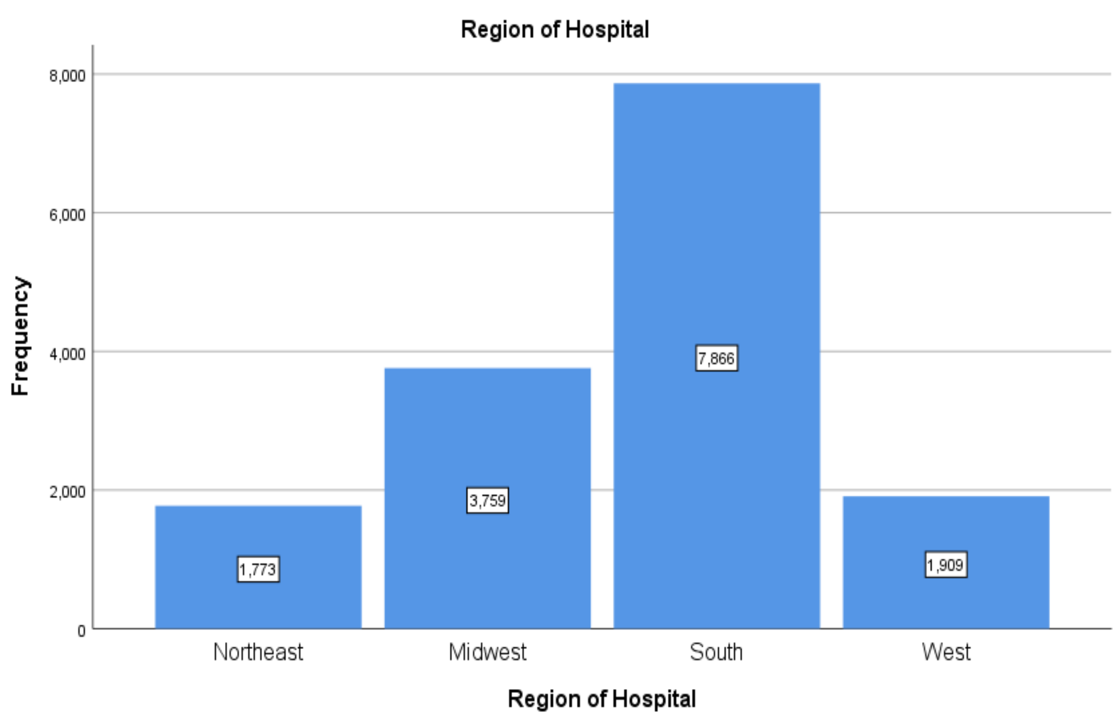

Figure 96 Region of Hospital for Sprains/Strains

4.10.9 Bivariate Pearson Correlation for Sprains/Strains Patients

The Bivariate Pearson Correlation shows significant correlation between indicator of sex and race, and indicator of sex and age groups. Also, correlation with age groups and race with sprains/strains patients. There is a negative correlation between: age groups and race, and indicator of sex and race. Moreover, if one variable increases, the other variable decreases with the same magnitude. In addition, there is a significant positive correlation between age groups and indicator of sex where both variables move in tandem as both increase or decrease. Table 179 below describes the correlation of age, indicator of sex, and race with sprains/strains patients.

Table 179 Bivariate Pearson Correlation for Sprains/Strains Patients

Correlations

		Age in Groups	Indicator of Sex	Race (Uniform)
Age Groups	Pearson Correlation	1	.016*	-.119**
	Sig. (2-tailed)		.045	.000
	N	15307	15301	12994
Indicator of Sex	Pearson Correlation	.016*	1	-.025**
	Sig. (2-tailed)	.045		.004
	N	15301	15301	12994
Race (Uniform)	Pearson Correlation	-.119**	-.025**	1
	Sig. (2-tailed)	.000	.004	
	N	12994	12994	12994

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

4.10.10 Chi-Square Test Race & Economic Status

The case processing summary counts 12,773 with 2,534 cases missing. Table 180 below describes the case summary.

Table 180 Case Processing Summary Race & Economic Status for Sprains/Strains

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Median Household Income	12773	83.4%	2534	16.6%	15307	100.0%

The crosstabulation for race and economic status shows the expected count versus the actual count for each race and median household income quartiles 1 through 4 in Table 181 below.

Table 181 Race and Economic Status Crosstabulation for Sprains/Strains

Race (Uniform) * Median Household Income Crosstabulation

			Median Household Income Quartile for Patients				Total
			1	2	3	4	
Race (Uniform)	White	Count	2479	2511	2105	1484	8579
		Expected Count	3100.3	2363.5	1882.0	1233.2	8579.0
	Black	Count	1140	512	342	162	2156
		Expected Count	779.2	594.0	473.0	309.9	2156.0
	Hispanic	Count	736	292	206	101	1335
		Expected Count	482.5	367.8	292.9	191.9	1335.0
	Asian/ Pacific	Count	24	26	44	33	127
		Expected Count	45.9	35.0	27.9	18.3	127.0
	Native American	Count	112	56	15	5	188
		Expected Count	67.9	51.8	41.2	27.0	188.0
	Other	Count	125	122	90	51	388
		Expected Count	140.2	106.9	85.1	55.8	388.0
Total		Count	4616	3519	2802	1836	12773
		Expected Count	4616.0	3519.0	2802.0	1836.0	12773.0

The Chi-Square Tests has a Pearson Chi-Square value of 816.204 and degrees of freedom (df) of 15 with significance equaling 0.000. See Table 182 below of Chi-Square Test.

Table 182 Chi-Square Tests for Sprains/Strains (Race & Economic Status)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	816.204[a]	15	.000
Likelihood Ratio	822.850	15	.000
Linear-by-Linear Association	221.493	1	.000
N of Valid Cases	12773		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 18.26.

The Cramer's V values of 0.146 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 183 below as shown.

Table 183 Symmetric Measure for Sprains/Strains (Race & Economic Status)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.146	.000
N of Valid Cases		12773	

4.10.11 Chi-Square Test Race & Region of Hospital

The case processing summary counts 12,994 with 2,313 cases missing. Table 184 below describes the case summary.

Table 184 Case Processing Summary Race & Region of Hospital for Sprains/Strains

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Region of Hospital	12994	84.9%	2313	15.1%	15307	100.0%

The crosstabulation for race and region shows the expected count versus the actual count for each race and regions 1 through 4 in Table 185.

Table 185 Race and Region of Hospital Crosstabulation for Sprains/Strains

Race (Uniform) * Region of Hospital Crosstabulation

			Region of Hospital				
			1	2	3	4	Total
Race (Uniform)	White	Count	1160	2359	4114	1104	8737
		Expected Count	1179.4	1981.5	4420.9	1155.2	8737.0
	Black	Count	344	353	1394	88	2179
		Expected Count	294.1	494.2	1102.6	288.1	2179.0
	Hispanic	Count	161	68	821	307	1357
		Expected Count	183.2	307.8	686.6	179.4	1357.0
	Asian/ Pacific	Count	13	19	51	45	128
		Expected Count	17.3	29.0	64.8	16.9	128.0
	Native American	Count	2	51	49	99	201
		Expected Count	27.1	45.6	101.7	26.6	201.0
	Other	Count	74	97	146	75	392
		Expected Count	52.9	88.9	198.4	51.8	392.0
Total		Count	1754	2947	6575	1718	12994
		Expected Count	1754.0	2947.0	6575.0	1718.0	12994.0

The Chi-Square Tests has a Pearson Chi-Square value of 1,003.047 and degrees of freedom (df) of 15 with significance equaling 0.000. See Table 186 below of Chi-Square Test.

Table 186 Chi-Square Tests for Sprains/Strains (Race & Region)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1003.047[a]	15	.000
Likelihood Ratio	1046.343	15	.000
Linear-by-Linear Association	100.691	1	.000
N of Valid Cases	12994		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 16.92.

The Cramer's V values of 0.160 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 187 below as shown.

Table 187 Symmetric Measure for Sprains/Strains (Race & Region)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.160	.000
N of Valid Cases		12994	

4.10.12 Multiple Linear Regression for Length of Stay and Total Charges

The Multiple Linear Regression method is used to find the predictors of length of hospital stay and total charges for sprains/strains patients. The Durbin Watson (DW) statistic yielded at 1.939 DW as shown in Table 188 below.

Table 188 Model Summary for Sprains/Strains (LOS)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.071[a]	.005	.005	6.063	1.939

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Length of stay (Cleaned)

There is a significant relationship between dependent and independent variables.

The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 97.

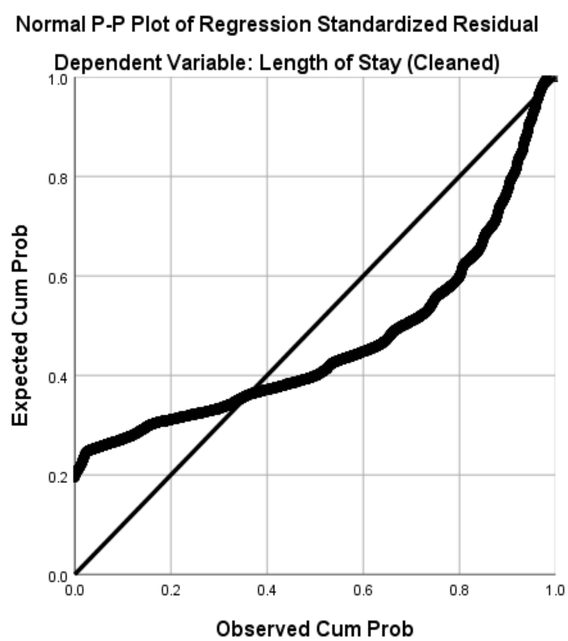

Figure 97 Normal P-P Plot of Regression Residual (LOS) for Sprains/Strains

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 98 below, the scatterplot shows perfect residual distribution.

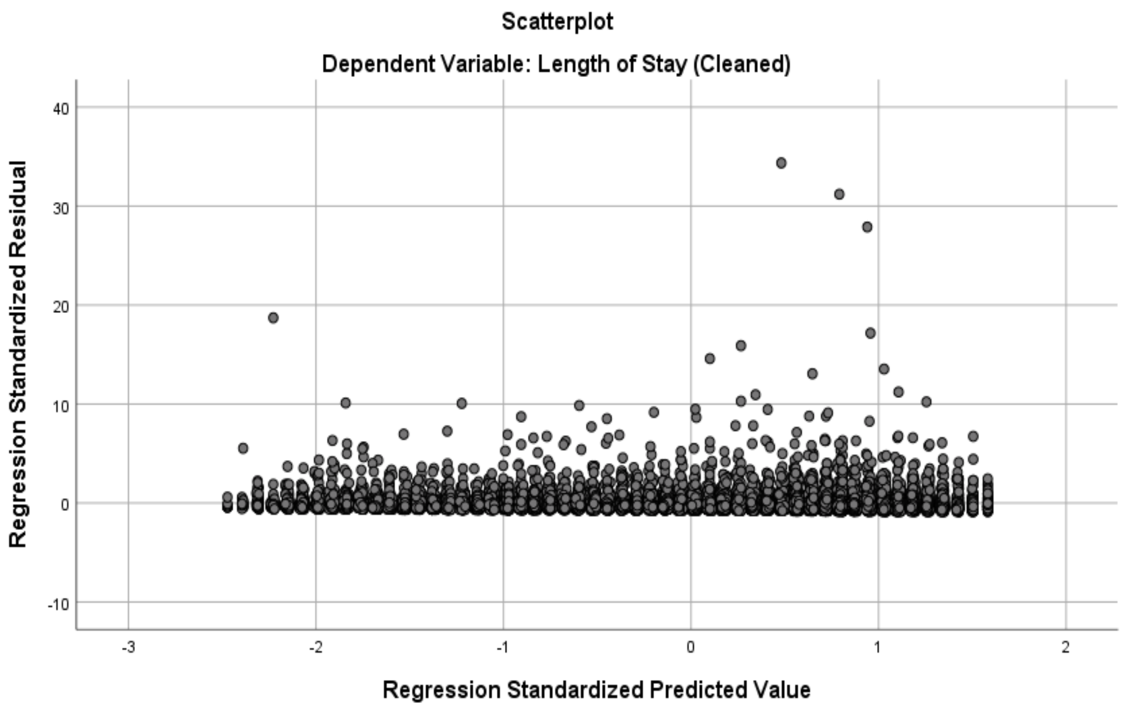

Figure 98 Scatterplot (LOS) for Sprains/Strains

After accepting all assumptions for length of stay, the final models for predictors for sprains/strains are shown in Table 189.

Table 189 Predictors for Length of Hospital Stay for Sprains/Strains Patients

Predictors	B	Std. Error	Beta	t	*Sig.	95.0% Confidence Lower Bound	95.0% Confidence Upper Bound	Tolerance	VIF
(Constant)	3.097	0.214		14.481	0.000	2.678	3.516		
Age in Years at Admission	0.034	0.004	0.071	8.698	0.000	0.026	0.041	0.999	1.001
Indicator of Sex	-0.105	0.099	-0.009	-1.063	0.288	-0.300	0.089	1.000	1.000
Economic Status	-0.036	0.047	-0.006	-0.774	0.439	-0.128	0.055	0.999	1.001

Collinearity diagnostics is used to determine multicollinearity. The **Variance Inflation Factor (VIF)** must result less than 2 or near 1 as an ideal result. All variables resulted less than 2. Moreover, the data shows no multicollinearity. Age in years is significant in the regression model to predict length of stay with 0.034 days. Indicator of sex and economic status were both factors in reducing the length of stay with 0.105 and 0.036 days, respectively. The length of hospital stay for sprains/strains = 3.097 (Constant) + 0.034 (Age in Years) – 0.105 (Indicator of Sex) – 0.036 (Economic Status).

The Durbin-Watson value for Total Charges yielded 1.791, which is close to the ideal Durbin Watson value of 2.0. Table 190 below displays the results.

Table 190 Model Summary for Sprains/Strains (TOTCHG)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.108[a]	0.012	0.011	51150.884	1.791

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Total Charges (Cleaned)

There is a significant relationship between dependent and independent variables.

The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 99.

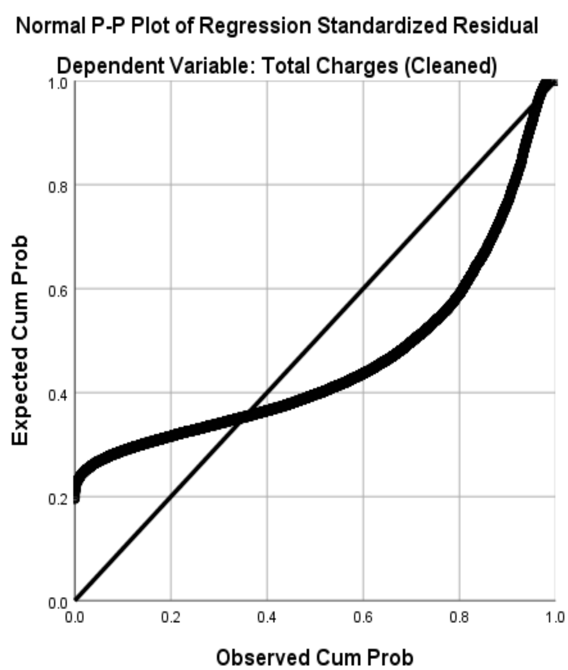

Figure 99 Normal P-P Plot of Regression Residual (TOTCHG) for Sprains/Strains

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 100, the scatterplot shows perfect residual distribution.

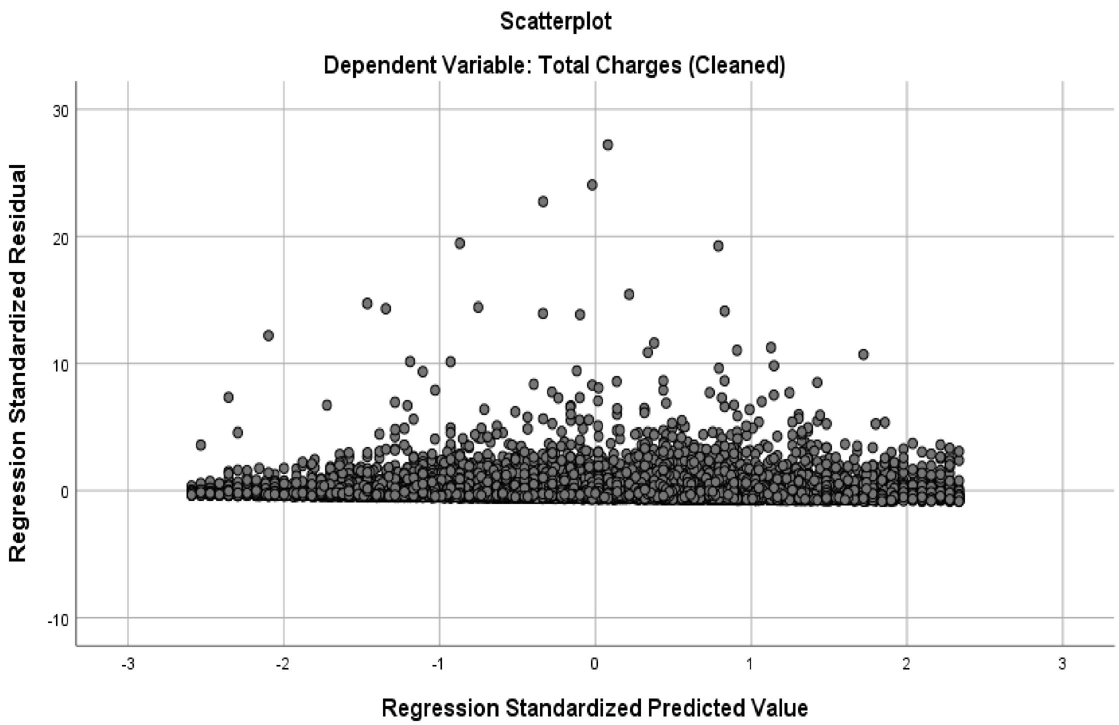

Figure 100 Scatterplot (TOTCHG) for Sprains/Strains

After accepting all assumptions for total charges, the final models for predictors for sprains/strains is shown in Table 191 below.

Table 191 Predictors for Total Charges for Sprains/Strains Patients

Predictors	B	Std. Error	Beta	t	*Sig.	95.0% Confidence Lower Bound	95.0% Confidence Upper Bound	Tolerance	VIF
(Constant)	17385.167	1808.286		9.614	0.000	13840.706	20929.628		
Age in Years at Admission	329.026	32.599	0.082081	10.093	0.000	265.127	392.924	0.999	1.001
Indicator of Sex	-4940.091	838.153	-0.04791	-5.894	0.000	-6582.974	-3297.208	1.000	1.000
Economic Status	2407.793	395.364	0.050	6.090	0.000	1632.830	3182.756	0.999	1.001

The VIF results must be less than 2 or near 1 as an ideal result. All variables resulted less than 2. Of the three independent variables, economic status is the predictor with the highest effect on total charges for sprains/strains with $2,407.793. The factor related to reduction of total charges was indicator of sex, which is negative $4,940.091. All three factors were significant variables that effect the total charges of patients with sprains/strains. The total charges of sprains/strains = 17,385.167 (Constant) + 329.026 (Age in Years) -4,940.091 (Indicator of Sex) + 2,407.793 (Economic Status).

4.11.1 Age for Struck By or Against Object

The patients were categorized into two age groups, where younger age was 18 to 30 years of age, and older age was 31 to 64 years of age. All other ages were excluded, because this range is the adult working age for work-related injuries[60,67,69]. The total amount of patients with ECODE1= "E916" was 6,554 patients where younger aged 18-30 years (20.1%) and older aged 31-64 years (79.9%), respectively, as shown in Table 192 below.

Table 192 Struck By or Against Object Age Groups

Age Groups	Frequency	Percent
18-30	1319	20.1%
31-64	5235	79.9%
Total	6554	100.0%

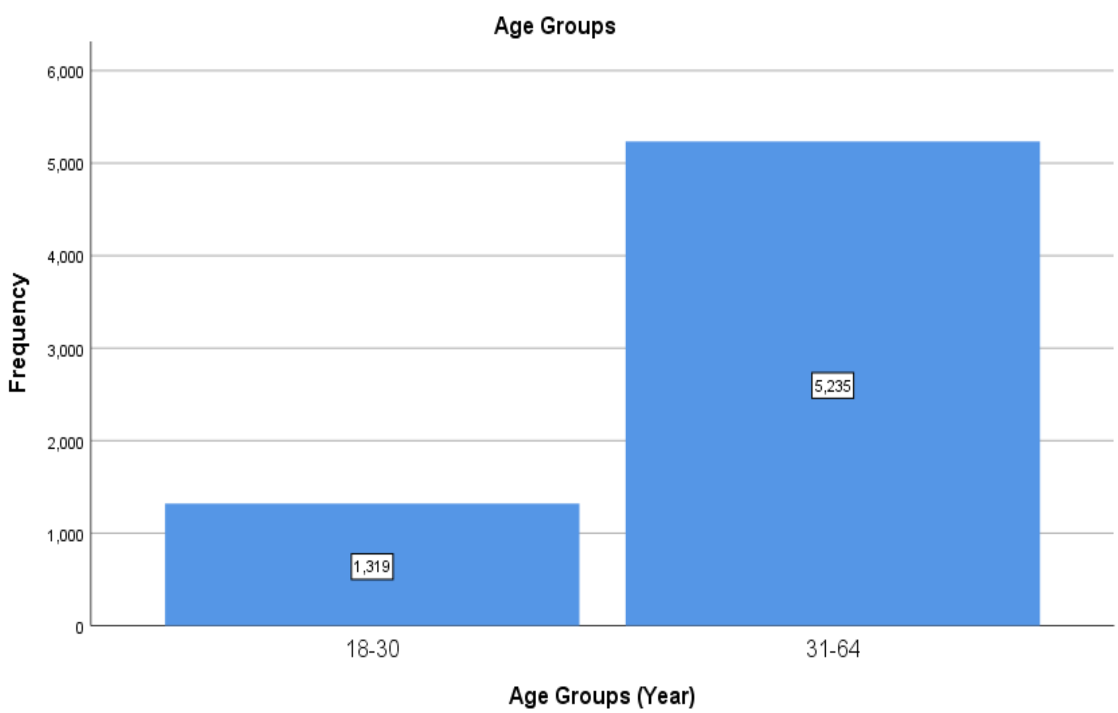

Figure 101 Age Groups of Struck By or Against Object

4.11.2 Struck By or Against Object Race Groups

White patients occupied the highest frequency of burns 3rd degree of the hand at 56.9%, followed by Hispanic patients at 14.5%, next highest is Black patients at 9.0%, and others as shown in Table 193.

Table 193 Patients Race Groups

Race	Frequency	Percent
White	3727	56.9%
Black	592	9.0%
Hispanic	948	14.5%
Asian or Pacific Islander	85	1.3%
Native American	55	0.8%
Other	205	3.1%
Missing System	942	14.4%
Total	6554	100.0%

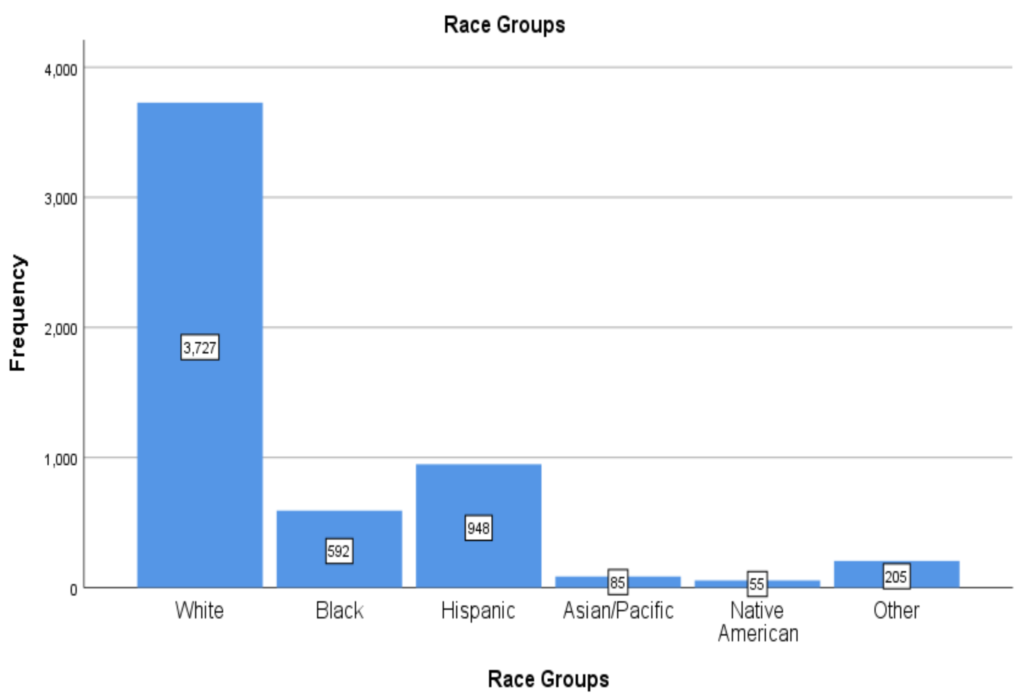

Figure 102 Frequency of Struck By or Against Object Among Races

4.11.3 Gender for Struck By or Against Object

Males showed higher frequency of struck by or against object compared to females (83.5% vs 16.5%), as shown in Table 194.

Table 194 Frequency of Struck By or Against Object between Genders

Genders	Frequency	Percent
Male	5450	83.5%
Female	1076	16.5%
Total	6526	100.0%

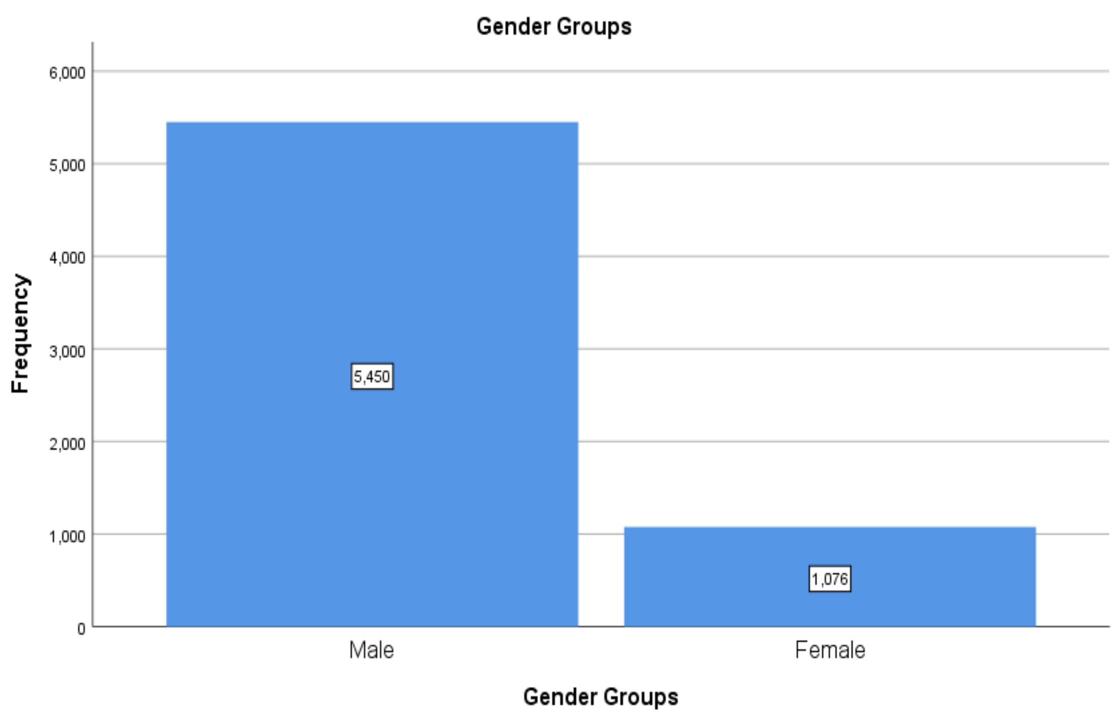

Figure 103 Frequency of Struck By or Against Object Among Genders

4.11.4 Length of Stay and Total Charges of Struck By or Against Object Patients

The mean for length of stay for patients with struck by or against object was 4.51 with a standard deviation (±SD) of ±6.082. The mean for total charges was $43,640.35 with ±SD of ±75,623.374 as shown in Table 195 below.

Table 195 Length of Stay and Total Charges of Struck By or Against Object

Parameters	Mean	Median	±SD	Skewness	Kurtosis
Length of Hospital Stay (Days)	4.51	3.00	6.082	5.191	44.105
Total Costs ($)	43,640.35	23,783.00	75,623.374	7.801	94.114

4.11.5 Median Household Income

Four levels of median household income were observed in this study, which are 0-25th percentile, 26th to 50th percentile, 51st to 75th percentile, and 76th to 100th percentile. The percentages of median income for patients with struck by or against object is the following: 31.5% (76th to 100th percentile), 26.9% (51st to 75th percentile), 23.7% (26th to 50th percentile), and 17.9% (0 to 25th percentile) respectively, as shown in Table 196. The 76th to 100th percentile has the highest frequency for struck by or against object patients.

Table 196 Median Household Income of Struck By or Against Object Patients (Year 2011)

Levels of Household Income	Dollar Amount	Frequency	Percent
76th to 100th Percentile	$ 1 to $38,999	2054	32.3%
51st to 75th Percentile	$39,000 to $47,999	1850	29.1%
26th to 50th Percentile	$48,000 to $63,999	1487	23.4%
0 to 25th Percentile	$64,000 +	965	15.2%
Total		6356	97.0%
Missing System		198	3.0%
Total Cumulation		6554	100.0%

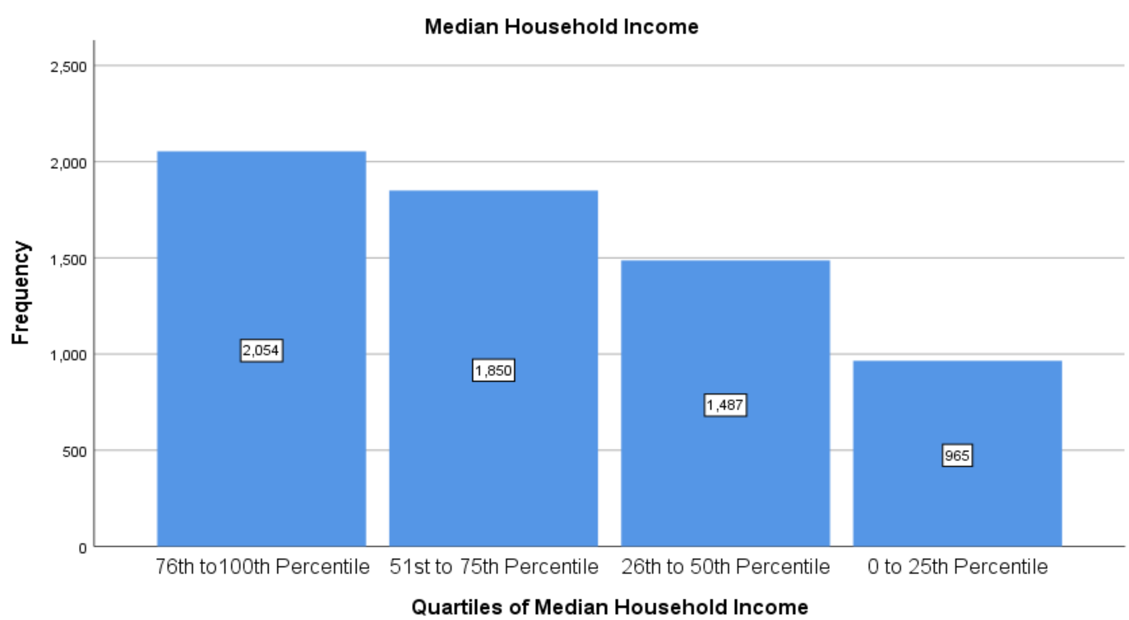

Figure 104 Median Household Income of Struck By or Against Object

4.11.6 Admission Day is a Weekend for Struck By or Against Object Patients

The admission of the patient was admitted to the weekday at 77.9% versus the weekend at 22.1% respectively, as shown in Table 197.

Table 197 Admission Day is a Weekend for Struck By or Against Object

Admission Day is a Weekend	Frequency	Percent
Weekday	5106	77.9%
Weekend	1448	22.1%
Total	6554	100.0%

Figure 105 Admission Day is a Weekend for Struck By or Against Object

4.11.7 Admission Month for Struck By or Against Object Patients

The month of admission for struck by or against object has more injuries during the month of August with 592 patients (9.9%) and December has the least patients with 400 (6.7%). Table 198 below describes the frequencies of injury per month.

Table 198 Admission Month for Struck By or Against Object

Admission Month	Frequency	Percent
January	449	7.5%
February	424	7.1%
March	440	7.4%
April	524	8.8%
May	511	8.5%
June	529	8.8%
July	569	9.5%
August	592	9.9%
September	526	8.8%
October	546	9.1%
November	475	7.9%
December	400	6.7%
Total	5985	100.0%
Missing System	569	9.5%
Total Cumulation	6554	100.0%

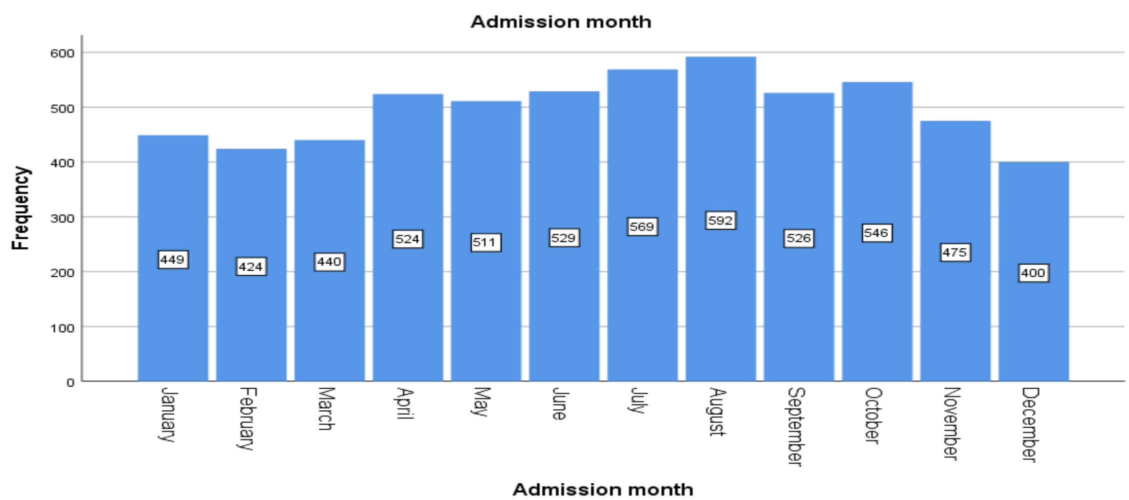

Figure 106 Month of Admission for Struck By or Against Object

4.11.8 Region of Hospital for Struck By or Against Object Patients

The region with the highest and lowest frequencies is the South at 40.6% (2,663 patients) versus the West at 18.9% (1,241 patients). Table 199 below describes all the region frequencies.

Table 199 Region of Hospital for Struck By or Against Object

Region of Hospital	Frequency	Percent
Northeast	1307	19.9%
Midwest	1343	20.5%
South	2663	40.6%
West	1241	18.9%
Total	6554	100.0%

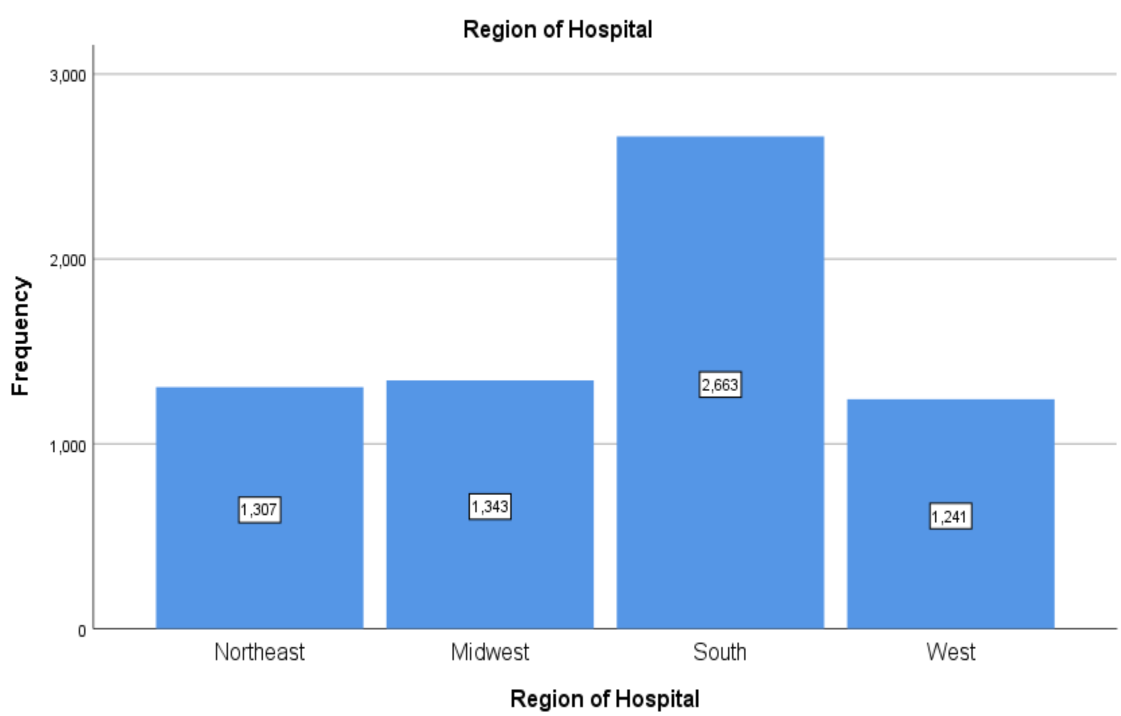

Figure 107 Region of Hospital for Struck By or Against Object

4.11.9 Bivariate Pearson Correlation for Struck By or Against Object Patients

The Bivariate Pearson Correlation shows significant correlation between indicator of sex and race, and age groups and race. There is a negative correlation between: indicator of sex and race, and age groups and race. Moreover, if one variable increases, the other variable decreases with the same magnitude. Table 200 below describes the correlation of age, indicator of sex, and race with struck by or against object patients.

Table 200 Bivariate Pearson Correlation for Struck By or Against Object Patients

Correlations

		Age Groups	Indicator of Sex	Race (Uniform)
Age Groups	Pearson Correlation	1	.070**	-.101**
	Sig. (2-tailed)		.000	.000
	N	6554	6526	5612
Indicator of Sex	Pearson Correlation	.070**	1	-.010
	Sig. (2-tailed)	.000		.436
	N	6526	6526	5611
Race (Uniform)	Pearson Correlation	-.101**	-.010	1
	Sig. (2-tailed)	.000	.436	
	N	5612	5611	5612

**. Correlation is significant at the 0.01 level (2-tailed).

4.11.10 Chi-Square Test Race & Economic Status

The case processing summary counts 5,442 with 1,112 cases missing. Table 201 below describes the case summary.

Table 201 Case Processing Summary Race & Economic Status for Struck By or Against Object

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Median Household Income	5442	83.0%	1112	17.0%	6554	100.0%

The crosstabulation for race and economic status shows the expected count versus the actual count for each race and median household income quartiles 1 through 4 in Table 202 below.

Table 202 Race and Economic Status Crosstabulation for Struck By or Against Object

Race (Uniform) * Median Household Income Crosstabulation

			Median Household Income Quartile for Patients				Total
			1	2	3	4	
Race (Uniform)	White	Count	998	1088	914	629	3629
		Expected Count	1179.0	1033.6	848.2	568.2	3629.0
	Black	Count	313	131	69	55	568
		Expected Count	184.5	161.8	132.8	88.9	568.0
	Hispanic	Count	352	241	215	107	915
		Expected Count	297.3	260.6	213.9	143.3	915.0
	Asian/ Pacific	Count	14	22	20	27	83
		Expected Count	27.0	23.6	19.4	13.0	83.0
	Native American	Count	25	19	5	2	51
		Expected Count	16.6	14.5	11.9	8.0	51.0
	Other	Count	66	49	49	32	196
		Expected Count	63.7	55.8	45.8	30.7	196.0
Total		Count	1768	1550	1272	852	5442
		Expected Count	1768.0	1550.0	1272.0	852.0	5442.0

The Chi-Square Tests has a Pearson Chi-Square value of 238.685 and degrees of freedom (df) of 15 with significance equaling 0.000. See Table 203 below of Chi-Square Test.

Table 203 Chi-Square Tests for Struck By or Against Object (Race & Economic Status)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	238.685[a]	15	.000
Likelihood Ratio	233.772	15	.000
Linear-by-Linear Association	25.312	1	.000
N of Valid Cases	5442		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.98.

The Cramer's V values of 0.121 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 204 below as shown.

Table 204 Symmetric Measure for Struck By or Against Object (Race & Economic Status)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.121	.000
N of Valid Cases		5442	

4.11.11 Chi-Square Test Race & Region of Hospital

The case processing summary counts 5,612 with 942 cases missing. Table 205 below describes the case summary.

Table 205 Case Processing Summary Race & Region of Hospital for Struck By or Against Object

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Race (Uniform) * Region of Hospital	5612	85.6%	942	14.4%	6554	100.0%

The crosstabulation for race and region shows the expected count versus the actual count for each race and regions 1 through 4 in Table 205.

Table 206 Race and Region of Hospital Crosstabulation for Struck By or Against Object

Race (Uniform) * Region of Hospital Crosstabulation

			Region of Hospital				Total
			1	2	3	4	
Race (Uniform)	White	Count	869	693	1522	643	3727
		Expected Count	846.1	560.5	1614.5	706.0	3727.0
	Black	Count	124	64	371	33	592
		Expected Count	134.4	89.0	256.4	112.1	592.0
	Hispanic	Count	175	48	430	295	948
		Expected Count	215.2	142.6	410.7	179.6	948.0
	Asian/ Pacific	Count	30	3	16	36	85
		Expected Count	19.3	12.8	36.8	16.1	85.0
	Native American	Count	3	16	21	15	55
		Expected Count	12.5	8.3	23.8	10.4	55.0
	Other	Count	73	20	71	41	205
		Expected Count	46.5	30.8	88.8	38.8	205.0
Total		Count	1274	844	2431	1063	5612
		Expected Count	1274.0	844.0	2431.0	1063.0	5612.0

The Chi-Square Tests has a Pearson Chi-Square value of 392.184 and degrees of freedom (df) of 15 with significance equaling 0.000. See Table 207 below of Chi-Square Test.

Table 207 Chi-Square Tests for Struck By or Against Object (Race & Region)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	392.184[a]	15	.000
Likelihood Ratio	415.918	15	.000
Linear-by-Linear Association	21.241	1	.000
N of Valid Cases	5612		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.27.

The Cramer's V values of 0.153 was significant equaling 0.000. Cramer's V is a way of calculating correlation in tables which have more than 2x2 rows and columns. It is used as post-test to determine strengths of association after chi-square has determined significance. See Table 208 below as shown.

Table 208 Symmetric Measure for Struck By or Against Object (Race & Region)

Symmetric Measure

		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.153	.000
N of Valid Cases		5612	

4.11.12 Multiple Linear Regression for Length of Stay and Total Charges

The Multiple Linear Regression method is used to find the predictors of length of hospital stay and total charges for struck by or against object patients. The Durbin Watson (DW) statistic yielded at 1.946 DW as shown in Table 209 below.

Table 209 Model Summary for Struck By or Against Object (LOS)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.104[a]	0.011	0.010	6.050	1.946

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Length of Stay (Cleaned)

There is a significant relationship between dependent and independent variables.

The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 108.

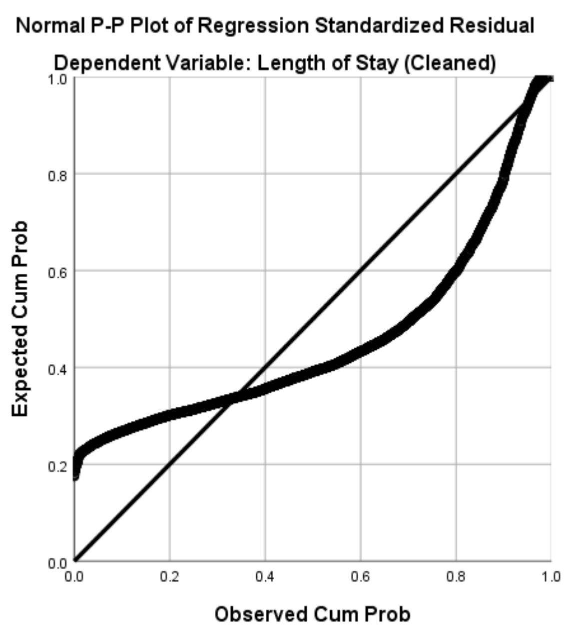

Figure 108 Normal P-P Plot of Regression Residual (LOS) Struck By or Against Object

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 109 below, the scatterplot shows perfect residual distribution.

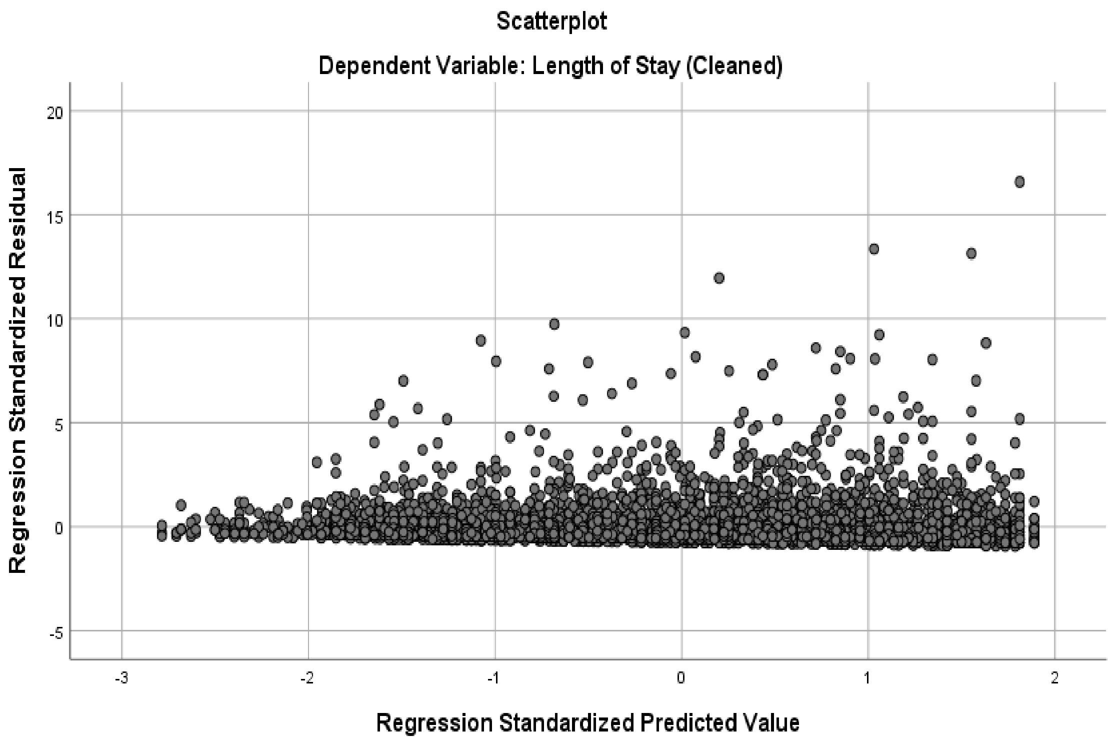

Figure 109 Scatterplot (LOS) for Struck By or Against Object

After accepting all assumptions for length of stay, the final models for predictors for struck by or against object is shown in Table 210.

Table 210 Predictors for Length of Hospital Stay for Struck By or Against Object Patients

Predictors	B	Std. Error	Beta	t	*Sig.	95.0% Confidence Lower Bound	95.0% Confidence Upper Bound	Tolerance	VIF
(Constant)	2.608	0.317		8.218	0.000	1.986	3.230		
Age in Years at Admission	0.050	0.006	0.101	8.087	0.000	0.038	0.062	0.995	1.005
Indicator of Sex	-0.493	0.205	-0.030	-2.397	0.017	-0.895	-0.090	0.994	1.006
Economic Status	-0.065	0.072	-0.011	-0.909	0.363	-0.206	0.076	0.999	1.001

Collinearity diagnostics is used to determine multicollinearity. The **Variance Inflation Factor (VIF)** must result less than 2 or near 1 as an ideal result. All variables resulted less than 2. Moreover, the data shows no multicollinearity. Two variables in the regression model predict length of stay with negative 0.493 and 0.065 days, respectively. Age in years and indicator of sex were the only two significant factors in the length of stay for struck by or against object patient. The length of hospital stay for struck by or against object = 2.608 (Constant) + 0.050 (Age in Years) – 0.493 (Indicator of Sex) – 0.065 (Economic Status).

The Durbin-Watson value for Total Charges yielded 1.826, which is close to the ideal Durbin Watson value of 2.0. Table 211 below displays the results.

Table 211 Model Summary for Struck By or Against Object (TOTCHG)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.072[a]	0.005	0.005	75444.632	1.826

a. Predictors: (Constant), Economic Status, Indicator of Sex, Age in Years at Admission

b. Dependent Variable: Total Charges (Cleaned)

There is a significant relationship between dependent and independent variables.

The normal P-P Plot of regression standardized residual and dependent variable, which tell us that the error terms follow normal distribution displayed in Figure 110.

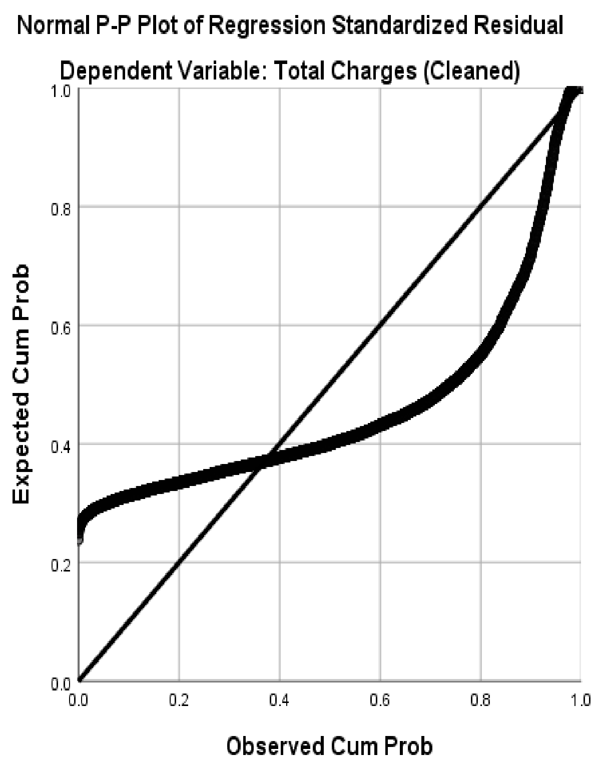

Figure 110 Normal P-P Plot of Regression Residual (TOTCHG) Struck By or Against Object

The scatterplot graph is used to assess model assumptions, such as constant variance and linearity, and to identify potential outliers. In Figure 111, the scatterplot shows perfect residual distribution.

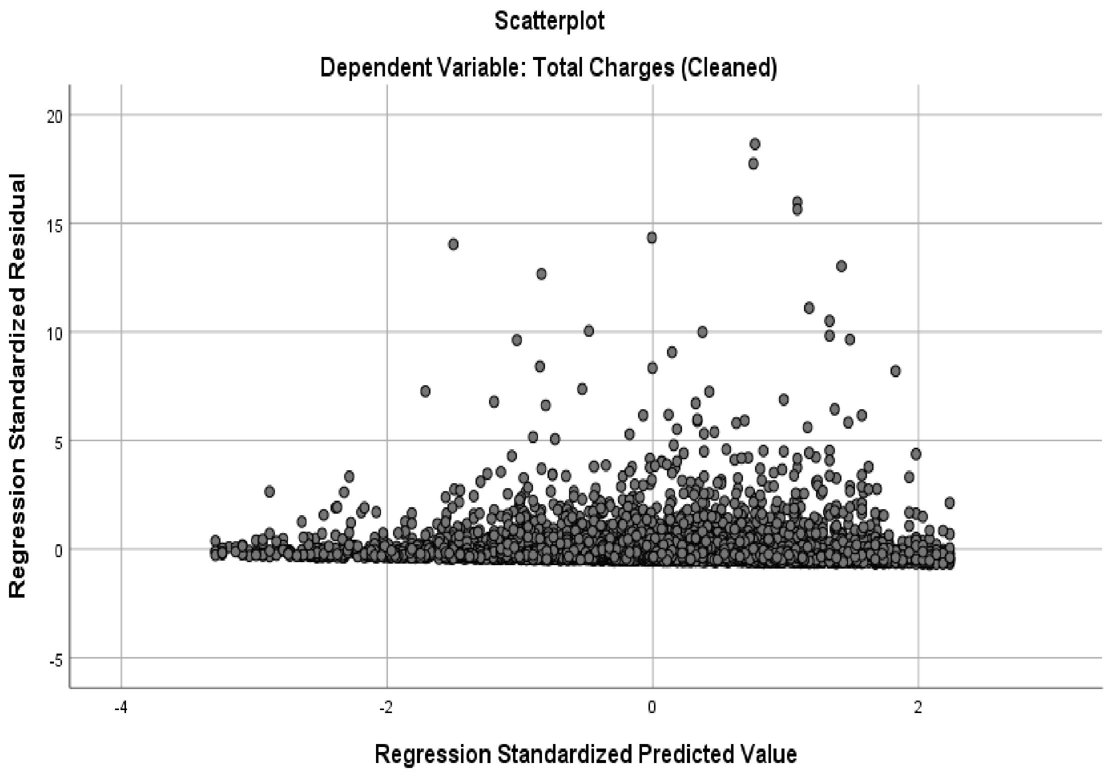

Figure 111 Scatterplot (TOTCHG) for Struck By or Against Object

After accepting all assumptions for total charges, the final models for predictors for struck by or against object is shown in Table 212 below.

Table 212 Predictors for Total Charges for Struck By or Against Object Patients

						95.0% Confidence			
Predictors	B	Std. Error	Beta	t	*Sig.	Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	27185.998	3972.366		6.844	0.000	19398.802	34973.194		
Age in Years at Admission	278.031	76.720	0.045733	3.624	0.000	127.634	428.427	0.995	1.005
Indicator of Sex	-9215.820	2572.311	-0.04522	-3.583	0.000	-14258.429	-4173.211	0.994	1.006
Economic Status	2713.748	900.320	0.038	3.014	0.003	948.813	4478.682	0.999	1.001

The VIF results must be less than 2 or near 1 as an ideal result. All variables resulted less than 2. Of the three independent factors, economic status is the predictor with the highest effects on total charges for struck by or against object with $2,713.748. The factor related to reduction of total charges was indicator of sex, which is negative $9,215.820. All three factors were significant variables that effect the total charges of patients with struck by or against object. The total charges of struck by or against object = 27,185.998 (Constant) + 278.031 (Age in Years) – 9,215.820 (Indicator of Sex) + 2,713.748 (Economic Status).

CHAPTER V

DISCUSSION AND LIMITATIONS

5.1 Discussion

5.1.1 Introduction

This study highlights the main outcomes related to patients with amputation of finger, burns of 3rd degree of the hand, falls on same level, fracture of upper limbs, heat stress, laceration of upper limbs, machine accidents, overexertion, sprains/strains, and struck by or against an object that were admitted to the United States hospitals between years 2007 through 2011. The study aimed to investigate the impact of the patients' sociodemographic characteristics, association between race and economic status and race and region of injury. Also, to examine their total cost and length of hospital stay per injury and illness. This study discovered several needs for gender equality, race disparity, and older age workers dominated the pool of each specific injury and illness except amputation of finger and have the highest frequency of injury.

5.2.1 Patients' Sociodemographics and Time of Injury

The data was obtained from the NIS database and involved 462,647 total patients between years 2007 through 2011 that were admitted to United States hospitals for the following specific injuries and illnesses: amputation of finger, burns 3rd degree of the hand, falls on same level, fracture of upper limbs, heat stress, laceration of upper limbs, machine accidents, overexertion, sprains/strains, and struck by or against object. Sociodemographics are the characteristics of a population, such as: age, gender, ethnicity, education level, income, years of experience, and location. The sociodemographics in this paper discusses each injury and illness population and identifies which age group, race, gender, household income, weekday or weekend, month of injury/illness, and region of injury/illness had the highest frequencies.

5.2.2 Patients' Sociodemographics and Time of Injury for Amputation of Finger

The data was obtained from the NIS database and involved 767 patients between years 2007 through 2011 that were admitted to United States hospitals. The highest incidence of patients admitted to the hospitals were younger aged patients 18-30 years of age (58.5%), white (54.9%), male (84.6%), and with a household income ranging from 0 to 25th percentile (33.0%). The weekday of admission has the highest frequency at 63.4% and the month of April was the highest at 11.0% versus the lowest in December at 6.5%. The Northeast region had the highest frequency at 33.1% versus the lowest in the Midwest at 15%.

5.2.3 Patients' Sociodemographics and Time of Injury for Burns 3rd Degree of the Hand

The data was obtained from the NIS database and involved 13,794 patients between years 2007 through 2011 that were admitted to United States hospitals. The highest incidence of patients admitted to the hospitals were older aged patients 31-64 years of age (97.9%), white (56.2%), female (51%), and with a household income ranging from 76th to 100th percentile (31.5%). The weekday of admission has the highest frequency at 79.2% and the month of March was the highest at 8.9% versus the lowest in November at 7.7%. The South region had the highest frequency at 41.9% versus the lowest in the Northeast at 13.3%.

5.2.4 Patients' Sociodemographics and Time of Injury for Falls from Same Level

The data was obtained from the NIS database and involved 70,226 patients between years 2007 through 2011 that were admitted to United States hospitals. The highest incidence of patients admitted to the hospitals were the older aged patients 31-64 years of age (92.1%), white (65.0%), female (58.1%), and with a household income ranging from 76th to 100th percentile (27.0%). The weekday of admission has the highest frequency at 73.4% and the month of January was the highest at 12.0% versus the lowest in November at 6.8%. The South region had the highest frequency at 33.1% versus the lowest in the Midwest at 21.6%.

5.2.5 Patients' Sociodemographics and Time of Injury for Fracture of Upper Limbs

The data was obtained from the NIS database and involved 7,049 patients between years 2007 through 2011 that were admitted to United States hospitals. The highest incidence of patients admitted to the hospitals were older aged patients 31-64 years of age (62.6%), white (60.6%), male (63.3%), and with a household income ranging from 76th to 100th percentile (35.0%). The weekday of admission has the highest frequency at 66.4% and the month of October was the highest at 8.9% versus the lowest in February at 7.3%. The South region had the highest frequency at 55.4% versus the lowest in the West at 10.8%.

5.2.6 Patients' Sociodemographics and Time of Injury for Heat Stress

The data was obtained from the NIS database and involved 3,373 patients between years 2007 through 2011 that were admitted to United States hospitals. The highest incidence of patients admitted to the hospitals were older aged patients 31-64 years of age (81.2%), white (55.5%), male (84.9%), and with a household income ranging from 76th to 100th percentile (40.7%). The weekday of admission has the highest frequency at 74.1% and the month of July was the highest at 17.0% versus the lowest in the months of January and February at 0.0%. The South region had the highest frequency at 60.8% versus the lowest in the Northeast at 8.9%.

5.2.7 Patients' Sociodemographics and Time of Injury for Laceration of Upper Limbs

The data was obtained from the NIS database and involved 20,198 patients between years 2007 through 2011 that were admitted to United States hospitals. The highest incidence of patients admitted to the hospitals were older aged patients 31-64 years of age (91.2%), white (60.5%), female (70.1%), and with a household income ranging from 76th to 100th percentile (26.3%). The weekday of admission has the highest frequency at 93.0% and the month of March was the highest at 9.0% versus the lowest in February at 7.6%. The South region had the highest frequency at 39.3% versus the lowest in the Northeast at 17.0%.

5.2.8 Patients' Sociodemographics and Time of Injury for Machine Accidents

The data was obtained from the NIS database and involved 752 patients between years 2007 through 2011 that were admitted to United States hospitals. The highest incidence of patients admitted to the hospitals were older aged patients 31-64 years of age (82.2%), white (61.6%), male (92.1%), and with a household income ranging from 76th to 100th percentile (37.7%). The weekday of admission has the highest frequency at 75.4% and the month of September was the highest at 12.0% versus the lowest in February at 3.0%. The South region had the highest frequency at 41.6% versus the lowest in the West at 13.7%.

5.2.9 Patients' Sociodemographics and Time of Injury for Overexertion

The data was obtained from the NIS database and involved 5,144 patients between years 2007 through 2011 that were admitted to United States hospitals. The highest incidence of patients admitted to the hospitals were older aged patients 31-64 years of age (82.3%), white (63.6%), male (58.2%), and with a household income ranging from 76th to 100th percentile (25.3%). The weekday of admission has the highest frequency at 74.8% and the month of October was the highest at 11.6% versus the lowest in February at 6.4%. The South region had the highest frequency at 32.5% versus the lowest in the Midwest at 20.2%.

5.2.10 Patients' Sociodemographics and Time of Injury for Sprains/Strains

The data was obtained from the NIS database and involved 15,307 patients between years 2007 through 2011 that were admitted to United States hospitals. The highest incidence of patients admitted to the hospitals were older aged patients 31-64 years of age (85.3%), white (57.1%), female (53.3%), and with a household income ranging from 76^{th} to 100^{th} percentile (36.8%). The weekday of admission has the highest frequency at 75.1% and the month of July was the highest at 9.8% versus the lowest in April at 6.6%. The South region had the highest frequency at 51.4% versus the lowest in the Northeast at 11.6%.

5.2.11 Patients' Sociodemographics and Time of Injury for Struck By or Against Object

The data was obtained from the NIS database and involved 6,554 patients between years 2007 through 2011 that were admitted to United States hospitals. The highest incidence of patients admitted to the hospitals were older aged patients 31-64 years of age (79.9%), white (56.9%), male (83.5%), and with a household income ranging from 76^{th} to 100^{th} percentile (32.3%). The weekday of admission has the highest frequency at 77.9% and the month of August was the highest at 9.9% versus the lowest in December at 6.7%. The South region had the highest frequency at 40.6% versus the lowest in the West at 18.9%.

5.3 Normalization of BLS Injuries & Illnesses

The Bureau of Labor statistics from 1975 through 2010 for races: Asian, Black, Hispanic, and White show the percent of unemployment of each prospective race[3]. In Figure 213 displays the percentage of unemployment by race. Blacks have the highest percentage of unemployment.

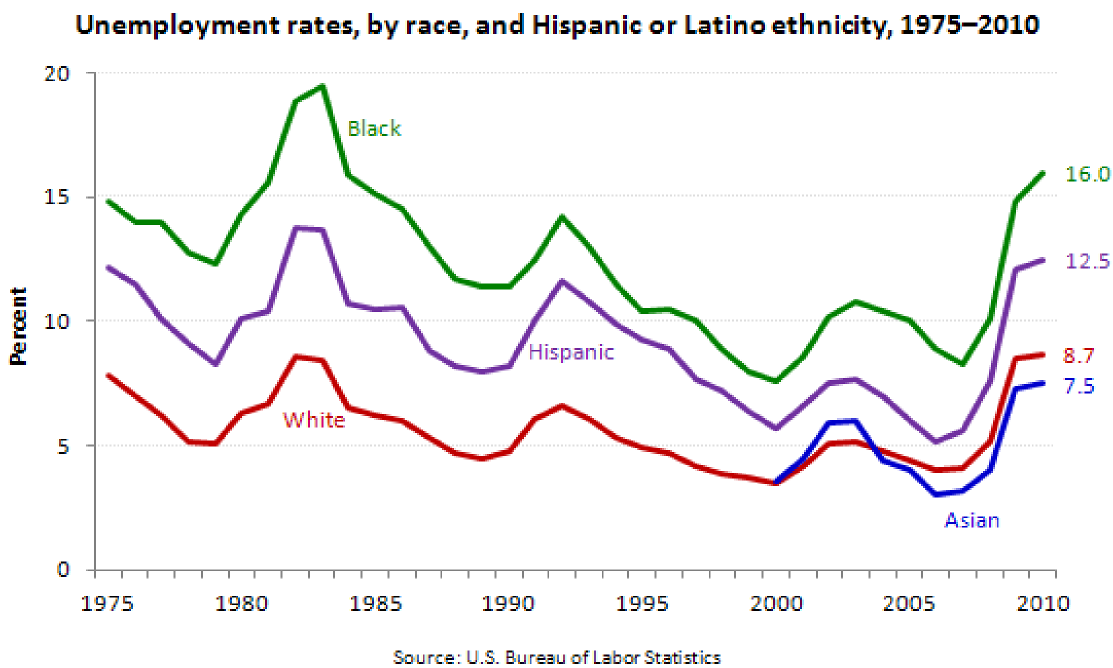

Figure 112 Unemployment Rates by Race – Asian, Black, Hispanic, and White 2010

When normalizing the populations of race: Black, Hispanic, and White in the US population is described in Table 213 to show the employed by race with the percent of that population working.

Table 213 Normalizing of BLS Injuries & Illnesses

2007 - 2011 YEARS (Avg.)		White	Black	Hispanic
US Population Employed	Quantity in Thousands	115,808	15,341	19,974
% of Population Working		61.5%	55.3%	62.0%
Case % of Population for Falls on Same Level		65%	9.60%	8.10%
Case % of Population for Fracture of Upper Limbs		61%	12.90%	9.00%
Rate of Injury for Falls	(Case%/% Working)	105.7%	17.4%	13.1%
Rate of Injury for Fracture	(Case%/% Working)	98.5%	23.3%	14.5%

Whites have the highest rate of injury for falls on same level and fracture of upper limbs. This trend is the same for the other 8 injuries and illnesses analyzed in the study.

5.4 Risk Factors (Predictors) of Length of Stay and Total Charges

Age in years at admission, indicator of sex, and economic status are the risk factors used to determine the length of stay and total charges for the following injuries and illnesses: amputation of finger, burns 3rd degree of hand, falls from same level, fracture of upper limbs, heat stress, laceration of upper limbs, machine accidents, overexertion, sprains/strains, and struck by or against object. The study found laceration of upper limbs had the highest mean for length of stay with 6.19 days and the highest mean for total charges of $69,501.93. Amputation of finger had the lowest mean for length of stay with 2.56 days, and heat stress had the lowest mean for total charges of $20,799.81.

The only injuries and illnesses that had all three variables significant in the regression model for length of stay were: falls from same level; [(age=0.056; 95% CI:0.052 to 0.060), (sex=-0.625; 95% CI:-0.725 to -0.525), and (economic=-0.224; 95% CI:-0.269 to -0180)]; fracture of upper limbs; [(age=0.035; 95% CI:0.019 to 0.051), (sex=-0.818; 95% CI:-1.270 to -0.367), and (economic=-0.561; 95% CI:-0.761 to -0.360)]; and laceration of upper limbs; [(age=0.061; 95% CI:0.049 to 0.072), (sex=-1.280; 95% CI:-1.552 to -1.009), and (economic=-0.393; 95% CI:-0.504 to -0.282)]. Indicator of sex had the highest negative impact with laceration of upper limbs patients for the length of stay (Beta = -1.280) in reducing the time, versus age in years at admission having a positive impact to the length of stay (Beta=0.061) that increases the time. On the contrary, machine accidents were the only injury/illness that had no variables that were significant in the regression model for length of stay.

For total charges, the only injuries and illnesses that had all three variables significant in the regression model were the following: burns 3rd degree of the hand; [(age=-298.228; 95% CI:-4.4.949 to -161.506), (sex=-3444.619; 95% CI:-5806.935 to -1082303), and (economic=2477.620; 95% CI:1394.624 to 3560.615)]; falls on same level; [(age=374.487; 95% CI:343.601 to 405.374), (sex=-3652.985; 95% CI:-4359.533 to -2946.437), and (economic=785.066; 95% CI:472.209 to 1097.923)]; sprains/strains; [(age=329.026; 95% CI:265.127 to 392.924), (sex=-4940.091; 95% CI:-6582.974 to -3297208), and (economic=2407.793; 95% CI:1632.830 to 3182.756)]; and struck by or against object; [(age=278.031; 95% CI:127.634 to 428.427), (sex=-9215.820; 95% CI:-14258.429 to -4173.211), and (economic=2713.748; 95% CI:948.813 to 4478.682)]. Indicator of sex for struck by or against patients had the highest negative impact to the total charges in reducing the total costs (Beta = -9215.820) versus economic status having the highest positive impact to total charges (Beta = 2713.748), which increases the total costs. On the other hand, amputation of finger and machine accidents were the only two injuries/illnesses that had no variables that were significant in the regression model for total charges.

Of the ten injuries and illnesses analyzed in the study, falls on same level was the only injury/illness that resulted in both regression models for length of stay and total charges to have all three variables significant. Also, falls from same level had the most patients admitted to the hospital in 70,226, which is 49% of the total population of all 10 injuries and illnesses. Moreover, of all 10 injuries and illnesses analyzed, falls on same level was the most prominent type of injury/illness. The risk factor indicator of sex was the key variable in the length of stay and total charges for fall on same level patients with the highest beta value in the regression model.

5.5 Study Limitations

The NIS data excluded Emergency Department sample where some injuries and illnesses may not require hospitalization. Fatalities, loss of consciousness, vehicular accidents were excluded from this study. Also, psychological, mental illness, and workplace violence were excluded. The study only identified 10 specific injuries and illnesses that are prominent type of work-related injuries and illnesses at an industrial setting excluding highway, railway line, and seashore locations.

CHAPTER VI

CONCLUSION AND FUTURE RESEARCH

6.1 Study Summary

The study discovered that the older aged (31 to 64 years) who are White males are the majority pool of working aged groups that have the highest frequency of injury and illness. There is a socioeconomic impact to those who fall into the 76th to 100th percentile that overall had the highest frequency of injury and illness. Majority of injuries and illnesses occurred in the South region. The regression model discovered that indicator of sex is they key variable in the amount of time spent in the hospital and the total amount of hospital charges. Falls from same level injury, had 70,226 patients, which is 49% of the total population of all 10 injuries and illnesses investigated. Also, older aged White females were the highest frequency of patients for falls from same level. In conclusion, preventative measures should improve work-related injuries and illnesses; especially for older ages, provide knowledge through specific training to prevent complacency and help workers to be more aware of risks associated with their age, gender, income, and job duties.

6.2 Future Research and Recommendations

Future research could include HCUP data from the National Emergency Department Database (SEDD) for immediate injuries and illnesses that don’t require hospitalization. Appropriate research designs and methods for evaluating age and race/ethnic groups, and to examine how access to training, education, and income is needed to better understand work-related injury and illness differences in the United States. Research is aimed to understand age and race/ethnic groups for disparities in work-related injury and illness, and to discover barriers to decrease work-related injury and illness outcomes. Moreover, future research will need to understand and diagnosis what are the work-related injuries and illnesses and their mechanisms (e.g. environmental and working with equipment).

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