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ESTIMATION OF EMERGENCY ROOM VISITS: IMPLICATIONS FOR UNINSURED IN SOUTH CAROLINA

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ESTIMATION OF EMERGENCY ROOM VISITS: IMPLICATIONS FOR UNINSURED IN SOUTH CAROLINA

A Dissertation
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy
Applied Economics

by
Anusha Pokuri
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Accepted by:
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ABSTRACT

This study assesses the relationships between the percentage of emergency room visits, the percentage of uninsured population, and socio-demographic characteristics. This is accomplished by developing linear models of the relationships among these variables for the 46 counties of South Carolina for the year 2000. The results showed that the percentage of non-White population and percentage of business establishments that employ fewer than 50 workers had significant positive influence on the percentage of uninsured population. The median household income and high percentage of population with educational attainment beyond high school had a significant negative influence on the percentage of uninsured population. The results also indicated that counties with a high percentage of uninsured population also had higher usage of emergency room facilities for most of the selected diagnoses categories (except mental disorders). Implications are that at the national level, there is a need for policy makers to study their options for enhancing access to health insurance for the groups that have traditionally been most likely to be uninsured. In addition, policy makers can provide programs that increase access to routine medical care for the uninsured population and programs to reduce the overall burden on emergency room utilization.

Key Words: Uninsured, Emergency room visits, Regression models
DEDICATION

To my parents Jaya Pokuri, Sesaiah Pokuri and to my brother Aditya.
ACKNOWLEDGMENTS

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CHAPTER 1
INTRODUCTION

The cost of health care in the U.S. has been increasing consistently in the last 15 years. Between 1990 and 2005, the cost of medical care more than doubled with an annual growth rate higher than the Consumer Price Index (The 2008 Statistical Abstract, 2008). During the same period, the household health care budget share grew from 5.20 percent in 1990 to 5.74 percent in 2005 while the share of household food budget share declined from 15.1 percent in 1990 to 12.7 percent in 2005. The health insurance budget share also grew, while the budget shares of drugs and medical services declined (The 2008 Statistical Abstract, 2008).

Private health insurance has been the predominant source of health coverage. In 2006, 67.9 percent of U.S. households had private health insurance while, Medicare and Medicaid were held by 13.6 and 12.9 percent of households, respectively (DeNavas et al., 2007). However, the percentage of the uninsured increased from 12.9 percent in 1987 to 15.8 percent in 2006.

The uninsured can neither afford private health insurance nor qualify for Medicare or Medicaid programs and usually substitute emergency department visits for usual sources of primary health care (Hadley, 2007). The health care
seeking behavior of uninsured people has negative externalities through mandated indigent care provisions paid for by taxpayers and paying patients. Moreover, the uninsured are usually sicker and costlier to treat when they seek care and this has the effect of raising overall cost of physician and hospital services (Institute of Medicine, 2001).

The health care literature shows that the uninsured can be differentiated based on demographic characteristics such as age, education, income, employment status and race (DeNavas et al., 2007; Kaiser Commission on Medicaid and the Uninsured, 2007; Bazzoli, 1986). Hence, the demographic characteristics related to the percentage of uninsured population are studied.

The number of emergency department visits in U.S. increased from 96.5 million in 1995 (36.9 visits per 100 persons) to 115.3 million in 2005 (39.6 visits per 100 persons) (Nawar et al., 2007). Emergency departments are essentially meant to provide treatment to patients who face serious medical problems, but many patients with less serious problems visit emergency departments due to difficulty in getting care elsewhere. This result in overcrowding of emergency departments, reduces quality care for patients, and increases waiting time. The uninsured are more likely to use emergency departments because they have access barriers to primary care (Grumbach et al., 1993). Therefore, there is a need to study the relationship between emergency room visits and the percentage of
uninsured population so that hospitals, government agencies, and health insurance companies can create the programs to reduce uninsured/ meet their needs, and reduce emergency room visits. These potential relationships have an important impact on policy planning implications.

Assuming that individuals exhibit health care financing behaviors that are similar to other individuals in the same age, education, income, employment status, and race or location group and using county as the reference unit, there is likely correspondence between county level health care behavior pattern (in terms of emergency room visits) and county demographic composition. Specifically, a county with a high percentage of the population in the uninsured demographic category (age, education, employment status, income level, and race) is likely to exhibit a different pattern of health care than a county with a lower percentage of the population in the uninsured demographic category.

Given the assumed relationship of health care seeking behavior of the uninsured, county level emergency room visits can provide some insight into the geographical distribution of the uninsured in South Carolina for maximizing the effects of intervention programs for the uninsured.
Objectives

The objectives of this study are:

1. Assess the association between uninsured persons and their socio-demographic, economic, and education characteristics.

2. Evaluate the relationship between emergency room visits for selected general diagnoses categories and the uninsured by taking socio-demographic, economic, and education characteristics into account.

Background

The U.S health care financing system is composed of government and private health insurance. The government health insurance targets specific demographic groups through Medicaid, Medicare, State Children’s Health Insurance Program (SCHIP) and Military Health Care (U.S. Census Bureau, 2008). Information imperfections in private health insurance market and demand for government health insurance by certain segments of population made government to act as a producer of health insurance in U.S. The main role of government is to subsidize health insurance to achieve equity and avoid inefficiencies associated with informational problems (Santerre and Neun, 2004). Both federal and state government generally funds the government insurance programs. Eligibility requirements, medical services covered, and payments to
providers vary widely across states because states are free to change the program once it meets minimum federal requirements.

The Medicaid program targets the poor, elderly, disabled parents and their dependent children, children below 6 years, pregnant women with family incomes less than 133 percent federal poverty level, and all children born after September 1983 who are under age 19 and are from families below the federal poverty level (Santerre and Neun, 2004). The Medicare program targets people who are 65 years and older while SCHIP provides insurance coverage to low-income uninsured children.

The private health insurance offered coverage to 67.9 percent of population in U.S. either through employers (59.7 percent) or direct purchase by an individual (9.1 percent) in 2006 (DeNavas et al., 2007). The private health insurance premium is based either on community rating or experience rating. The premium rates are community based as the individuals with similar characters regarding to age, income, education, race or location group exhibit similar health care financing behaviors. The former is based on community and the later on individual demographic and health characteristics. The growing percentage of population aged 65 years and older, occupational shifts from manufacturing to service sectors, rising health insurance premiums are some of the reasons for decline in private health insurance (Santerre and Neun, 2004).
The percentage of people covered by employer-sponsored health insurance declined from 60.2 percent in 2005 to 59.7 percent in 2006 (DeNavas et al., 2007). The decline may be due to workforce changes, increased part-time, self-employment and temporary contract work, and industry/occupational shifts or an increase in the cost of health premiums (Cope et al., 2006). The findings of Stanton and Rutherford (2004) showed that larger firms are more likely to offer health insurance than smaller firms are. Furthermore, eligibility and enrollment rates have declined while offer rates have risen.

Uninsured

“The people were considered as “uninsured” if they were not covered by any type of health insurance at any time in that year” (DeNavas et al., 2007, p.18). There were 47 million uninsured people (15.8 percent of total population) in the U.S. in 2006 (DeNavas et al., 2007). The unit of this study, South Carolina, ranked 39th in the percentage of uninsured in 2006, while it ranked 31st in 2005 in U.S. (United Health Foundation, 2006). U.S. Census Bureau (2008) show that over 721,000 (16.4 percent) were uninsured in South Carolina in 2007, which increased from 672,000 (15.9 percent) in 2006. The reasons for the high uninsured rate are (1) increases in health insurance premiums outpace inflation and earnings

1 A ranking of #1 indicates the lowest percentage of uninsured.
growth (Kaiser Commission on Medicaid and the Uninsured, 2007) and (2) a decline in employer sponsored health insurance.

The uninsured are differentiable by age, education, employment status, health status, household income, nativity and race. Individuals without health insurance are less likely to get routine primary health care services and tend to visit emergency departments when they are usually sicker and costlier to treat (Grumbach et al., 1993). The uninsured have high risk of becoming medically indigent and dependent on charity care (Bazzoli, 1986). This places a tax burden on the public and increases health care costs for paying patients, as it is mandatory for hospitals to provide uncompensated treatment under the circumstances.
Health Insurance Coverage in United States

Figure 1.1: Percentage of Uninsured in United States: 1987-2006.

Figure 1.1 shows that the percentage of people without health insurance in the U.S. increased from 12.9 percent in 1987 to 15.8 percent in 2006. The uninsured number increased from 44.8 million (2005) to 47.0 (2006) million (DeNavas et al., 2007). Nationwide the 3-year average from 2004-2006 showed that the percentage of the uninsured ranged from 8.5 percent (Minnesota) to 24.1 percent (Texas) (Figure 1.2). This shows that the uninsured rates follow a wide range of variation across states. There were fifteen states with uninsured rate higher than that of the national rate while twenty-nine states and the District of Columbia had uninsured rates lower than the national rate. In six states,
including South Carolina, the uninsured rates were not different from the national uninsured rate.

Figure 1.2: Percent Uninsured by State in United States: 2004-2006 (3 year average).
County level uninsured data in South Carolina show variability among counties with Allendale county having the highest and McCormick county the lowest percentages of the uninsured, 23.8 percent and 12.0 percent, respectively, in 2000 (Figure 1.3).

Figure 1.3: Percent Uninsured by county in South Carolina, 2000.
Who are the Uninsured?

The national demographic profiles of the uninsured shows predictable categorical differences relative to household income, age, firm size, race nativity, employment status, metropolitan status and region (Figure 1.4-Figure 1.12). The U.S. Census Bureau data on percentage of population uninsured by selected characteristics were illustrated graphically. The percentage of the uninsured\(^2\) was inversely related to household income in 2006 (Figure 1.4), age in 2006 (Figure 1.5) and firm size in 2004 (Figure 1.6). The data shows that 26 percent of the uninsured work in firms fewer than 10 employees while, only 3 percent of uninsured work in firms with 500-999 employees. The small firms (3-199 workers) were less likely to offer health insurance benefits (59 percent)\(^3\) than large firms (200 or more workers) were (99 percent) (Figure 1.7).

\(^2\) Note: Percentage uninsured = (Number of uninsured in that category in U.S./Total population in that category in U.S.) *100 [Figure 1.4, Figure 1.5, Figure 1.8, Figure 1.9, Figure 1.10, Figure 1.11, Figure 1.12].

\(^3\) Note: Percent = (Number of firms offering Health Benefits in that category/ Total number of firms in that category) *100[Figure 1.7]
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**Figure 1.4:** Percent Uninsured by Household Income in United States: 2006.

Age:


**Figure 1.5:** Percent Uninsured by Age in United States: 2006.
Firm Size:

Data Source: ASPE, 2005.

Figure 1.6: Percent Uninsured by Firm Size in United States: 2004.

Data Source: The Kaiser Family Foundation and Health Research and Educational Trust, 2006.

Figure 1.7: Percentage of firms offering health benefits in United States: 2007.
Similarly, there were categorical differences in the percentages of the uninsured with respect to race, nativity, employment status, residential location and region. The racial distribution of the uninsured range from 34.1 percent (Hispanic) to 14.9 percent (White) in 2006 (Figure 1.8) and the percentage of the uninsured was higher among foreign-born (33.8 percent) than native-born (13.2 percent) residents of United States in 2006. Among the foreign residents, the percentage of the uninsured was higher among non-citizens (45 percent) than citizens (16.4 percent) in 2006 (Figure 1.9). Slightly over one quarter (26.1 percent) of the unemployed and 18.7 percent of the employed were uninsured, and a higher percentage of those employed part-time (22.9 percent) than those employed full-time (17.9 percent) were uninsured (Figure 1.10) in 2006.

Based on residential location, metropolitan versus non-metropolitan areas, the percentage of the uninsured was higher in non-metropolitan areas (16 percent) than metropolitan areas (15.8 percent); and within the metropolitan areas, the percentage of the uninsured was higher inside principal cities (19 percent) than outside principal cities (18 percent) (Figure 1.11) in 2006. Similarly, there were regional differences in the percentage of the uninsured ranging from 19 percent (South) to 11.4 percent (Midwest) with the Northeast and the West in between at 12.3 percent and 17.9 percent, respectively (Figure 1.12) in 2006.
Race:


Figure 1.8: Percent Uninsured by Race in United States: 2006.

Nativity:


Figure 1.9: Percent Uninsured by Nativity in United States: 2006.
Employment Status:


Figure 1.10: Percent Uninsured by Employment status in United States: 2006.

Metropolitan Status:


Figure 1.11: Percent Uninsured by Metropolitan Status in United States: 2006.
Health Insurance Coverage in South Carolina

The U.S. Census Bureau (2007) data shows that nearly 700,000 South Carolinians (18.1 percent) were uninsured in 2006. To offset the loss created by uninsured, the insured end up paying more for insurance premiums and health care. As the premium increases, employer sponsored and individual health insurance coverage declines and leads to more uninsured persons (South Carolina Hospital Association, 2006).

The South Carolina demographic profiles of the uninsured show predictable categorical differences relative to age, family work status, federal
poverty level, race, and firm size (Figure 1.13-Figure 1.17). The percentage of uninsured was directly related to poverty levels (Figure 1.13) and inversely related to firm size (Figure 1.14).

**Federal Poverty Level:**

![Bar chart showing uninsured rates for the nonelderly by federal poverty level, South Carolina: 2005-2006.](image)


**Figure 1.13: Uninsured Rates for the Nonelderly by Federal Poverty Level, South Carolina: 2005-2006.**
Firm Size:

![Bar chart showing health insurance coverage by private firm size, South Carolina: 2005.](image)

Data Source: South Carolina Hospital Association, 2006.

**Figure 1.14: Health Insurance Coverage by Private Firm Size, South Carolina: 2005.**

Similarly, there were categorical differences in the percentage of the uninsured with respect to race, family work status, and age. The racial distribution of uninsured ranged from 42 percent (Hispanics) to 17 percent (Whites) (Figure 1.15).
Race:


**Figure 1.15: Uninsured Rates for the Nonelderly by Race/Ethnicity, South Carolina: 2005-2006.**

The percentage of uninsured was higher for adults aged between 19-64 years (22 percent) than for children aged 18 and under (11 percent) (Figure 1.16). The highest percentage of uninsured was in families employed part-time (26 percent) than in families, which contains at least one full time worker (17 percent). The uninsured rates decline if families contain more number of full time workers (Figure 1.17).
Age:


Figure 1.16: Uninsured Rates for the Nonelderly by Age, South Carolina: 2005-2006.
Family Work Status:


Figure 1.17: Uninsured Rates for the Nonelderly by Family Work Status, South Carolina: 2005-2006.

Health Insurance Coverage of Total Population in South Carolina

Slightly over one-half (51 percent) of the health insurance coverage was employer based, followed by Medicaid (14 percent), Medicare (13 percent), individual (4 percent) and other public insurance programs (3 percent) (Figure 1.18).

Figure 1.18: Sources of Health Insurance Coverage, South Carolina: 2005-2006.

Costs of being Uninsured in U.S. and South Carolina

It was estimated that $65 to $130 billion worth is lost in terms of diminished health and shorter life spans of uninsured Americans for each year of health insurance foregone (Institute of Medicine, 2003). The value of uncompensated care provided to uninsured was roughly $35.8 billion for year 2001 (Institute of Medicine, 2003).

The uninsured are more likely to visit emergency rooms which results in relatively expensive treatment. In 2005, South Carolina Hospitals spent $622 million in the form of uncovered care to the uninsured, and part of this cost ($352
million) was shifted to employers offering health insurance and insured individuals (South Carolina Hospital Association, 2006). As a result, the average American family on average has paid $922 more per year in health insurance premiums, in 2005 (South Carolina Hospital Association, 2006). The data also shows that nearly 100,000 children were uninsured, which affects economic progress of the state. Uninsured children face greater risk in development delays that in turn affect their achievements and opportunities in later life.

**Consequences of Being Uninsured**

Uninsured people receive less medical care than those insured and pay a larger proportion out-of-pocket medical care expenses (Taylor et al., 2001). This may lead to higher mortality and morbidity. This is because the diseases are diagnosed at more advanced stages, and once diagnosed may receive less treatment and lead to higher deaths (Institute of Medicine, 2002). Family economic stability is also affected by a lack of health insurance coverage (Institute of Medicine, 2001). If a parent is uninsured, the ability to take care of their children is affected adversely and the entire family is exposed to potentially ruinous financial costs. Some uninsured persons pay out of pocket expenses when they access health care and some try to obtain subsidized or free care from hospitals, physicians working in private practice, government sponsored primary care and specialty clinics (Institute of Medicine, 2001). The funds for
subsidy or free care generated either by higher prices or by higher taxes from another segment of the community (Institute Of Medicine, 2001). There may exist other consequences such as “overcrowded emergency rooms, cutbacks in service, relocation of physicians’ offices or even hospitals from areas of town that have concentrations of uninsured persons” (Institute of Medicine, 2001, p. 104).

Uninsured individuals have spillover effects on their communities. It is dangerous to the whole community, as the uninsured are more likely to visit doctor at advanced stages of the transmittable diseases (such as tuberculosis) rather than having them diagnosed at early stages (Institute of Medicine, 2001).

The uninsured have higher out-of-pocket expenses for health care than insured and impair ability to work (Institute of Medicine, 2003). About 20 percent of uninsured are more likely to use emergency rooms as a source of care than the insured (3 percent). The uninsured are less likely to have a regular source of care and the use of a doctor’s office than insured persons are. Most of the uninsured postpone seeking care because of cost (Kaiser Commission on Medicaid and the Uninsured, 2003).

Studies also show that the number of deaths among uninsured adults is roughly 18,000 a year. That exceeds the mortality rates from diabetes (15,000-16,000) and cerebro-vascular disease (e.g., stroke) (18,000-19,000) among the same age group (Institute of medicine, 2002). The uninsured had problems paying
medical bills and had to change their way of life to pay bills (Kaiser Commission on Medicaid and the Uninsured, 2003). Dorn (2008) found that a lack of insurance resulted in 137,000 deaths from 2000-2006 and almost 22,000 people in 2006 alone. Hadley, 2003 found that uninsured more likely to receive fewer diagnostic and preventive services, low productivity than insured.

Why is the uninsured number increasing?

The consistent increase in health insurance premium outpaces inflation and growth in workers’ earnings, making it difficult for families and employers to purchase coverage (The Kaiser Family Foundation and Health Research and Educational Trust, 2006). The Kaiser Family Foundation and Health Research and Educational Trust (2006) showed that cost of premiums rose 7.7 percent in 2006, which is higher than the overall rate of inflation (3.5 percent) or the increase in workers’ earnings (3.8 percent). The family premiums have increased by 87 percent, since the year 2000 (Figure 1.19). The increase in premiums by 10 percent reduces the probability of being employed by 1.2 percentage points and hours worked by 2.4 percent. Increased premiums increase likelihood of being employed part-time by 1.9 percentage points (Baicker and Chandra, 2006).
Data Source: The Kaiser Family Foundation and Health Research and Educational Trust, 2006.

Figure 1.19: Annual Growth rates of Employer-Sponsored Health Insurance Premiums, Inflation and Workers’ earnings: 2000-2007.

Holahan and Cook (2008) cited that the main reason for increase in the uninsured rate in the U.S. is a decline in employer-sponsored health insurance. The study of DeNavas et al., 2007 showed that there was a decrease in the percentage of people covered by employment-based health insurance from 60.2 percent in 2005 to 59.7 percent in 2006 (Figure 1.20).
Figure 1.20: Health Insurance Coverage by Type: 2005 and 2006.

The decline in health coverage is affected by employment dynamics such as a decrease in the share of employees working in large firms (66 percent in 2001 to 64 percent in 2005), more employees working in firms with fewer than 10 employees (Cope et al., 2006), and occupational shifts.

The economy is changing fast, changing employee-employer relations such as more contract jobs, restricting work forces, shifting from manufacturing to service sectors, rising small firm employment, increasing number of self-employed and contingent workers, rising in temporary government employees.
These are some of the important reasons for the decline in employer-sponsored health insurance according to Swartz (2006).

**Emergency Department Visits**

Emergency department is defined as “a hospital facility for the provision of unscheduled outpatient services to patients whose conditions require immediate care and is staffed 24 hours a day. Off-site emergency departments’ open less than 24 hours are included if staffed by the hospital’s emergency department” (National Centre for Health Statistics, 2007). The National Hospital Ambulatory Medical Care Survey (2007) defined emergency department visit as “a direct personal exchange between a patient and a physician or other health care providers working under the physician’s supervision, for the purpose of seeking care and receiving personal health services”.

The number of emergency department visits in U.S. increased from 96.5 million in 1995 (36.9 visits per 100 persons) to 115.3 million in 2005 (39.6 visits per 100 persons) (Nawar et al., 2007). This represents a 31 percent increase in number of visits per emergency department by 2005 (30,388 visits per emergency department) when compared to 1995 (23,119 visits per emergency department). For every minute, there were about 219 visits to U.S. emergency departments in the year 2005. The average waiting time to see a physician is 56.3 minutes and average full duration of emergency department visit is 3.3 hours in 2005. Nawar
et al., 2007 found that the leading illness-related diagnosis at emergency department is the abdominal pain and of all emergency department visits, injury-related visits account to 41.9 million or 14.4 visits per 100 persons. The average charge for emergency room is $1,049 while, the average charge for physician’s office is $153 (Myers, 2007, July 31).

The uninsured are more likely to use emergency department as they have access barriers to primary care (Grumbach et al, 1993). This is because emergency rooms do not require proof of insurance before treating patients while physicians’ offices do require proof of insurance and under federal law, people could not be turned away who visit emergency department (Myers, 2007, July 31).

The increase in emergency department visits affected by both demand and supply side problems. Increased demand to emergency room services is due to increased uninsured patients seeking care in emergency rooms, changes in structure of Health Maintenance Organizations and enforcement of federal Emergency Medical Treatment and Labor Act strictly (Brewster et al, 2001). The number of emergency departments decreased from 4,176 (1995) to 3,795 (2005) (Nawar et al., 2007) decreasing facilities to growing demand for emergency visits. All these factors lead to emergency department crowding which reduces care for patients and increases waiting time.
Characteristics of patients who visit Emergency Departments

The findings of Nawar et al. (2007) showed that the annual per capita emergency department visit rate was higher for Blacks (69 visits per 100 Black persons) than for Whites (36.8 visits per 100 White persons), regardless of age (Figure 1.21) in the year 2005. Females (41.8 visits per 100 female persons) are more likely to have higher emergency department utilization rate than males (37.4 visits per 100 male persons) (Figure 1.22). Infants under 12 months of age have highest emergency department visit rate (91.3 visits per 100 infants) of all age groups (Figure 1.23). The emergency department visits and utilization rate do vary with source of payment. Private insurance represented 39.9 percent of all emergency department visits, followed by Medicaid /SCHIP (24.9 percent) while no insurance represented 16.7 percent (Figure 1.24).

However, the emergency department visits utilization rate (number of visits per 100 persons) was higher for the no insurance category (45.9) than for private insurance (23.8). Medicaid has the highest emergency department visit rate (89.4) (Figure 1.25).
Race:

Data Source: National Hospital Ambulatory Medical Care Survey (NHAMCS), 2005 (as cited in Nawar et al., 2007).

Figure 1.21: Rate of Emergency Department Visits per Year by Race in U.S., 2005.
Sex:

Data Source: National Hospital Ambulatory Medical Care Survey (NHAMCS), 2005 (as cited in Nawar et al., 2007).

Figure 1.22: Rate of Emergency Department Visits per Year by Sex in U.S., 2005.
Age:

Data Source: National Hospital Ambulatory Medical Care Survey (NHAMCS), 2005 (as cited in Nawar et al., 2007).

Figure 1.23: Rate of Emergency Department Visits per Year by Age in U.S., 2005.
Data Source: National Hospital Ambulatory Medical Care Survey (NHAMCS), 2005 (as cited in Nawar et al., 2007).

Figure 1.24: Percentage of all Emergency Department Visits by Payment Source, 2005.
Source: National Hospital Ambulatory Medical Care Survey (NHAMCS), 2005 (as cited in Nawar et al., 2007).

**Figure 1.25: Rate of Emergency Department Visits per Year by Payment Source in U.S., 2005.**

The data from National Center for Health Statistics (2007) also shows that uninsured adults are more likely to lack a usual source of health care than insured\(^4\). Figure 1.26 shows that, 53 percent of uninsured lack usual source of care while, only 9.7 % of insured lack usual source of care.

\(^4\) Persons who report the emergency department as the place of their usual source of care are defined as having ‘no usual source of care’ (National Center for Health and Statistics, 2007).

**Figure 1.26: Percent of Adults (18-64 Years) Without a Usual Source of Health Care, 2005-2006.**

**Emergency Department Visits in United States:**

Nationwide the emergency department visits ranged from 26.6 (Hawaii) to 90.1 (Alaska) percent of total population in 2006 (Figure 1.27).
Figure 1.27: Percentage of Hospital Emergency Room Visits, 2006.

South Carolina Emergency Department Visits

In 2006, South Carolina reported 1,852,247 number of emergency department visits, a 3.11 percent increase from 1,844,353 visits in 2005 (Office of Research and Statistics: South Carolina State Budget and Control Board, 2006).

County level emergency department visits data in South Carolina shows the variability of percentage of emergency department visits among counties. (Figure 1.28) shows county level data for percentage of emergency department visits to total population in South Carolina.

Figure 1.28: Emergency Room Visits in South Carolina: 2005.
Organization of the Dissertation

The remaining dissertation describes the work completed to meet the objectives of the research. Chapter 2 provides with a brief literature review related to the characteristics related to uninsured, factors contributing to uninsured and consequences of uninsured. Chapter 3 describes the data and statistical methods used in the study. In this study, regression models were used to predict the relationship between uninsured and socio-demographic, education, economic characteristics and relationship between emergency room visits and uninsured. Chapter 3 also discusses methodology to characterize group differences in counties by taking into account emergency room visits. Chapter 4 discusses about results of various models used in the research, coefficients and levels of significance. Various tests were carried out to test the validity of the model. A summary of the results, conclusions, policy implications, limitations of the study and recommendations for future research are provided in Chapter 5.
CHAPTER 2
LITERATURE REVIEW

There is an extensive literature on health insurance coverage. The following sections discuss the characteristics, consequences, and reasons for being uninsured. Models used to predict relation between variables and policy implications are also described.

Uninsured

There were 47 million uninsured people in U.S. in 2006. The percentage of uninsured increased from 15.3 percent in 2005 to 15.8 percent in 2006 (DeNavas et al., 2007). The number of uninsured has grown by nearly six million annually between 2000 and 2004 (Kaiser Commission on Medicaid and the Uninsured, 2007). The number of uninsured increased by an additional 13.4 million between 2004 and 2006 although the economy was improving (Kaiser Commission on Medicaid and the Uninsured, 2007). Gilmer and Kronick (2005) projected that the number of nonelderly uninsured Americans will grow to 56 million by 2013 from 45 million in 2003. They also estimated that a one-percent increase in health spending relative to personal income increases the number of uninsured people by 246,000.
Who are the Uninsured?

The survey by Kaiser Commission on Medicaid and the Uninsured (2007), shows that about two-thirds of the uninsured are either poor or near poor\(^5\). About 29 percent of the near poor with incomes between 100 to 199 percent of the poverty level are uninsured as they are more likely to be ineligible for Medicaid. The likelihood of being uninsured is higher in families earning less than $10,000 (35 percent) than in families earning $75,000 or more (7 percent) (Fronstin, 2006). People earning annual incomes less than $35,000 were more likely to be uninsured (32 percent) and more likely to be in fair or poor health (25 percent) than people earning more than $35,000 (7 percent and 7 percent, respectively) (Budetti et al., 1999).

The non-elderly adults who lack health insurance are mostly with less education who are not eligible for higher-skilled jobs that provide health coverage (Kaiser Commission on Medicaid and the Uninsured, 2007). According to Dewar (1998) persons with higher wages and higher levels of education have an increased likelihood of insurance coverage. Baker et al. (2001) showed that among adults 51 to 61 years old, the risk in overall health was increased due to the lack of health insurance.

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\(^5\) Poor is defined as income less than 100 percent of the federal poverty level- $20,614 for a family of four in 2006.
Young adults and members of racial and ethnic minorities (especially Hispanic males) have the highest probability of being uninsured (Vistnes and Zuvekas, 1999; Zuvekas and Weinick, 1999). Fronstin (2006) cited that young adults are more likely to be uninsured than other age groups as they do not have permanent jobs yet or are no longer covered by a family policy. Whites (13 percent) are less likely to be uninsured than Blacks (22 percent) and Hispanics (36 percent) (Kaiser Commission on Medicaid and the Uninsured, 2007). The studies by Saver and Mark (2000) showed that minorities and less educated people are more likely to be uninsured after adjusting for income and wealth. Hispanic adults were more likely to be uninsured than White or Black adults according to Budetti et al. (1999) and Fronstin (2006).

Studies show that non-citizens (47 percent) have higher uninsured rates compared to citizens (Kaiser Commission on Medicaid and the Uninsured, 2007). The reason is that non-citizens employed in low-wage jobs, which are less likely to offer employer based health coverage (Kaiser Commission on Medicaid and the Uninsured, 2007). The results of Angel’s et al. (2005) work showed that health care safety was affected by state of residence, ethnicity, race and household structure. In addition, there is high risk of lack of insurance for children of poorly-educated parents, immigrants and Mexican-origin parents. The Kaiser Commission on Medicaid and the Uninsured (2004) and a study by Ku and
Waidmann (2003) reported that immigrants are more likely to be uninsured than native citizens due to working in low-wage jobs, small firms which are less likely to offer health insurance. The race, language proficiency does affect the health insurance coverage, access to care and quality of care among the low-income population (Ku and Waidmann, 2003). A study by Ku (2003) showed that non-citizen immigrants’ health coverage declined in both 2000 and 2001.

There are differences among uninsured estimates between high and low income persons. Low-income persons are more likely to be uninsured or covered by public insurance than high-income persons are (Rhine and Ying, 1998). A lower percentage of uninsured Whites (56 percent) had incomes less than 200 percent of federal poverty level when compared to uninsured Blacks and Hispanics (75 percent) (Lillie-Blanton and Hoffman, 2005). Uninsured Whites or Hispanics are more likely to come from working families than uninsured Blacks (Lillie-Blanton and Hoffman, 2005).

The likelihood of being uninsured is high in the South (19.6 percent) and West (18.9 percent) when compared to the Northeast (14.2 percent) and Midwest (12.5 percent). Also, people living outside MSAs (metropolitan statistical areas) (18.7 percent) were more likely to be uninsured than those living within MSAs (16.3 percent) (Vistnes and Zuvekas, 1999). Mei et al. (2006) concluded, that there was a significant association between residential locations and uninsured status,
but varies from state to state. Rural residents are more likely to be uninsured than urban residents in Florida, Indiana and Kansas.

People working in firms with firm size less than 10 workers as their principal job and people in the agriculture sector are more likely to be uninsured. This uninsured rate declines as firm size increases (Chollet, 1994). Workers in the manufacturing sector (14.6 percent) are less likely to be uninsured than wholesale and retail trade (18.5 percent); the service sector (22.1 percent); and agriculture, forestry, mining, and construction (36.9 percent). More than 50 percent of the uninsured were either self-employed or working in private-sector firms (less than 100 employees). Full-time and full-year workers more likely to have employment based health insurance than part-time and seasonal workers (Fronstin, 2006). The risk of being uninsured is highest for self-employed workers and those working in smaller firms with less than 25 employees (Hoffman et al., 2004), because small firms are price sensitive to health insurance coverage (Morrisey et al., 1994).

The poor, unmarried (widowed, divorced or never married), non-White, Hispanic, Asian American, African American and born in a country other than U.S. are more likely to lack insurance (Mold et al., 2004). The studies by Holahan and Johny (2000) showed that Hispanics, persons with incomes below 200 percent poverty level and non-workers uninsured rate increased between 1994
and 1998. The studies by DeNavas et al. (2007) showed that the uninsured rate increased for Hispanics, non-citizens, low-income people earning less than $25,000, part-time workers, and non-workers.—Diehr (1991) showed that a significant correlation exists between the percentage uninsured and per-capita income, percentage unemployed and percentage of people enrolled in Medicaid. Jensen and Saupe (1987) studied that the determinants of health insurance coverage are larger household size, lower total income, and being more conservative with respect to taking risks in farming. In addition, lower levels of formal education and lack of availability of fringe benefits to the operator are associated with a lack of health insurance.

Factors Contributing for Uninsured

Increased premium rates are one of the most important factors responsible for increasing uninsured rates in U.S. The high cost of insurance is the most common factor for lack of coverage (Thorpe and Florence, 1999; Mold et al., 2004). The studies of Kornick and Gilmer (1999) showed that the increase in per capita health care spending (5.5 percent per year) is not on par with the increase in income (2.7 percent). Kornick and Gilmer forecast that the number of uninsured increases by 0.4 percent every year. Chernew et al. (2005) found that increases in health insurance premiums contributed to decline in health insurance coverage rates. Their study suggested that a one percent increase in
premiums results in a net increase in uninsured of 164,000 people. The decrease in employer-sponsored insurance is another important factor contributing to the increase in uninsured rates. The reduction in employer-sponsored insurance is due to rising health care costs, employment shifts from large to small firms and high to low Employment-Sponsored Insurance (ESI) industries, and a decline in employment (Holahan and Wang, 2004). There was a decrease in the percentage of people covered by employment-based health insurance from 60.2 percent in 2005 to 59.7 percent in 2006 (DeNavas et al., 2007). The changes in workers’ jobs, change from full time to part time jobs, and change from manufacturing to wholesale or retail trade are the main factors behind the downward trend in employer-sponsored insurance offers. Meanwhile, the decline in employer-sponsored insurance take-up was mainly due to rising premiums between 1999 and 2002 (Shen and Sharon, 2006). According to Brown (1996), California’s insurance rate fell below national level because of raising insurance costs, falling family incomes and change in economy and labor market structure. One-fifth of the decline in usual source of care among Hispanic Americans and young adults between 1977 and 1996 was explained by a decline in health insurance coverage (Zuvekas and Weinick, 1999).

The erosion of employer-sponsored health insurance among American workers is due to the loss of manufacturing jobs, increase of service jobs and
increase in part-time employment (Chollet, 1994). The main reasons for the reduction in private health coverage are higher unemployment, fewer businesses offering health insurance, and job based coverage becoming too expensive for many workers (Ku, 2003). The studies by Cope et al. (2006) showed that employer-sponsored health insurance is sensitive to increases in premiums. The premiums for employer-sponsored health insurance are increasing not less than 9 percent each year. Farber and Levy (2000) cited that the decline in eligibility for new full-time and old part-time workers and the decline in core workers take-up rate are the two factors responsible for the decline in employment-based health insurance coverage. The studies by Casey et al. (2004) showed that lack of health insurance, limited income, and linguistic and cultural barriers results in many unmet health care needs in three rural Midwestern communities.

There was a decrease in employer sponsored insurance between 2001 (81.2 percent) and 2005 (77.4 percent) due to shifts in labor force, lower employment rates, an increase in the number of low-income families, and increased premiums (Cope et al., 2006). Lillie-Blanton and Hoffman (2005) studied that Whites have higher rates of health insurance coverage than minority Americans because they are more likely to have employer-sponsored coverage. The number of uninsured persons increased between 2000 and 2006 due to the decrease in employer sponsored insurance coverage. Insurance rates declined mostly for low income
adults, small firm workers, self employed, services and construction industries, non-citizens and in the South (Holahan and Cook, 2008).

Contrary to many studies, Holahan et al. (1995) showed that the decline in employer-sponsored coverage was offset by increases in Medicaid at national level, which in turn reduced percentage of poor population without health insurance. This result is supported by Ku’s (2003) finding that the State Children’s Health Insurance Program and Medicaid partly offset downturns in private coverage.

**Consequences of Uninsured**

Uninsured patients are more likely to receive fewer services, receive substandard care, and experience high mortality rates than insured patients (Institute of Medicine, 2002). A report by the Kaiser Commission on Medicaid and the Uninsured (2007) showed that the uninsured are more likely to postpone care due to cost, do not have access to usual care, needed care but did not get it, and could not afford prescription drugs. The uninsured individuals met with unintentional injury or chronic conditions are less likely to receive any medical care, and the uninsured are less likely to report being fully recovered than insured persons (Hadley, 2007). The studies by McWilliams et al. (2004) observed that the uninsured were more likely to report higher mortality than insured
persons and are concentrated among those with low incomes or with diabetes or cardio-vascular disease.

The lack of insurance results in an excessive number of deaths of about 18,000 per year among adults aged 25-64 (Institute of Medicine, 2002). Uninsured children (12 percent) are more likely to have less contact with doctor or other health professional in more than 2 years, when compared to children with private coverage (2 percent) or with children covered under Medicaid or public coverage (4 percent), and uninsured children have delayed care (Bloom and Cohen, 2007). Uninsured children (4 percent) are more likely to use emergency room as a usual source of health care compared to children (1 percent) with Medicaid or public coverage (Bloom and Cohen, 2007). The studies by Newacheck et al. (2000) also showed that uninsured children are less likely to have a usual source of care (79.2 percent vs. 96.9 percent) and physician contacts (73.6 percent vs. 89.3 percent) than insured children. Uninsured children are more likely to report unmet health needs.

The risk of decline in overall health is higher for continuously uninsured participants than for continuously insured participants between 1992 and 1996 (Baker et al., 2001). The access to health care is reduced for the uninsured relative to the insured (Ayanian et al., 1993). Long-term uninsured adults were less likely to receive routine checkups than insured adults even for chronic conditions.
Uninsured women had more advanced breast cancer than privately insured women, and the survival rate was low (Ayanian et al., 1993).

The uninsured utilize hospital resources less frequently than commercially insured and Medicare groups in Acute Myocardial Infarction (Canto et al., 2000). The uninsured children have higher rates of total hospital admission, higher mortality rates, higher severity of illness, and more emergency department visits when compared to privately insured children; and non-White and/or Hispanic children have higher hospitalization rates (Todd et al., 2006). This leads to significantly higher hospital charges per insured child, and $5.3 billion could have been saved if children with private insurance and public/uninsured had the same hospitalization outcomes in U.S. in the year 2000 (Todd et al., 2006). The uninsured were less likely to receive medical care even for highly serious and morbid symptoms than the insured (Baker et al., 2000) and were more likely to lack a usual source of health care (Weinick et al., 1997). Schoen et al., (1997) found that the uninsured are more likely to report access problems and lower quality care and less likely to have a regular provider than Medicaid and privately insured persons.

The majority of the patients who visited emergency departments are poor, un-employed, non-White, young, and uninsured (Grumbach et al., 1993). The uninsured are more likely to cite access barriers as the reason for emergency
department visit, and people who cite access barriers usually lack regular source of care. One-third of emergency department visits are for non-urgent conditions (Grumbach et al., 1993). Ullman et al., (1975) found that Blacks, low-income people and people from inner-city areas are “high-frequency” users of emergency rooms, and accidental injury constitutes a relatively small percentage of visits. Patients with household income less than $10,000 and with education less than or high school are more likely to be frequent users of emergency departments (Sun et al., 2003). Contrary to the above studies, the study by Schull (2005) showed that the lack of health insurance is not associated with emergency department visits. The factors associated with usage of emergency department are being poor, having unmet health needs, and being in ill health (Schull, 2005). Hunt et al., (2006) found that frequent users of emergency department are uninsured, and 33 percent frequent users have family incomes below the federal poverty level, while only 16 percent have incomes above 400 percent of federal poverty level.

**Models used in Previous Studies**

Holahan and Cook (2008) studied the changes in coverage between 2000-2004 and 2004-2006 by tabular analysis and checked whether the change is statistically significant or not. The data used in the study was from Current Population Survey. Shen and Sharon (2006) examined the factors explaining offer
and take-up rates of employer sponsored health insurance coverage between 1999-2002 by using the Oaxaca-Blinder regression-based decomposition method for the data collected from National Survey of America’s Families. The trends in health insurance coverage in California were studied between 1989-1993 by using tabular and graphical analysis for the data on Current Population Survey (Brown, 1996). The differences in proportions were tested for statistical significance. Diehr et al., (1991) used regression analysis to estimate the relation between percentage uninsured and percentage employed, at county level in Washington, but to predict validity of regression equations “Jack-Knife” approach was used. The data for the study were collected from Basic Health Plan and State Office of Financial Management. To predict the impact of education on likelihood of employer-sponsored health insurance, Dewar (1998) used probit regression for the data from National Medical Expenditure Survey. Kornick and Gilmer (1999) used logistic regressions to study the relation between changes in percentage uninsured and changes in expenditure-to-income ratio for the Current Population Survey and National Medical Care Expenditure Survey data. Chernew et al. (1997) estimated the demand for health insurance coverage by low-income workers and assess the extent to which coverage rates have increased due to premium reductions using probit regression. The data used in the study was from Small Business Benefit Survey. Jensen and Saupe (1987) studied the
major factors associated with lack of health insurance using logit model. The data was collected from interviews in eight counties of Southern Wisconsin. Chernew et al. (2005) used probit regression and instrumental variable regression techniques to determine the association between health insurance costs and insurance coverage for Current Population Survey data. Mei et al., (2006) used logistic regression models to examine relationship between residential setting in health insurance coverage for adult residents of Florida, Indiana and Kansas. Rhine and Ying (1998) studied the effect of employment status on private health insurance coverage by using multinominal logit regression model for the data of National Medical Expenditure Survey.

**Policy Implications**

According to Feder et al. (2001) insurance coverage should be expanded to the uninsured population as they are less likely to afford coverage and more likely to face difficulties in getting appropriate and timely care. Mainous et al. (1999) in their study “Access to care for the uninsured: Is access to a physician enough?” concluded that although providing free physician services increases access to care, it is not sufficient. Schoen et al. (1997) concluded that there is need to expand subsidized coverage to low income families, as in their study they found that risk of being uninsured was related positively to state Medicaid eligibility levels. Chernew et al. (2005) studied that major reason for decline in
health insurance is raising health insurance premiums and concluded that health benefits have to be designed in such a way as to reduce costs and at the same time consider medical advances. Kronick and Gilmer (1999) suggested that provision of new subsidies for low-income workers will make insurance affordable.
CHAPTER 3
METHODOLOGY

Data

The data used in this analysis were obtained from the Office of Research and Statistics: South Carolina State Budget and Control Board, U.S. Census Bureau and South Carolina Community profiles: A publication of the South Carolina Office of Research and Statistics for the year 2000. These data contain emergency room visits for selected general diagnoses categories; percentage of uninsured population; median household income; percentage of population by race, age, and education attainment; number of business establishments by number of employees; and percentage of population living in urbanized areas. The sample used for the analysis is all 46 counties in the South Carolina state of U.S. for the year 2000. Models used in this study:

The data were analyzed by using the following models:

(a) Linear Models for Categorical Data

Categorical data analysis was performed to evaluate county level differences in emergency room visits and draw implications for the geographical distribution of the uninsured in South Carolina using variables influencing uninsured and emergency room visits (for analyzing associations between
variables). The average of each variable for all 46 counties was calculated. Based on the averages, the counties were divided into two categories: “HIGH” and “LOW”. If the county falls above the state average of a particular variable then it was classified as “HIGH”; otherwise it was classified as “LOW”. The predicted probabilities for associations between two variables were calculated by using linear models. The variable categories are defined in the Table 3.1.

**Table 3.1: Variable Categories.**

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Categories*</th>
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<tbody>
<tr>
<td>LOW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HIGH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NON-WHITES</td>
<td>Percentage of population who are not categorized under White</td>
<td>≤ 40.02 %</td>
</tr>
<tr>
<td>ESTBL50</td>
<td>Percentage of business establishments with less than 50 employees</td>
<td>≤ 1.90 %</td>
</tr>
<tr>
<td>MHHI</td>
<td>Median Household Income</td>
<td>≤ $33597</td>
</tr>
<tr>
<td>EDUC</td>
<td>Percentage of population with education attainment more than high school</td>
<td>≤ 38.72 %</td>
</tr>
<tr>
<td>ERV</td>
<td>Percentage of emergency room visits</td>
<td>≤ 40.02 %</td>
</tr>
<tr>
<td>UNINSURED</td>
<td>Percentage of population uninsured</td>
<td>≤ 15.88 %</td>
</tr>
<tr>
<td>URBAN</td>
<td>Percentage of population living in urban areas</td>
<td>≤ 43.07 %</td>
</tr>
<tr>
<td>AGE UNDER 18</td>
<td>Percentage of population aged under 18</td>
<td>≤ 25.61 %</td>
</tr>
<tr>
<td>AGE 65 AND OVER</td>
<td>Percentage of population aged 65 and over</td>
<td>≤ 12.7 %</td>
</tr>
</tbody>
</table>

*Classification percentages are county averages.

The $\chi^2$ (chi-square) test shows whether there is relationship between dependent and independent variables while the predicted probabilities shows
how strong the relationship appears to be. The hypotheses for $\chi^2$ test was as follows:

$H_0$ : Independent variable does not predict/influence dependent variable  
$H_A$ : Independent variable does influence dependent variable  

If the p-value for the $\chi^2$ statistic was less than $\alpha = 0.05$, the null hypothesis was rejected and it was concluded that independent variable do influence dependent variable at 5 % level of significance. As only one independent variable was used at a time, the influence of other variables was not taken into consideration, which leads to loss of information. In addition, there is a chance of change in relationship between two categorical variables due to the effect of lurking variables. This phenomenon is known as Simpson’s Paradox. Moore and William (2006, p.488) defined Simpson’s Paradox as “[a]n association or comparison that holds for all of several groups can disappear or even reverse direction when the data are combined to form a single group.” Therefore, to further explore the relation between emergency room visits and uninsured with socio-demographic characteristics, several additional models and estimation techniques were used. The simple and multiple linear regression models were defined and estimated to find the relation between percentage uninsured and socio-demographic characteristics, and the relation between emergency room visits and uninsured persons with socio-demographic characteristics. In addition,
the multiple linear regression models were estimated with two-stage least squares (2SLS) to correct for endogeneity. Seemingly unrelated regressions were performed to correct for the correlations among different types of emergency visits.

(b) Ordinary Least Squares Regression

A linear regression model was developed to determine the association between uninsured status and socio-demographic, economic, and education characteristics. Following Mendenhall and Sincich (2003), the model was specified as follows:

\[
UNINSURED_i = \alpha_0 + \alpha_1 MHHI_i + \alpha_2 EDUC_i + \alpha_3 ESTBL50_i + \alpha_4 NON\text{-}WHITES_i + \alpha_5 MHHIEDUC_i + \epsilon_i
\]

where:

UNINSURED=Percentage of population uninsured (all ages)

MHHI=Median household income ($)

EDUC=Percentage of population with education attainment more than high school

ESTBL50=Percentage of business establishments with fewer than 50 employees

NON-WHITES=Percentage of population who are not categorized as White
MHHIEDUC=Interaction between education attainment and Median household income

The parameters include the constant term \( \alpha_0 \) (an intercept), variable coefficients \( \alpha_j \) \((j = 1, 2, 3, 4, 5)\) and the random error component \( \nu \).

(c) Ordinary Least Squares Regression:

To investigate the relationship between percentage of all emergency room visits and the percentage of people who are uninsured, Simple Linear Regression was carried out using uninsured as an independent variable and emergency room visits as a dependent variable. Following Greene (2003), the model was specified as follows:

\[
ERV_i = \delta_0 + \delta_1 UNINSURED_i + \omega_i
\]

where \( ERV \) (dependent variable) is the percentage of all emergency room visits, \( UNINSURED \) (independent variable) is the percentage of uninsured population and \( i \) refers to the county index. The parameters include the constant term \( \delta_0 \) (an intercept), variable coefficient \( \delta_1 \) and the random error component \( \omega \).

From the R-Square and the scatter plot between uninsured and emergency room visits, it can be concluded that while a weak relationship exists, there appears to be other variables influencing emergency room visits along with uninsured status. Hence, socio-demographic, economics and education variables were included along with uninsured variable as other independent variables.
Thus, a multiple linear regression was carried out using emergency room visits as a dependent variable and uninsured, age, race, urban population, education attainment, percentage of business establishments, and median household income as independent variables. The result showed that most of the variables were not significant even at 10 percent level of significance, and the signs were not as expected. This problem may be due to endogeneity. By using instrumental variable regression (specifically two-stage least squares) the problem of endogeneity was reduced.

(d) Instrumental Variable Regression Model (Two-Stage Least Squares)

A two-stage least squares (2SLS) model was developed to determine the influence of selected socio-demographic, economic, education and health factors on emergency room visits. In the first stage, least squares predictions were obtained from regression of percentage uninsured on race, education attainment, percentage of establishments, median household income, age, and urban population. In the second stage, least squares regression of emergency room visits on predicted values of uninsured, as well as age and urban population was carried out. Following Greene (2003), the model was specified as follows:

\[
ERV_{ei} = \beta_0 + \beta_1UNINSURED_i + \beta_2AGEUNDER18_i + \beta_3AGE65ANDOVER_i + \beta_4URBAN_i + \epsilon_i
\]
In Equation 3, ERV is the dependent variable, UNINSURED is the endogenous variable, \( \hat{UNINSURED} \) is the predicted values of uninsured from first stage regression, AGEUNDER18, AGE65ANDOVER, and URBAN are the exogenous determinants of ERV. The set of instruments that affect UNINSURED are MHHI, EDUC, ESTBL50, NON-WHITES and MHHIEDUC.

\[
ERV = \text{Percentage of emergency room visits}
\]

\[
AGEUNDER18 = \text{Percentage of population aged under 18}
\]

\[
AGE65ANDOVER = \text{percentage of population aged 65 and over}
\]

\[
URBAN = \text{percentage of population living in urban areas}
\]

\( C \) refers to emergency room visits for different general diagnoses categories

\( i \) refers to county index

The parameters include the constant term \( \beta_0 \) (an intercept), variable coefficients \( \beta_j \) (\( j = 1,2,3,4 \)) and the random error component \( \epsilon \).

**Variables and Variable Measurements**

Variables used in the study, their measurements and specific hypothesis to be tested are described in the following section.
Emergency Room Visits (ERV)

This variable includes all emergency room visits (outpatient and those resulting in admission) by patient origin for selected general diagnoses categories, by hospital South Carolina hospital emergency room data system for the year 2000. This variable is defined as the percentage of population who visit emergency rooms. The emergency room visits for all conditions fall under different selected diagnoses categories. The categories are emergency room visits for infective and parasitic diseases, neoplasms, endocrine, nutritional and metabolic diseases, diseases of blood and blood-forming organs, mental disorders, diseases of the nervous system and sense organs, diseases of the circulatory system, diseases of the respiratory system, diseases of the digestive system, diseases of the genitourinary system, complications of pregnancy or birth, diseases of the skin and subcutaneous tissues, diseases of musculoskeletal system and connective tissues, symptoms and ill-defined conditions, accidents, poison and violence and all other conditions. The following graph shows the percentage of emergency room visits by selected general diagnoses categories. The Figure 3.1 shows that of all emergency room visits, the highest percentage is for accidents, poison and violence (25.65), while the lowest percentage is for neoplasms (0.39) in South Carolina.

\[ \text{Percentage} = \left( \frac{\text{Number of emergency room visits}}{\text{Total county population}} \right) \times 100 \]

Figure 3.1: Percentage of emergency room visits for selected general diagnoses categories to the total emergency room visits in South Carolina.

Uninsured

Uninsured is defined as the percentage of population who are not covered by health insurance. According to Current Population Survey (U.S. Census Bureau, 2007) definition, “[a] person was considered covered by health insurance at some time during the year if he or she was covered by at least one of the following types of coverage’s: (1) employer/union, (2) privately purchased (not related to employment), (3) Medicare, (4) Medicaid, (5) military health care, (6) someone outside the household, (7) other”. The data was collected from U.S. Census Bureau: Small Area Health Insurance Estimates, (2000) for people of all ages. The literature (Institute of Medicine, 2003; Kaiser Commission on Medicaid
and the Uninsured, 2003) shows that the uninsured generally postpone their regular checkups for primary health care and visit emergency room when sick. This results in overcrowding of emergency departments and an increase in premiums for insured. This suggests the positive relation between ERV and Uninsured, tested by the following hypotheses.

\[ H_0 : \beta_1 = 0; \quad H_A : \beta_1 > 0 \]

**Age (AGEUNDER18 and AGE65ANDOVER)**

These variables are the percentage of population aged under 18 years and aged 65 and over. The population with these ages was hypothesized to have a positive influence on emergency room visits.

\[ H_0 : \beta_2 = 0; \quad H_A : \beta_2 > 0 \]

\[ H_0 : \beta_3 = 0; \quad H_A : \beta_3 > 0 \]

**Urban population (URBAN)**

This variable is the percentage of population living in urban areas. According to South Carolina Community profiles-A publication of the South Carolina Office of Research and Statistics, 2000 defined urban as “[a]ll territory, population and housing units in urbanized areas and in places of more than 2,500 persons outside of urbanized areas. Urban classification cuts across other
hierarchies and can be in metropolitan or non-metropolitan areas”. This variable was hypothesized to have a positive influence on emergency room visits.

\[ H_0 : \beta_4 = 0; H_A : \beta_4 > 0 \]

**Median Household Income (MHHI)**

This variable is the median household income for each county in South Carolina (in dollars). According to South Carolina Community profiles-A publication of the South Carolina Office of Research and Statistics (2000) “‘Household income includes the income of the householder and all persons 15 years old and over in the household, whether related to the householder or not”. People earning annual incomes less than $35,000 were more likely to be uninsured (32 percent) than people earning more than $35,000 (7 percent) (Budetti et al., 1999). Thus median household income was hypothesized to have a negative influence on percentage uninsured.

\[ H_0 : \alpha_1 = 0; H_A : \alpha_1 < 0 \]

**Education attainment (EDUC)**

This variable includes percentage of population (age 25 and over) with education attainment beyond high school. The non-elderly adults who lack health insurance generally have less education and are not eligible for higher-skilled jobs, which provide health coverage (Kaiser Commission on Medicaid
and the Uninsured, 2007). According to Dewar (1998), people with higher levels of education have increased likelihood of insurance coverage. This suggests that education attainment beyond high school was hypothesized to have a negative influence on percentage uninsured.

\[ H_0 : \alpha_2 = 0; H_A : \alpha_2 < 0 \]

**Percentage of Business Establishments Fewer Than 50 Employees (ESTBL50)**

This variable describes the percentage of business establishments with fewer than 50 employees. The data were collected from U.S. Census Bureau (County Business Patterns, 2000). The literature (ASPE, 2005; The Kaiser Family Foundation and Health Research and Educational Trust, 2005) shows that the percent of the population that is uninsured decreases with an increase in firm size because the employer-sponsored health insurance is mostly offered by large firms. Thus, the percentage of business establishments with less than 50 employees was hypothesized to have a positive influence on uninsured.

\[ H_0 : \alpha_3 = 0; H_A : \alpha_3 > 0 \]

**Race (NON-WHITES)**

This variable includes percentage of population who are not categorized under White. According to South Carolina Community profiles-A publication of the South Carolina Office of Research and Statistics (2000), “[f]or the 2000
Census, the term ‘White’ refers to people having origins in any of the original peoples of Europe, the Middle East, or North Africa. It includes people who reported ‘White’ or wrote in entries such as Irish, German, Italian, Lebanese, Near Easterner, Arab or Polish”. The studies by Kaiser Commission on Medicaid and the Uninsured, 2007 showed that Whites are more likely to have health insurance than other races. This variable was hypothesized to have a positive influence on percent uninsured.

\[ H_0 : \alpha_s = 0; H_A : \alpha_s > 0 \]

The following tests (Greene, 2003) were conducted to test inconsistency of OLS and validity of Over-Identifying restrictions.

**Hausman Test:**

Hausman test was used to test whether the variables, thought to be endogenous were really endogenous and problematic. If they were not endogenous, then OLS (ordinary least squares) is the best procedure for estimation (consistent and efficient); otherwise OLS is inconsistent. In this study, a Hausman test was conducted to test whether OLS or 2SLS is consistent for estimating the relation between emergency room visits and uninsured. For example, consider a model \( Y = X\beta + \epsilon \) and \( X = [X_1, X_2] \) in which \( X_2 \) is exogenous, but \( X_1 \) may be endogenous. If \( X_1 \) is correlated with \( \epsilon \), OLS estimation will be inconsistent. However, if 2SLS estimation is used and \( X_1 \) is in fact exogenous,
the 2SLS results are consistent but inefficient relative to OLS. Therefore, the consistency of OLS was tested by the following hypotheses (Greene, 2003):

\[ H_0 : b_{OLS} \text{ is consistent and efficient} \]

\[ H_A : b_{OLS} \text{ is inconsistent} \]

where, \( b_{OLS} \) is OLS estimator.

The Hausman statistic (\( H \)) is measured as

\[ (4) \quad H = (b_{2SLS} - b_{OLS})'\Delta^{-1}(b_{2SLS} - b_{OLS}) \]

where, \( \Delta = \hat{\sigma}^2 (\hat{X}'\hat{X})^{-1} - \hat{\sigma}^2 (X'X)^{-1} \), Hausman statistic, follows a \( \chi^2 \) distribution with degrees of freedom equal to the number of right hand side variables for which instruments are formed in 2SLS.

When the null hypothesis is rejected, it is concluded that OLS is inconsistent and the difference in the estimates of 2SLS (two-stage least squares) and OLS will be large relative to the difference in the covariance matrices.

**Testing the Over-Identifying Restrictions:**

When the number of excluded instruments is greater than number of endogenous right hand side variables, the model is said to be over-identified. If the variables in the excluded instruments are exogenous, they would show little relationship to the estimated 2SLS residuals and be considered valid. There are several tests of over-identifying restrictions such as the generalized method of
moments (GMM) test for over-identification, Bausman test and Sargan statistic. In this study, to test for over-identifying restrictions the Sargan statistic was calculated using STATA software (StataCorp, 2005).

\[ H_0 : \text{The instruments are valid} \]

\[ H_A : \text{The instruments are not valid} \]

The degrees of freedom for this test is the number of excluded instruments minus the number of endogenous right hand side variables. If the number of excluded instruments is exactly equal to the number of endogenous right hand side variables, the model is said to be exactly identified. Thus, there should be a greater number of instruments than right hand side endogenous variables to test for over-identification. When null hypothesis is not rejected, we conclude that instruments are legitimate and they do not belong in the equation.

(e) **Seemingly Unrelated Regressions**

“In this procedure regression coefficients in all equations are estimated simultaneously by applying Aitken’s generalized least squares to the whole system of equations” (Zellner, 1962, p.348). This procedure is used when the error terms of a set of equations are correlated. Seemingly unrelated regression was performed in this study because each regression equation refers to a particular classification category. The model is specified as follows (Kmenta, 1971):
(5) \[ Y_m = X_m \beta_m + \epsilon_m (m = 1, 2, \ldots, M) \]

Where \( Y_m \) refers to each category of emergency room visits, \( X_m \) refers to explanatory variables for each category of emergency room visits and \( m \) refers to a set of equations. In this study, each of the seemingly unrelated regressions involves same explanatory variables and \( \epsilon_m \) is the disturbance term of each seemingly unrelated regression. In this study, as uninsured is an endogenous variable, seemingly unrelated regression was carried out in two stages. In the first stage, linear regression analysis of uninsured on all variables was carried out and predicted values of percentage of uninsured were obtained. In the second stage, these predicted uninsured values were used as one of the explanatory variables along with other exogenous variables, while emergency room visits by category is used as the dependent variable.

**Breusch-Pagan Test of Independence:**

This test was used to observe whether error terms of a set of equations were correlated or not of seemingly unrelated equations (Breusch and Pagan, 1980).

\[ H_0 : \text{Residuals from the equations are independent} \]

\[ H_A : \text{Residuals are not independent} \]
When null hypothesis is rejected it can be concluded that residuals are not independent across equations.

In economics, elasticity is a tool to measure responsiveness of one variable to a change in other variable. Elasticities are widely used by policy makers due to their simplicity in interpretation. Therefore, the elasticities of the uninsured population with respect to socio-demographic characteristics and elasticities of emergency room visits with respect to percentage of uninsured populations and other socio-demographics were calculated.

(f) Elasticities of Uninsured with Respect to Socio-Demographic Characteristics

In this study, elasticities were calculated at means as follows:

\[
E_{u,s_p} = \frac{\partial u / \partial s_p}{\bar{u}/\bar{s}_p}
\]

where, \(E_{u,s_p}\) is the elasticity of uninsured with respect to Socio-demographic characteristics, \(u\) represents uninsured, \(s\) socio-demographic variable, \(p\) represents socio-demographic characteristics, \(\partial u / \partial s_p\) is the estimated slope from the particular regression model, \(\bar{u}\) is the mean of uninsured, and \(\bar{s}\) is the mean of socio-demographic variables.
(g) Elasticities of Emergency Room Utilization with Respect to Uninsured and socio-demographic characteristics

The elasticities of emergency room utilization with respect to uninsured status and socio-demographic characteristics, respectively, are calculated as follows:

\[
E_{ej,u} = \frac{\partial e}{\partial u} \frac{\bar{e}}{u}
\]

\[
E_{ej,s} = \frac{\partial e}{\partial s} \frac{\bar{e}}{s}
\]

where, \( e \) represents emergency room utilization, \( j \) categories of emergency room visits, \( u \) uninsured, \( \bar{e} \) mean of emergency room visits for each category, \( \bar{u} \) mean of uninsured, \( s \) socio-demographic variable and \( \bar{s} \) mean of socio-demographic variables. The descriptive statistics of variables are presented in the appendix A.
CHAPTER 4
RESULTS AND DISCUSSION

A series of economic analysis were performed on the South Carolina data to find (1) the relationship between the uninsured population and socio-demographic characteristics and (2) the relationship between emergency room visits for selected diagnosis categories and the uninsured by taking into account socio-demographics. The results are presented in the following sections.

Linear Model Analysis for Categorical Data

To identify and characterize group differences in counties of South Carolina by taking into account uninsured and emergency room visits, categorical analysis was performed.

Two-dimensional contingency tables were formed to summarize the data by using PROC FREQ in SAS. In this study, two variables were selected, and average of each variable is calculated. Based on the average of each variable, all 46 counties were classified into two categories: “HIGH” (if the value of a variable in that county is above state average) and “LOW” (if the value of a variable in that county is below state average). The frequencies form the data for further analysis. To examine the effect of independent variable on the response of dependent variable, linear models were used. In SAS, the function PROC
CATMOD was used to analyze the data that can be represented by a two-dimensional contingency table. By default, PROC CATMOD estimates model by maximum likelihood technique. After PROC CATMOD, the WEIGHT statement was used to represent the number of times each observation occurs. From the $\chi^2$ value of the independent variable in the maximum likelihood analysis of variance, it can be concluded whether the independent variable does have/does not have the influence with regard to dependent variable. The counties with percentage uninsured above state average are classified as HIGH; counties at or below the state average are classified as LOW. Similarly, the counties were classified into two categories based on averages of each independent variable. Then the associations between dependent and independent variable categories were analyzed using linear model. In this analysis, the uninsured percentage of the population is the dependent variable and other socio-demographics are independent variables. The maximum likelihood predicted values for probabilities are illustrated graphically as follows.
Predicted Probability of a County Falling Into HIGH/LOW Uninsured vs. Socio-Demographic Characteristics

![Bar Chart](image)

**Figure 4.1: Predicted probability of a county falling into HIGH/LOW uninsured by HIGH/LOW median household income (MHHI) categories.**

The predicted probability of a county that is below the average median household income falling into HIGH uninsured level was 0.7391 and the predicted probability of a county that is above the average median household income falling into HIGH uninsured level was 0.1739 (Figure 4.1). The estimate of maximum likelihood analysis showed that a county with a HIGH median household income is less likely to be HIGH uninsured (Table 4.1). From the p-value (0.0003) it can be concluded that the median household income does have influence with regard to percentage uninsured in South Carolina at a 5 percent level of significance. If the county has larger than state average percentage of small business establishments (less than 50 employees), then the predicted
probability of the county falling into LOW uninsured level (0.6316) is higher than the predicted probability of that county falling into HIGH uninsured level (0.3684) (Figure 4.2). The maximum likelihood estimates showed that counties with HIGH percentage of establishments (less than 50 employees) are less likely to be HIGH uninsured (Table 4.1). Also, the p-value (0.3164) suggests that the percentage of business establishments with less than 50 employees do not have influence on the proportion of the population that is uninsured. This result does not corroborate previous studies (Hoffman et al., 2004; Chollet, 1994) that concluded that the risk of being uninsured is highest for workers in firms with fewer than 25 employees and the uninsured rate declines as firm size increases.

![Figure 4.2: Predicted probability of a county falling into HIGH/LOW uninsured by HIGH/LOW percentage of establishments fewer than 50 employees (ESTBL50) categories.](image-url)
Similarly, the predicted probability of a county being uninsured above state average is higher (0.6538) with below state average percentage of population educated beyond high school than a county with above state average percentage of population educated beyond high school (0.2) (Figure 4.3). The negative sign on the coefficient showed that counties with a HIGH percentage of educated population are less likely to be HIGH uninsured (Table 4.1). The p-value (0.0036) in maximum likelihood analysis of variance concludes that education attainment with more than high school influences the percentage of uninsured. Also, the predicted probability of a county falling into HIGH uninsured category is higher if, the county has a HIGH non-Whites measure (0.7826) than if the county has a LOW non-Whites measure (0.1304) (Figure 4.4). The positive sign on the coefficient showed that counties with a HIGH percentage of non-Whites population are more likely to be HIGH uninsured (Table 4.1). In this analysis, the p-value is less than 0.0001, which suggests that the percentage of non-Whites do influence percentage uninsured in a county.
Figure 4.3: Predicted probability of a county falling into HIGH/LOW uninsured by HIGH/LOW education attainment (MTHS=more than high school) categories.

Figure 4.4: Predicted probability of a county falling into HIGH/LOW uninsured by HIGH/LOW race (NONWHITE=Percentage of population not categorized under WHITE) categories.

The maximum likelihood estimates (uninsured population as dependent variable and socio-demographics as independent variables) are presented in the following Table 4.1.
Table 4.1: Maximum Likelihood Estimates: Categorical Data Analysis.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate</th>
<th>Standard Error</th>
<th>Pr&gt;chisq</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDHII (HIGH UNINSURED)</td>
<td>-1.299</td>
<td>0.3634</td>
<td>0.0003*</td>
</tr>
<tr>
<td>ESTBL50 (HIGH UNINSURED)</td>
<td>-0.3066</td>
<td>0.3060</td>
<td>0.3164</td>
</tr>
<tr>
<td>MTHS (HIGH UNINSURED)</td>
<td>-1.011</td>
<td>0.3473</td>
<td>0.0036*</td>
</tr>
<tr>
<td>NONWHITE (HIGH UNINSURED)</td>
<td>1.589</td>
<td>0.3997</td>
<td>&lt;0.0001*</td>
</tr>
</tbody>
</table>

*' indicates significance at 5 percent.
Predicted Probability of a County Falling Into HIGH/LOW Emergency Room Visits vs. Socio-demographic Characteristics

In this analysis, the dependent variable is the percentage of emergency room visits for all conditions, and independent variables are the percentage uninsured and other socio-demographic characteristics. The predicted probabilities of a county’s emergency room visits with regard to independent variables are illustrated graphically as follows:

![Graph showing predicted probabilities](image)

**Figure 4.5: Predicted probability of a county falling into HIGH/LOW emergency room visits category (ERV) by HIGH/LOW insurance categories.**

Figure 4.5 shows the association between two variables: the percentage of uninsured population and the percentage of all emergency room visits. The results show that if a county’s percentage of uninsured population is above state average, the predicted probability of that county having emergency room visits above state average is 0.6667. The positive sign on maximum likelihood estimate
showed that counties with HIGH uninsured rates are more likely to have HIGH emergency room visits (Table 4.2). From the p-value (0.0108), it can be concluded that the percentage of uninsured do have influence with regard to percentage of emergency room visits at 5 percent level of significance.

![Figure 4.6: Predicted probability of a county falling into HIGH/LOW emergency room visits (ERV) by HIGH/LOW median household income (MEDHHI) categories.](image)

The predicted probability of a county with a median household income above the state average falling into the HIGH category of emergency room visits (Figure 4.6) is 0.3043, which is lower than the predicted probability of that county falling into the LOW category of emergency room visits (0.6957). The negative maximum likelihood estimate showed that a county with a HIGH median household income is less likely to have HIGH emergency room visits (Table 4.2). From the p-value (0.0417), it can be concluded that there is influence
of median household income on percentage of emergency room visits at 5 percent level of significance. Similarly, the predicted probability of a county falling into HIGH emergency room visits is higher if the county has LOW education attainment (percentage of the population with more than high school) than if the county has HIGH education attainment (0.5385 and 0.35, respectively) (Figure 4.7). Though the maximum likelihood coefficient shows that a county with HIGH education attainment beyond high school is less likely to have HIGH emergency room visits (Table 4.2), p-value (0.2064) concludes that the association is not significant at 5 percent level.

**Figure 4.7:** Predicted probability of a county falling into HIGH/LOW emergency room visits (ERV) by HIGH/LOW education attainment (MTHS=more than high school) categories.
Figure 4.8: Predicted probability of a county falling into HIGH/LOW emergency room visits (ERV) by HIGH/LOW race (NONWHITE=Percentage of population not categorized under WHITE) categories.

Figure 4.8 shows that the predicted probability of a county falling into the HIGH emergency room visits category is 0.6522 if that county has an above-average non-White population, and 0.2609 if that county has a below-average non-White population. The positive sign of the maximum likelihood estimate shows that a county with a HIGH non-White population is more likely to have HIGH emergency room visits (Table 4.2). The p-value (0.0097) concludes that the percentage of non-White population does influence the percentage of emergency room visits.
Figure 4.9: Predicted probability of a county falling into HIGH/LOW emergency room visits (ERV) by HIGH/LOW percentage of establishments fewer than 50 employees (ESTBL50) categories.

In a county for which the percentage of establishments with fewer than 50 employees is above the state average, the predicted probability of that county having HIGH emergency room visits is 0.4737, but having LOW emergency room visits is 0.5263 (Figure 4.9). However, the positive sign on the coefficient of ESTBL50 shows that a county with HIGH ESTBL50 is more likely to have HIGH emergency room visits (Table 4.2), the p-value of 0.8446 concluded that the association is not significant at 5 percent level.
Figure 4.10: Predicted probability of a county falling into HIGH/LOW emergency room visits (ERV) by HIGH/LOW URBAN (URBAN=Percentage of population living in urbanised areas) categories.

Figure 4.10 shows that the predicted probability of a county falling into the LOW emergency room visits category with HIGH urban population is 0.6667, but 0.44 with LOW urban population. The negative coefficient on URBAN shows that a county with HIGH urban population is less likely to have HIGH emergency room visits (Table 4.2), but the association is not significant at 5 percent level (p-value=0.1279).
Figure 4.11: Predicted probability of a county falling into HIGH/LOW emergency room visits (ERV) by HIGH/LOW age (UNDER18=Percentage of population aged under 18) categories.

The results show that the predicted probability of a county falling into HIGH emergency room visits category is 0.64 with HIGH under 18 populations and 0.2381 with LOW under 18 populations. The maximum likelihood estimates showed that a county with a HIGH percentage of population aged under 18 years is more likely to have HIGH emergency room visits (Table 4.2). The p-value (0.0085) shows that age (population under 18) does influence the percentage of emergency room visits.
Figure 4.12: Predicted probability of a county falling into HIGH/LOW emergency room visits (ERV) by HIGH/LOW age (AGE65ANDOVER=Percentage of population aged 65 and over) categories.

The results showed that the predicted probability of a county falling into the HIGH emergency room visits category is 0.4286 with HIGH percentage of population aged 65 and over and 0.48 with LOW percentage of population aged 65 and over (Figure 4.12). The maximum likelihood estimates showed that a county with a HIGH percentage of population aged 65 and over is less likely to have HIGH emergency room visits (Table 4.2). The p-value (0.7274) shows that age (population aged 65 and over) do not influence the percentage of emergency room visits.

The maximum likelihood estimates (percentage of emergency room visits as dependent variable, uninsured and socio-demographics as independent variables) are presented in the Table 4.2.
Table 4.2: Maximum Likelihood Estimates: Categorical Data Analysis.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate</th>
<th>Standard Error</th>
<th>Pr&gt;Chisq</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNINSURED (HIGH ERV)</td>
<td>0.8188</td>
<td>0.3212</td>
<td>0.0108*</td>
</tr>
<tr>
<td>MEDHHI (HIGH ERV)</td>
<td>-0.6343</td>
<td>0.3114</td>
<td>0.0417*</td>
</tr>
<tr>
<td>MTHS (HIGH ERV)</td>
<td>-0.3866</td>
<td>0.3060</td>
<td>0.2064</td>
</tr>
<tr>
<td>ESTBL50 (HIGH ERV)</td>
<td>0.0589</td>
<td>0.3005</td>
<td>0.8446</td>
</tr>
<tr>
<td>NONWHITE (HIGH ERV)</td>
<td>0.8350</td>
<td>0.3229</td>
<td>0.0097*</td>
</tr>
<tr>
<td>URBAN (HIGH ERV)</td>
<td>-0.4672</td>
<td>0.3068</td>
<td>0.1279</td>
</tr>
<tr>
<td>UNDER18 (HIGH ERV)</td>
<td>0.8693</td>
<td>0.3302</td>
<td>0.0085*</td>
</tr>
<tr>
<td>AGW65ANDOVER (HIGH ERV)</td>
<td>-0.1038</td>
<td>0.2978</td>
<td>0.7274</td>
</tr>
</tbody>
</table>

‘*’ indicates significance at 5 percent.

The categorical analysis finds the relation between two categorical variables, and it is easy to analyze the data and interpret the coefficients. However, as only one independent variable was used at a time; the influence of other variables was not taken into consideration, which leads to loss of information. In addition, the signs of the coefficients for some variables are opposite of expectations. For example, the maximum likelihood estimates of ESTBL50 showed that counties with a HIGH percentage of establishments (with fewer than 50 employees) are less likely to be HIGH uninsured, but this does not corroborate previous studies. These results may be due to Simpson’s paradox. Therefore, to find the relation between uninsured and socio-demographic characteristics, ordinary least square (OLS) regression was performed.
Ordinary Least Squares Estimates of Percentage Uninsured on Socio-Demographic Characteristics

The ordinary least squares regression estimates of uninsured are provided in the Table 4.3. The estimated coefficients on the percentage of population who were not categorized as White and the percentage of business establishments with fewer than 50 employees were positive and statistically significant at the 5 percent level of significance. However, the estimated coefficients on median household income and the percentage of the population with educational attainment greater than high school were negative and statistically significant at 5 percent level.
Table 4.3 Ordinary Least Squares Regression Results for Percentage of Uninsured (Dependent Variable) and Socio-Demographic Characteristics (Independent Variables) in South Carolina.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NON-WHITES</td>
<td>Percentage of population who are not categorized under white</td>
<td>0.0767*</td>
<td>0.0317</td>
<td>2.42</td>
</tr>
<tr>
<td>ESTBL50</td>
<td>Percentage of business establishments with less than 50 employees</td>
<td>1.8741*</td>
<td>0.6850</td>
<td>2.74</td>
</tr>
<tr>
<td>MHHI</td>
<td>Median Household Income</td>
<td>-0.0005*</td>
<td>0.0002</td>
<td>-2.04</td>
</tr>
<tr>
<td>EDUC</td>
<td>Percentage of population with education attainment more than high school</td>
<td>-0.5364*</td>
<td>0.2018</td>
<td>-2.66</td>
</tr>
<tr>
<td>MHHIEDUC</td>
<td>Interaction between education attainment and Median household income</td>
<td>0.00001*</td>
<td>5.34e-06</td>
<td>2.04</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td>33.5419</td>
<td>9.4522</td>
<td>3.55</td>
</tr>
</tbody>
</table>

R²=0.67, ‘*’ indicates significance at 5 percent, and figures in parentheses are the p-values.

The estimated coefficient on the percentage of population who were not categorized as White shows that the uninsured status increases by 0.0767 % for every 1 percent increase in non-Whites when all other independent variables in the model are held fixed. The sign of the coefficient was as expected. This finding corroborates previous studies of Mold et al. (2004) and Kaiser Commission on Medicaid and the Uninsured (2007) in which Whites are less likely to lack health insurance.

Similarly, the estimated coefficient on the percentage of business establishments with fewer than 50 employees was positive, as expected. Table 4.3
shows that, the percentage of uninsured increases by 1.8741 for a 1% increase in business establishments with less than 50 employees, holding other independent variables fixed in the model. These results support evidence from previous studies (ASPE, 2005; Kaiser Family Foundation and Health Research and Educational Trust, 2006).

The percentage of the population with education attainment beyond high school had a negative sign on the estimated coefficient, as expected, and a one percent increase in the percentage of the population with education attainment beyond high school was associated with a $-0.53+0.00001\times\text{MHHI}$ (i.e. -0.06 or less) percentage decrease in the percentage of the population that was uninsured for all values (in the data) of MHHI, keeping all other variables in the model fixed. Studies by Kaiser Commission on Medicaid and the Uninsured (2007) showed that the non-elderly adults who lack health insurance are mostly those with less education and who are not eligible for higher-skilled jobs that provide health coverage. In addition, the studies by Dewar (1998) concluded that persons with higher levels of education have increased likelihood of insurance coverage.

The estimated coefficient on median household income was negative and as expected. Table 4.3 shows that for every $1 increase in median household income, the percentage of the population that is uninsured decreases by $-0.0005+0.00001\times\text{EDUC}$ (i.e. -0.00001 or less) for education attainment more than
high school less than 50% and increases by -0.0005+0.00001*EDUC (i.e. 0.00001 or more) for education attainment more than high school higher than 50 percent, keeping all other variables in the model fixed. This finding corroborates previous studies of DeNavas et al., (2007), Fronstin (2006) and Budetti et al., (1999) who concluded that there is inverse relationship between likelihood of being uninsured and family income earnings.

Ordinary Least Squares Regression (Percentage of Emergency Room Visits as Dependent Variable and Percentage Uninsured as Independent Variable)

To find the relation between the percentage of emergency room visits and the percentage uninsured, OLS was carried out. The results showed that the $R^2$ was low (0.1641), which means only 16.41% of variability in emergency room visits was explained by uninsured. The scatter plot (Figure 4.13) slopes upward as moved from left to right, which shows that emergency room visits and uninsured were positively associated. The regression results are presented in Table 4.4.
Table 4.4: Ordinary Least Squares Regression Results for Percentage of Emergency Room Visits (Dependent Variable) and Percentage Uninsured (Independent Variable) in South Carolina.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNINSURED</td>
<td>Percentage of population who are uninsured</td>
<td>1.365*</td>
<td>0.4644</td>
<td>2.94</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td>18.5253</td>
<td>7.5039</td>
<td>2.47</td>
<td>(0.018)</td>
</tr>
</tbody>
</table>

‘*’ indicates significance at 5 percent, and figures in parentheses are the p-values.

Figure 4.13: Scatter plot between percentage of emergency room visits and uninsured.

The low $R^2$ value and scatter plot suggest that other independent variables are influencing the percentage of emergency room visits along with the uninsured population. Hence, several additional exogenous variables (urban, age), endogenous variables (uninsured) and instruments (median household
income, percentage of population with education attainment more than high school, percentage of non-Whites, percentage of business establishments with fewer than 50 employees) were included in the model to attempt to improve the $R^2$ and reduce the variation in the scatter plot.

**Instrumental Variable Regression Results**

To evaluate the relation between the percentage of emergency room visits by each category and the percentage of the suspected endogenous variable uninsured, two-stage least squares regression was carried out using the exogenous variables representing the percentage of population lived in urban areas, the percentage of population aged under 18, and the percentage of population aged 65 (by including instrumental variables MHHI, ESTBL50, EDUC, NON-WHITES). The Hausman test was conducted to test whether the suspected variables were actually endogenous. If these variables in the model are endogenous, then OLS is inconsistent and it is beneficial to estimate model coefficients by 2SLS model. The Hausman test showed that there is sufficient evidence to conclude OLS is inconsistent (except for diseases of blood and blood-forming organs and other conditions) inferring that uninsured status is endogenous. Then validity of the instruments was tested (i.e. whether instruments used in the model are exogenous). The test for over-identifying restrictions (Sargan statistic) showed that there is insufficient evidence to
conclude that instruments are not valid at the 5 percent level of significance (except for diseases of blood and blood-forming organs). The Hausman test and Sargan statistic results for each of the categories of emergency room visits are presented in Table 4.5.

**Table 4.5: Results of Hausman Test and Test for Over-Identifying Restrictions.**

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Hausman Test (P-Value)</th>
<th>Sargan Statistic (P-Value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>INFECPER</td>
<td>0.0026*</td>
<td>0.4630</td>
</tr>
<tr>
<td>NEOPER</td>
<td>0.0324*</td>
<td>0.1292</td>
</tr>
<tr>
<td>ENDOPER</td>
<td>0.0000*</td>
<td>0.4455</td>
</tr>
<tr>
<td>BLOODPER</td>
<td>0.3124^Ns</td>
<td>0.0289^Nv</td>
</tr>
<tr>
<td>MENTALPER</td>
<td>0.0017*</td>
<td>0.5874</td>
</tr>
<tr>
<td>NERVOUSPER</td>
<td>0.0006*</td>
<td>0.5234</td>
</tr>
<tr>
<td>CIRCUPER</td>
<td>0.0003*</td>
<td>0.4397</td>
</tr>
<tr>
<td>RESPER</td>
<td>0.0004*</td>
<td>0.6127</td>
</tr>
<tr>
<td>DIGPER</td>
<td>0.0001*</td>
<td>0.3391</td>
</tr>
<tr>
<td>GENITOPER</td>
<td>0.0002*</td>
<td>0.7807</td>
</tr>
<tr>
<td>BIRTHPER</td>
<td>0.0221*</td>
<td>0.2886</td>
</tr>
<tr>
<td>SKINPER</td>
<td>0.0005*</td>
<td>0.8920</td>
</tr>
<tr>
<td>MUSCLEPER</td>
<td>0.0006*</td>
<td>0.5724</td>
</tr>
<tr>
<td>SYMPTOMSOPER</td>
<td>0.0086*</td>
<td>0.2185</td>
</tr>
<tr>
<td>ACCIDENTPER</td>
<td>0.0041*</td>
<td>0.5596</td>
</tr>
<tr>
<td>OTHERPER</td>
<td>0.2325^Ns</td>
<td>0.4616</td>
</tr>
</tbody>
</table>

'*' indicates significance at 5 percent, '^[Ns]' indicates not significant and '^[Nv]' indicates not valid.

**Variable Description**

Variable names are described as follows:

INFECPer= Percentage of emergency room visits for infective and parasitic diseases
NEOPER= Percentage of emergency room visits for neoplasms

ENDOPER= Percentage of emergency room visits for endocrine, nutritional and metabolic diseases

BLOODPER= Percentage of emergency room visits for diseases of the blood and blood-forming organs

MENTALPER= Percentage of emergency room visits for mental disorders

NERVOUSPER= Percentage of emergency room visits for diseases of the nervous system and sense organs

CIRCPER= Percentage of emergency room visits for diseases of the circulatory system

RESPPER= Percentage of emergency room visits for diseases of the respiratory system

DIGPER= Percentage of emergency room visits for diseases of the digestive system

GENITOPER= Percentage of emergency room visits for diseases of the genitourinary system

BIRTHPER= Percentage of emergency room visits for complications of pregnancy or birth

SKINPER= Percentage of emergency room visits for diseases of the skin and subcutaneous tissues
MUSCLEPER = Percentage of emergency room visits for diseases of the musculoskeletal system and connective tissues

SYMPTOMSPER = Percentage of emergency room visits for symptoms and ill-defined conditions

ACCIDENTPER = Percentage of emergency room visits for accidents, poison and violence

OTHERPER = Percentage of emergency room visits for all other conditions

The instrumental variable regression results showed that the estimated coefficients on the predicted percentage of uninsured are positive, as expected, and statistically significant at the 5 percent level of significance for all categories of emergency room visits except for mental disorders, which is significant at the 10 percent level. This study showed that as the uninsured percentage of the population increases, the percentage of emergency room visits increases, keeping all other variables in the model fixed. This finding corroborates previous studies of Todd et al. (2006), Weinick et al. (1997), Hunt et al. (2006), and Grumbach et al. (1993) in which the uninsured were more likely to visit emergency rooms than the insured. The estimated coefficients on population living in urban areas are positive and significant at the 5 percent level of significance for some categories of emergency room visits while age is insignificant for most of the categories of
emergency room visits. The instrumental variable regression results are reported in the following tables:

**Table 4.6: Instrumental Variable Regression Results of Percentage of Emergency Room Visits for Infective and Parasitic Diseases.**

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>uninsured</td>
<td>Percentage of population uninsured</td>
<td>0.1899*</td>
<td>0.0445</td>
<td>4.27 (0.000)</td>
</tr>
<tr>
<td>age65andover</td>
<td>Percentage of population aged 65 and over</td>
<td>0.0415</td>
<td>0.0675</td>
<td>0.62 (0.269)</td>
</tr>
<tr>
<td>ageunder18</td>
<td>Percentage of population aged under 18</td>
<td>0.0056</td>
<td>0.0728</td>
<td>0.08 (0.469)</td>
</tr>
<tr>
<td>urban</td>
<td>Percentage of population lived in urban areas</td>
<td>0.0029</td>
<td>0.0043</td>
<td>0.67 (0.250)</td>
</tr>
<tr>
<td>constant</td>
<td></td>
<td>-2.3693</td>
<td>2.2224</td>
<td>-1.07 (0.286)</td>
</tr>
</tbody>
</table>

‘*’ indicates significance at 5 percent, and figures in parentheses are the p-values.

The results (The instrumental variable regression results showed that the estimated coefficients on the predicted percentage of uninsured are positive, as expected, and statistically significant at the 5 percent level of significance for all categories of emergency room visits except for mental disorders, which is significant at the 10 percent level. This study showed that as the uninsured percentage of the population increases, the percentage of emergency room visits increases, keeping all other variables in the model fixed. This finding corroborates previous studies of Todd et al. (2006), Weinick et al. (1997), Hunt et al. (2006), and Grumbach et al. (1993) in which the uninsured were more likely to visit emergency rooms than the insured. The estimated coefficients on
population living in urban areas are positive and significant at the 5 percent level of significance for some categories of emergency room visits while age is insignificant for most of the categories of emergency room visits. The instrumental variable regression results are reported in the following tables:

Table 4.6, Table 4.7, Table 4.8, Table 4.9) show that as the uninsured population increases by 1%, the percentage of emergency room visits increases by 0.1899 for infective and parasitic diseases; by 0.0155 for neoplasms; by 0.1151 for endocrine, nutritional and metabolic diseases; and by 0.0676 for diseases of the blood and blood-forming organs, keeping all other variables in the model fixed. The age and urban variables are not significant even at the 10 percent level of significance for infective and parasitic diseases and endocrine, nutritional and metabolic diseases.

Table 4.7 shows that as the population aged 65 and over increases by 1 percent, the percentage of emergency room visits for neoplasm increases by 0.0166, holding other variables in the model fixed. The estimated coefficient of urban is positive, which explains that as the percentage of people living in urban areas increases by 1 percent, the percentage of emergency room visits for neoplasm (Table 4.7) and the percentage of emergency room visits for blood and blood-forming organs (Table 4.9) increases by 0.001 and 0.0023, respectively.
Table 4.7: Instrumental Variable Regression Results of Percentage of Emergency Room Visits for Neoplasms.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>uninsured</td>
<td>Percentage of population uninsured</td>
<td>0.0155*</td>
<td>0.0039</td>
<td>3.93 (0.000)</td>
</tr>
<tr>
<td>age65andover</td>
<td>Percentage of population aged 65 and over</td>
<td>0.0166*</td>
<td>0.0060</td>
<td>2.78 (0.0025)</td>
</tr>
<tr>
<td>under18</td>
<td>Percentage of population aged under 18</td>
<td>0.0020</td>
<td>0.0064</td>
<td>0.32 (0.376)</td>
</tr>
<tr>
<td>urban</td>
<td>Percentage of population lived in urban areas</td>
<td>0.0010*</td>
<td>0.0003</td>
<td>2.62 (0.0045)</td>
</tr>
<tr>
<td>constant</td>
<td></td>
<td>-0.3971</td>
<td>0.1975</td>
<td>-2.01 (0.044)</td>
</tr>
</tbody>
</table>

'*' indicates significance at 5 percent, and figures in parentheses are the p-values.
Table 4.8: Instrumental Variable Regression Results of Percentage of Emergency Room Visits for Endocrine, Nutritional and Metabolic Diseases.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>uninsured</td>
<td>Percentage of population uninsured</td>
<td>0.1151*</td>
<td>0.0255</td>
<td>4.52 (0.000)</td>
</tr>
<tr>
<td>age65andover</td>
<td>Percentage of population aged 65 and over</td>
<td>0.0454</td>
<td>0.0386</td>
<td>1.17 (0.120)</td>
</tr>
<tr>
<td>under18</td>
<td>Percentage of population aged under 18</td>
<td>-0.0120</td>
<td>0.0417</td>
<td>-0.29 (0.386)</td>
</tr>
<tr>
<td>urban</td>
<td>Percentage of population lived in urban areas</td>
<td>0.0023</td>
<td>0.0025</td>
<td>0.93 (0.177)</td>
</tr>
<tr>
<td>constant</td>
<td></td>
<td>-1.3350</td>
<td>1.2732</td>
<td>-1.05 (0.294)</td>
</tr>
</tbody>
</table>

* indicates significance at 5 percent, and figures in parentheses are the p-values.

Table 4.9: Instrumental Variable Regression Results of Percentage of Emergency Room Visits for Diseases of the Blood and Blood-Forming Organs.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>uninsured</td>
<td>Percentage of population uninsured</td>
<td>0.0676*</td>
<td>0.0142</td>
<td>4.74 (0.000)</td>
</tr>
<tr>
<td>age65andover</td>
<td>Percentage of population aged 65 and over</td>
<td>0.0038</td>
<td>0.0216</td>
<td>0.18 (0.430)</td>
</tr>
<tr>
<td>under18</td>
<td>Percentage of population aged under 18</td>
<td>-0.0186</td>
<td>0.0233</td>
<td>-0.80 (0.213)</td>
</tr>
<tr>
<td>urban</td>
<td>Percentage of population lived in urban areas</td>
<td>0.0023*</td>
<td>0.0014</td>
<td>1.63 (0.051)</td>
</tr>
<tr>
<td>constant</td>
<td></td>
<td>-0.4678</td>
<td>0.7125</td>
<td>-0.66 (0.511)</td>
</tr>
</tbody>
</table>

* indicates significance at 5 percent, and figures in parentheses are the p-values.
Table 4.10: Instrumental Variable Regression Results of Percentage of Emergency Room Visits for Mental Disorders.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsured</td>
<td>Percentage of population uninsured</td>
<td>0.0372**</td>
<td>0.0274</td>
<td>1.36 (0.087)</td>
</tr>
<tr>
<td>age65andover</td>
<td>Percentage of population aged 65 and over</td>
<td>0.0608**</td>
<td>0.0416</td>
<td>1.46 (0.072)</td>
</tr>
<tr>
<td>under18</td>
<td>Percentage of population aged under 18</td>
<td>0.0242</td>
<td>0.0449</td>
<td>0.54 (0.294)</td>
</tr>
<tr>
<td>urban</td>
<td>Percentage of population lived in urban areas</td>
<td>0.0054*</td>
<td>0.0027</td>
<td>2.01 (0.022)</td>
</tr>
<tr>
<td>constant</td>
<td>-1.2271</td>
<td>1.3714</td>
<td>-0.89 (0.371)</td>
<td></td>
</tr>
</tbody>
</table>

‘*’ indicates significance at 5 percent, ‘**’ indicates significance at 10 percent and figures in parentheses are the p-values.

Table 4.11: Instrumental Variable Regression Results of Percentage of Emergency Room Visits for Diseases of Nervous System and Sense Organs.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsured</td>
<td>Percentage of population uninsured</td>
<td>0.1062*</td>
<td>0.0509</td>
<td>2.09 (0.018)</td>
</tr>
<tr>
<td>age65andover</td>
<td>Percentage of population aged 65 and over</td>
<td>0.0940</td>
<td>0.0772</td>
<td>1.22 (0.112)</td>
</tr>
<tr>
<td>under18</td>
<td>Percentage of population aged under 18</td>
<td>0.0697</td>
<td>0.0833</td>
<td>0.84 (0.201)</td>
</tr>
<tr>
<td>urban</td>
<td>Percentage of population lived in urban areas</td>
<td>0.0073**</td>
<td>0.0050</td>
<td>1.46 (0.072)</td>
</tr>
<tr>
<td>constant</td>
<td>-2.8400</td>
<td>2.5419</td>
<td>-1.12 (0.264)</td>
<td></td>
</tr>
</tbody>
</table>

‘*’ indicates significance at 5 percent, ‘**’ indicates significance at 10 percent and figures in parentheses are the p-values.
The results from Table 4.10 and Table 4.11 showed that estimated coefficient of percentage of uninsured population is positive and significant at the 5 percent level for diseases of the nervous system and sense organs, but significant at the 10 percent level for mental disorders. This means that the percentage of uninsured has little influence on emergency room visits for mental disorders. The coefficient on urban population is positive and significant for diseases of mental disorders at the 5 percent level.

**Table 4.12: Instrumental Variable Regression Results of Percentage of Emergency Room Visits for Diseases of the Circulatory System.**

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>uninsured</td>
<td>Percentage of population uninsured</td>
<td>0.1245*</td>
<td>0.0410</td>
<td>3.04 (0.001)</td>
</tr>
<tr>
<td>age65andover</td>
<td>Percentage of population aged 65 and over</td>
<td>0.1554*</td>
<td>0.0622</td>
<td>2.50 (0.006)</td>
</tr>
<tr>
<td>under18</td>
<td>Percentage of population aged under 18</td>
<td>0.0221</td>
<td>0.0671</td>
<td>0.33 (0.370)</td>
</tr>
<tr>
<td>urban</td>
<td>Percentage of population lived in urban areas</td>
<td>0.0060</td>
<td>0.0040</td>
<td>1.50 (0.067)</td>
</tr>
<tr>
<td>constant</td>
<td></td>
<td>-2.6825</td>
<td>2.0478</td>
<td>-1.31 (0.190)</td>
</tr>
</tbody>
</table>

‘*’ indicates significance at 5 percent, and figures in parentheses are the p-values.
**Table 4.13: Instrumental Variable Regression Results of Percentage of Emergency Room Visits for Diseases of the Respiratory System.**

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsured</td>
<td>Percentage of population uninsured</td>
<td>0.3230*</td>
<td>0.1260</td>
<td>2.56 (0.005)</td>
</tr>
<tr>
<td>age65andover</td>
<td>Percentage of population aged 65 and over</td>
<td>0.1357</td>
<td>0.1911</td>
<td>0.71 (0.239)</td>
</tr>
<tr>
<td>under18</td>
<td>Percentage of population aged under 18</td>
<td>0.0787</td>
<td>0.2062</td>
<td>0.38 (0.351)</td>
</tr>
<tr>
<td>urban</td>
<td>Percentage of population lived in urban areas</td>
<td>0.0093</td>
<td>0.0124</td>
<td>0.75 (0.226)</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td>-3.8103</td>
<td>6.2919</td>
<td>-0.61 (0.545)</td>
</tr>
</tbody>
</table>

* indicates significance at 5 percent, and figures in parentheses are the p-values.

Table 4.12, Table 4.13, Table 4.14 and Table 4.15 showed that as the uninsured percentage of the population increases by 1 percent, the percentage of emergency room visits increases by 0.1245, 0.3230, 0.2594, and 0.1288 for diseases of the circulatory system, for diseases of the respiratory system, for diseases of the digestive system and diseases of the genitourinary system, respectively. The estimated coefficient on age 65 and over is positive and significant at the 5 percent level of significance (Table 4.12). This result showed that as the population aged 65 and over increases by 1 percent, the percentage of emergency room visits for diseases of circulatory system increases by 0.1554, keeping all the variables in the model fixed. In addition, the estimated coefficient of urban is
positive and significant at 5 percent level for diseases of the genito-urinary system.

Table 4.14: Instrumental Variable Regression Results of Percentage of Emergency Room Visits for Diseases of the Digestive System.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsured</td>
<td>Percentage of population uninsured</td>
<td>0.2594*</td>
<td>0.0729</td>
<td>3.56 (0.000)</td>
</tr>
<tr>
<td>age65andover</td>
<td>Percentage of population aged 65 and over</td>
<td>0.1390</td>
<td>0.1106</td>
<td>1.26 (0.104)</td>
</tr>
<tr>
<td>under18</td>
<td>Percentage of population aged under 18</td>
<td>0.0003</td>
<td>0.1193</td>
<td>0.00 (0.499)</td>
</tr>
<tr>
<td>urban</td>
<td>Percentage of population lived in urban areas</td>
<td>0.0076</td>
<td>0.0072</td>
<td>1.06 (0.145)</td>
</tr>
<tr>
<td>constant</td>
<td></td>
<td>-3.3611</td>
<td>3.6424</td>
<td>-0.92 (0.356)</td>
</tr>
</tbody>
</table>

‘*’ indicates significance at 5 percent, and figures in parentheses are the p-values.
Table 4.15: Instrumental Variable Regression Results of Percentage of Emergency Room Visits for Diseases of the Genitourinary System.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsured</td>
<td>Percentage of population uninsured</td>
<td>0.1288*</td>
<td>0.0457</td>
<td>2.82 (0.002)</td>
</tr>
<tr>
<td>age65andover</td>
<td>Percentage of population aged 65 and over</td>
<td>0.0853</td>
<td>0.0693</td>
<td>1.23 (0.109)</td>
</tr>
<tr>
<td>under18</td>
<td>Percentage of population aged under 18</td>
<td>0.0417</td>
<td>0.0748</td>
<td>0.56 (0.288)</td>
</tr>
<tr>
<td>urban</td>
<td>Percentage of population lived in urban areas</td>
<td>0.0074*</td>
<td>0.0045</td>
<td>1.65 (0.049)</td>
</tr>
<tr>
<td>constant</td>
<td></td>
<td>-2.4481</td>
<td>2.2824</td>
<td>-1.07 (0.283)</td>
</tr>
</tbody>
</table>

*' indicates significance at 5 percent, and figures in parentheses are the p-values.

Table 4.16: Instrumental Variable Regression Results of Percentage of Emergency Room Visits for Complications of Pregnancy or Birth.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsured</td>
<td>Percentage of population uninsured</td>
<td>0.1278*</td>
<td>0.0303</td>
<td>4.22 (0.000)</td>
</tr>
<tr>
<td>age65andover</td>
<td>Percentage of population aged 65 and over</td>
<td>0.0198</td>
<td>0.0459</td>
<td>0.43 (0.333)</td>
</tr>
<tr>
<td>under18</td>
<td>Percentage of population aged under 18</td>
<td>-0.0304</td>
<td>0.0496</td>
<td>-0.61 (0.269)</td>
</tr>
<tr>
<td>urban</td>
<td>Percentage of population lived in urban areas</td>
<td>0.0054*</td>
<td>0.0029</td>
<td>1.83 (0.033)</td>
</tr>
<tr>
<td>constant</td>
<td></td>
<td>-1.0349</td>
<td>1.5134</td>
<td>-0.68 (0.494)</td>
</tr>
</tbody>
</table>

*' indicates significance at 5 percent and figures in parentheses are the p-values.
Table 4.17: Instrumental Variable Regression Results of Percentage of Emergency Room Visits for Diseases of the Skin and Subcutaneous Tissues.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsured</td>
<td>Percentage of population uninsured</td>
<td>0.0648*</td>
<td>0.0222</td>
<td>2.91 (0.002)</td>
</tr>
<tr>
<td>age65andover</td>
<td>Percentage of population aged 65 and over</td>
<td>0.0290</td>
<td>0.0337</td>
<td>0.86 (0.195)</td>
</tr>
<tr>
<td>under18</td>
<td>Percentage of population aged under 18</td>
<td>-0.0037</td>
<td>0.0364</td>
<td>-0.10 (0.459)</td>
</tr>
<tr>
<td>urban</td>
<td>Percentage of population lived in urban areas</td>
<td>0.0045*</td>
<td>0.0021</td>
<td>2.07 (0.019)</td>
</tr>
<tr>
<td>constant</td>
<td></td>
<td>-0.4870</td>
<td>1.1118</td>
<td>-0.44 (0.661)</td>
</tr>
</tbody>
</table>

‘*’ indicates significance at 5 percent, and figures in parentheses are the p-values.

The results (Table 4.16, Table 4.17, Table 4.18 and Table 4.19) show that as the uninsured population increases by 1 percent, the percentage of emergency room visits increases by 0.1278, 0.0648, 0.2290, and 0.2884 for complications of pregnancy or birth, diseases of the skin and subcutaneous tissues, diseases of the musculoskeletal system and connective tissues, and symptoms and ill-defined conditions, respectively. In addition, the estimated coefficient of urban is positively related to the percentage of emergency room visits for complications of pregnancy or birth, diseases of the skin and subcutaneous tissues, diseases of the musculoskeletal system and connective tissues and for symptoms and ill-defined conditions at 5 percent level of significance.
Table 4.18: Instrumental Variable Regression Results of Percentage of Emergency Room Visits for Diseases of the Musculoskeletal System and Connective Tissues.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsured</td>
<td>Percentage of population uninsured</td>
<td>0.2290*</td>
<td>0.0605</td>
<td>3.78 (0.000)</td>
</tr>
<tr>
<td>age65andover</td>
<td>Percentage of population aged 65 and over</td>
<td>0.1088</td>
<td>0.0918</td>
<td>1.18 (0.118)</td>
</tr>
<tr>
<td>under18</td>
<td>Percentage of population aged under 18</td>
<td>-0.0258</td>
<td>0.0991</td>
<td>-0.26 (0.397)</td>
</tr>
<tr>
<td>urban</td>
<td>Percentage of population lived in urban areas</td>
<td>0.0113*</td>
<td>0.0059</td>
<td>1.90 (0.028)</td>
</tr>
<tr>
<td>constant</td>
<td></td>
<td>-2.3171</td>
<td>3.0242</td>
<td>-0.77 (0.444)</td>
</tr>
</tbody>
</table>

'*' indicates significance at 5 percent and figures in parentheses are the p-values.

Table 4.19: Instrumental Variable Regression Results of Percentage of Emergency Room Visits for Symptoms and Ill-Defined Conditions.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsured</td>
<td>Percentage of population uninsured</td>
<td>0.2884*</td>
<td>0.1237</td>
<td>2.33 (0.010)</td>
</tr>
<tr>
<td>age65andover</td>
<td>Percentage of population aged 65 and over</td>
<td>0.2498</td>
<td>0.1876</td>
<td>1.33 (0.091)</td>
</tr>
<tr>
<td>under18</td>
<td>Percentage of population aged under 18</td>
<td>0.1510</td>
<td>0.2024</td>
<td>0.75 (0.227)</td>
</tr>
<tr>
<td>urban</td>
<td>Percentage of population lived in urban areas</td>
<td>0.0225*</td>
<td>0.0122</td>
<td>1.85 (0.032)</td>
</tr>
<tr>
<td>constant</td>
<td></td>
<td>-5.9050</td>
<td>6.1753</td>
<td>-0.96 (0.339)</td>
</tr>
</tbody>
</table>

'*' indicates significance at 5 percent and figures in parentheses are the p-values.
Table 4.20: Instrumental Variable Regression Results of Percentage of Emergency Room Visits for Accidents, Poison and Violence.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsured</td>
<td>Percentage of population uninsured</td>
<td>0.3231*</td>
<td>0.1789</td>
<td>1.81 (0.035)</td>
</tr>
<tr>
<td>age65andover</td>
<td>Percentage of population aged 65 and over</td>
<td>0.4868*</td>
<td>0.2714</td>
<td>1.79 (0.036)</td>
</tr>
<tr>
<td>under18</td>
<td>Percentage of population aged under 18</td>
<td>0.3533</td>
<td>0.2928</td>
<td>1.21 (0.114)</td>
</tr>
<tr>
<td>urban</td>
<td>Percentage of population lived in urban areas</td>
<td>0.0415*</td>
<td>0.0176</td>
<td>2.35 (0.009)</td>
</tr>
<tr>
<td>constant</td>
<td></td>
<td>-12.2312</td>
<td>8.9337</td>
<td>-1.37 (0.171)</td>
</tr>
</tbody>
</table>

* indicates significance at 5 percent, and figures in parentheses are the p-values.

Table 4.20 shows that the estimated coefficients on the percentage uninsured, population aged 65 and over, and population living in urban areas are positive and significant at 5 percent level in the regression of emergency room visits for accidents, poison, and violence. As the population living in urban areas increases by 1 percent, the percentage of emergency visits for accidents, poison and violence increases by 0.0415, keeping all other variables in the model fixed.
Table 4.21: Instrumental Variable Regression Results of Percentage of Emergency Room Visits for All Other Conditions.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Description</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsured</td>
<td>Percentage of population uninsured</td>
<td>0.0544*</td>
<td>0.0236</td>
<td>2.30 (0.010)</td>
</tr>
<tr>
<td>age65andover</td>
<td>Percentage of population aged 65 and over</td>
<td>0.0287</td>
<td>0.0358</td>
<td>0.80 (0.211)</td>
</tr>
<tr>
<td>under18</td>
<td>Percentage of population aged under 18</td>
<td>-0.0081</td>
<td>0.0386</td>
<td>-0.21 (0.417)</td>
</tr>
<tr>
<td>urban</td>
<td>Percentage of population lived in urban areas</td>
<td>0.0080*</td>
<td>0.0023</td>
<td>3.44 (0.0005)</td>
</tr>
<tr>
<td>constant</td>
<td></td>
<td>-0.4469</td>
<td>1.1803</td>
<td>-0.38(0.705)</td>
</tr>
</tbody>
</table>

‘*’ indicates significance at 5 percent, and figures in parentheses are the p-values.

The results shows that the percentage of emergency room visits for all other conditions increases by 0.0544, for one percent increase in the uninsured population, holding other independent variables in the model fixed. In addition, the estimated coefficient of population living in urban areas is positive and significant at 5 percent level.
Seemingly Unrelated Regression Results

The seemingly unrelated regression results (Table 4.22) showed that the estimated coefficient of predicted values of the percentage of the population that is uninsured is positive, as expected, and statistically significant at the 5 percent level of significance for all categories of emergency room visits except for mental disorders which is significant at the 10 percent level. It was observed that the estimates of instrumental variable regression and seemingly unrelated regression are the same, but the standard errors of the estimates in seemingly unrelated are smaller than in instrumental variable regression.
Table 4.22: Seemingly Unrelated Regression Results for Each Category of Emergency Room Visits: Estimated Coefficients on Predicted Values of Percentage of Uninsured.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z - Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>INFECPER</td>
<td>0.1899*</td>
<td>0.0372</td>
<td>5.10(0.000)</td>
</tr>
<tr>
<td>NEOPER</td>
<td>0.0155*</td>
<td>0.0036</td>
<td>4.30(0.000)</td>
</tr>
<tr>
<td>ENDOPER</td>
<td>0.1151*</td>
<td>0.0184</td>
<td>6.26(0.000)</td>
</tr>
<tr>
<td>BLOODPER</td>
<td>0.0676*</td>
<td>0.0147</td>
<td>4.59(0.000)</td>
</tr>
<tr>
<td>MENTALPER</td>
<td>0.0372**</td>
<td>0.0253</td>
<td>1.47(0.070)</td>
</tr>
<tr>
<td>NERVOUSPER</td>
<td>0.1062*</td>
<td>0.0445</td>
<td>2.38(0.017)</td>
</tr>
<tr>
<td>CIRCPER</td>
<td>0.1245*</td>
<td>0.0336</td>
<td>3.70(0.000)</td>
</tr>
<tr>
<td>RESPPPER</td>
<td>0.3230*</td>
<td>0.1069</td>
<td>3.02(0.001)</td>
</tr>
<tr>
<td>DIGPER</td>
<td>0.2594*</td>
<td>0.0563</td>
<td>4.60(0.000)</td>
</tr>
<tr>
<td>GENITOPER</td>
<td>0.1288*</td>
<td>0.0378</td>
<td>3.42(0.0005)</td>
</tr>
<tr>
<td>BIRTHPER</td>
<td>0.1278*</td>
<td>0.0273</td>
<td>4.67(0.000)</td>
</tr>
<tr>
<td>SKINPER</td>
<td>0.0648*</td>
<td>0.0186</td>
<td>3.48(0.0005)</td>
</tr>
<tr>
<td>MUSCLEPER</td>
<td>0.2290*</td>
<td>0.0489</td>
<td>4.68(0.000)</td>
</tr>
<tr>
<td>SYMPTOMSPPPER</td>
<td>0.2884*</td>
<td>0.1115</td>
<td>2.59(0.005)</td>
</tr>
<tr>
<td>ACCIDENTPER</td>
<td>0.3231*</td>
<td>0.1627</td>
<td>1.99(0.023)</td>
</tr>
<tr>
<td>OTHERPER</td>
<td>0.0544*</td>
<td>0.0230</td>
<td>2.37(0.009)</td>
</tr>
</tbody>
</table>

‘*’ indicates significance at 5 percent, ‘**’ indicates significance at 10 percent and figures in parentheses are the p-values.

Table 4.23 shows that the estimated coefficient on the percentage of the population living in urban areas is positive and statistically significant at 5 percent for most categories and significant at 10 percent for diseases of endocrine, nutritional and metabolic diseases, blood and blood-forming organs and diseases of digestive system. However, the coefficient on urban population is not significant even at 10 percent for infective and parasitic diseases. The positive
coefficient explains that as the population living in urban areas increases, the emergency room visits also increase, keeping all other variables fixed.

Table 4.23: Seemingly Unrelated Regression Results for Each Category of Emergency Room Visits: Estimated Coefficients on Percentage of Population Living in Urban Areas.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z -Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>INFECPER</td>
<td>0.0029</td>
<td>0.0367</td>
<td>0.81(0.210)</td>
</tr>
<tr>
<td>NEOPER</td>
<td>0.0010*</td>
<td>0.0003</td>
<td>2.86(0.002)</td>
</tr>
<tr>
<td>ENDOPER</td>
<td>0.0023**</td>
<td>0.0018</td>
<td>1.28(0.099)</td>
</tr>
<tr>
<td>BLOODPER</td>
<td>0.0023**</td>
<td>0.0014</td>
<td>1.58(0.057)</td>
</tr>
<tr>
<td>MENTALPER</td>
<td>0.0054*</td>
<td>0.0025</td>
<td>2.18(0.014)</td>
</tr>
<tr>
<td>NERVOUSPER</td>
<td>0.0073*</td>
<td>0.0044</td>
<td>1.67(0.048)</td>
</tr>
<tr>
<td>CIRCPER</td>
<td>0.0060*</td>
<td>0.0033</td>
<td>1.83(0.034)</td>
</tr>
<tr>
<td>RESPPER</td>
<td>0.0093</td>
<td>0.0105</td>
<td>0.89(0.187)</td>
</tr>
<tr>
<td>DIGPER</td>
<td>0.0076**</td>
<td>0.0055</td>
<td>1.37(0.086)</td>
</tr>
<tr>
<td>GENITOPER</td>
<td>0.0074*</td>
<td>0.0037</td>
<td>2.01(0.022)</td>
</tr>
<tr>
<td>BIRTHPER</td>
<td>0.0054*</td>
<td>0.0027</td>
<td>2.03(0.021)</td>
</tr>
<tr>
<td>SKINPER</td>
<td>0.0045*</td>
<td>0.0018</td>
<td>2.47(0.006)</td>
</tr>
<tr>
<td>MUSCLEPER</td>
<td>0.0113*</td>
<td>0.0048</td>
<td>2.35(0.009)</td>
</tr>
<tr>
<td>SYMPTONSPer</td>
<td>0.0225*</td>
<td>0.0110</td>
<td>2.05(0.020)</td>
</tr>
<tr>
<td>ACCIDENTPER</td>
<td>0.0415*</td>
<td>0.0160</td>
<td>2.58(0.005)</td>
</tr>
<tr>
<td>OTHERPER</td>
<td>0.0084*</td>
<td>0.0022</td>
<td>3.54(0.009)</td>
</tr>
</tbody>
</table>

* indicates significance at 5 percent, and ** indicates significance at 10 percent figures in parentheses are the p-values.
Table 4.24: Seemingly Unrelated Regression Results for Each Category of Emergency Room Visits: Estimated Coefficients on Percentage of Population Aged Under 18.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z -Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>INFECPER</td>
<td>0.0056</td>
<td>0.6092</td>
<td>0.09(0.463)</td>
</tr>
<tr>
<td>NEOPER</td>
<td>0.0020</td>
<td>0.0059</td>
<td>0.35(0.364)</td>
</tr>
<tr>
<td>ENDOPER</td>
<td>-0.0120</td>
<td>0.0301</td>
<td>-0.40(0.344)</td>
</tr>
<tr>
<td>BLOODPER</td>
<td>-0.0186</td>
<td>0.0241</td>
<td>-0.77(0.220)</td>
</tr>
<tr>
<td>MENTALPER</td>
<td>0.0242</td>
<td>0.0414</td>
<td>0.59(0.279)</td>
</tr>
<tr>
<td>NERVOUSPER</td>
<td>0.0697</td>
<td>0.0729</td>
<td>0.96(0.169)</td>
</tr>
<tr>
<td>CIRCPER</td>
<td>0.0221</td>
<td>0.0550</td>
<td>0.40(0.344)</td>
</tr>
<tr>
<td>RESPPER</td>
<td>0.0787</td>
<td>0.1750</td>
<td>0.45(0.326)</td>
</tr>
<tr>
<td>DIGPER</td>
<td>0.0003</td>
<td>0.0922</td>
<td>0.00(0.498)</td>
</tr>
<tr>
<td>GENITOPER</td>
<td>0.0417</td>
<td>0.0616</td>
<td>0.68(0.249)</td>
</tr>
<tr>
<td>BIRTHPER</td>
<td>-0.0304</td>
<td>0.0447</td>
<td>-0.68(0.248)</td>
</tr>
<tr>
<td>SKINPER</td>
<td>-0.0377</td>
<td>0.0304</td>
<td>-0.12(0.451)</td>
</tr>
<tr>
<td>MUSCLEPER</td>
<td>-0.0258</td>
<td>0.8013</td>
<td>-0.32(0.373)</td>
</tr>
<tr>
<td>SYMPTOMSPER</td>
<td>0.1510</td>
<td>0.1825</td>
<td>0.83(0.204)</td>
</tr>
<tr>
<td>ACCIDENTPER</td>
<td>0.3533**</td>
<td>0.2663</td>
<td>1.33(0.092)</td>
</tr>
<tr>
<td>OTHERPER</td>
<td>-0.0081</td>
<td>0.0376</td>
<td>-0.22(0.415)</td>
</tr>
</tbody>
</table>

‘**’ indicates significance at 10 percent and figures in parentheses are the p-values.

Table 4.24 shows that the percentage of population aged under 18 has a negative influence on emergency room visits for endocrine, nutritional and metabolic diseases, diseases of blood and blood-forming organs, complications of pregnancy or birth, diseases of the skin and subcutaneous tissues, diseases of musculoskeletal system and connective tissues, and all other conditions but is not significant even at 10 percent. The estimated coefficient on population aged under 18 is positive and significant at the 10 percent level of significance for
emergency room visits of accidents, violence and poisoning. The percentage of emergency room visits for accidents category increases by 0.3533, for 1 percent increase in the population aged under 18 years, keeping other variables fixed.

**Table 4.25: Seemingly Unrelated Regression Results for Each Category of Emergency Room Visits: Estimated Coefficients on Percentage of Population aged 65 and Over.**

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z -Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>INFECPER</td>
<td>0.0415</td>
<td>0.0564</td>
<td>0.74(0.231)</td>
</tr>
<tr>
<td>NEOPER</td>
<td>0.0166*</td>
<td>0.0054</td>
<td>3.04(0.001)</td>
</tr>
<tr>
<td>ENDOPER</td>
<td>0.0454**</td>
<td>0.0279</td>
<td>1.63(0.052)</td>
</tr>
<tr>
<td>BLOODPER</td>
<td>0.0038</td>
<td>0.0223</td>
<td>0.17(0.432)</td>
</tr>
<tr>
<td>MENTALPER</td>
<td>0.0608**</td>
<td>0.0384</td>
<td>1.58(0.056)</td>
</tr>
<tr>
<td>NERVOUSPER</td>
<td>0.0940**</td>
<td>0.0676</td>
<td>1.39(0.082)</td>
</tr>
<tr>
<td>CIRCPER</td>
<td>0.1554*</td>
<td>0.0510</td>
<td>3.04(0.001)</td>
</tr>
<tr>
<td>RESPPER</td>
<td>0.1357</td>
<td>0.1622</td>
<td>0.84(0.201)</td>
</tr>
<tr>
<td>DIGPER</td>
<td>0.1390**</td>
<td>0.0855</td>
<td>1.63(0.052)</td>
</tr>
<tr>
<td>GENITOPPER</td>
<td>0.0853**</td>
<td>0.0571</td>
<td>1.49(0.067)</td>
</tr>
<tr>
<td>BIRTHPER</td>
<td>0.0198</td>
<td>0.0415</td>
<td>0.48(0.316)</td>
</tr>
<tr>
<td>SKINPER</td>
<td>0.0290</td>
<td>0.0282</td>
<td>1.03(0.152)</td>
</tr>
<tr>
<td>MUSCLEPER</td>
<td>0.1088**</td>
<td>0.0742</td>
<td>1.46(0.071)</td>
</tr>
<tr>
<td>SYMPTONSPER</td>
<td>0.2498**</td>
<td>0.1692</td>
<td>1.48(0.070)</td>
</tr>
<tr>
<td>ACCIDENTPER</td>
<td>0.4868*</td>
<td>0.2469</td>
<td>1.97(0.024)</td>
</tr>
<tr>
<td>OTHERPER</td>
<td>0.0287</td>
<td>0.0349</td>
<td>0.82(0.205)</td>
</tr>
</tbody>
</table>

‘*’ indicates significance at 5 percent, and ‘**’ indicates significance at 10 percent figures in parentheses are the p-values.

Table 4.25 explains that there is a positive influence of population aged 65 and over on emergency room visits for neoplasms; diseases of circulatory system; and accidents, poison, violence, and the estimated coefficients are significant at the 5 percent level of significance. Similarly, the estimated coefficients on
The population aged 65 and over is positive and significant at the 10 percent level of significance for emergency room visits of endocrine, nutritional and metabolic diseases; mental disorders; diseases of nervous system and sense organs; diseases of musculoskeletal system and connective tissues; digestive system; genitourinary system; and symptoms and ill-defined conditions.

A Breusch-Pagan test of independence ($\text{Chi}^2 (120) = 1563.36$, Probability=0.000) showed that there is sufficient evidence to conclude error terms from set of equations are correlated.

Results on Elasticities of Uninsured with respect to Socio-Demographic Characteristics

Table 4.26: Elasticities of Uninsured with Respect to Socio-Demographic Characteristics at Means.

| Variable Name       | Elasticities | Standard Error | P>|Z|  | [95 % Confidence Interval] |
|---------------------|--------------|----------------|------|-----------------------------|
| Uninsured w.r.t non-Whites | 0.19         | 0.0800         | 0.016| 0.0365                       | 0.3501|
| Uninsured w.r.t ESTBL50 | 0.22         | 0.0822         | 0.006| 0.0635                       | 0.3857|
| Uninsured w.r.t MHHI  | -1.14*       | 0.5608         | 0.041| -2.2433                      | -0.0447|
| Uninsured w.r.t EDUC  | -1.30*       | 0.4926         | 0.008| -2.2733                      | -0.3423|

‘*’ indicates ‘Relatively Elastic’ and w.r.t represents ‘with respect to’. 
Table 4.26 shows that the percentage of uninsured is highly responsive to changes in median household income and education attainment beyond high school. The elasticity of uninsured with respect to median household income is -1.14. Thus, the percentage of uninsured decreases by 1.14 percent for a $10,000 increase in median household income at the mean. Similarly, the percentage of uninsured decreases by 1.30 percent for 1 percent increase in the percentage of the population educated beyond high school at the mean. Confidence interval provides a method of evaluating hypotheses $H_0 : \varepsilon = 1; H_A : \varepsilon > 1$. The 95 percent confidence intervals for elasticities of the uninsured population with respect to median household income and percentage of population with education attainment beyond high school does not include one, which indicates that elasticities are significantly (5 percent level) greater than 1 and considered as ‘Relatively Elastic’.

Results on Elasticities of Emergency Room Visits with Respect to Socio-Demographic Characteristics

Table 4.27 shows that emergency room utilization for infective and parasitic diseases, neoplasms, endocrine, nutritional and metabolic diseases, diseases of the blood and blood-forming organs, diseases of digestive system and complications of pregnancy or birth is relatively elastic to changes in the percentage of uninsured persons.
Table 4.27: Elasticities of Emergency Room Utilization for selected Diagnoses Categories with respect to Uninsured at Means.

<table>
<thead>
<tr>
<th>Variable Names</th>
<th>Elasticities</th>
<th>Standard Error</th>
<th>[95 % Confidence Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERV for INFECPER w.r.t Uninsured</td>
<td>2.08*</td>
<td>0.5014</td>
<td>1.1012</td>
</tr>
<tr>
<td>ERV for NEOPER w.r.t Uninsured</td>
<td>1.55**</td>
<td>0.4027</td>
<td>0.7699</td>
</tr>
<tr>
<td>ERV for ENDOPER w.r.t Uninsured</td>
<td>2.11*</td>
<td>0.4823</td>
<td>1.1735</td>
</tr>
<tr>
<td>ERV for BLOODPER w.r.t Uninsured</td>
<td>3.86*</td>
<td>0.8875</td>
<td>2.1235</td>
</tr>
<tr>
<td>ERV for MENTALPER w.r.t Uninsured</td>
<td>0.59</td>
<td>0.4401</td>
<td>-0.2672</td>
</tr>
<tr>
<td>ERV for NERVOUSPER w.r.t Uninsured</td>
<td>0.78</td>
<td>0.3787</td>
<td>0.0447</td>
</tr>
<tr>
<td>ERV for CIRCPER w.r.t Uninsured</td>
<td>0.94</td>
<td>0.3122</td>
<td>0.3305</td>
</tr>
<tr>
<td>ERV for RESPPER w.r.t Uninsured</td>
<td>0.93</td>
<td>0.3684</td>
<td>0.2168</td>
</tr>
<tr>
<td>ERV for DIGPER w.r.t Uninsured</td>
<td>1.43**</td>
<td>0.4102</td>
<td>0.6358</td>
</tr>
<tr>
<td>ERV for GENITOPER w.r.t Uninsured</td>
<td>0.98</td>
<td>0.3526</td>
<td>0.2963</td>
</tr>
<tr>
<td>ERV for BIRTHPER w.r.t Uninsured</td>
<td>2.88*</td>
<td>0.7183</td>
<td>1.4755</td>
</tr>
<tr>
<td>ERV SKINPER w.r.t Uninsured</td>
<td>1.01**</td>
<td>0.3521</td>
<td>0.3285</td>
</tr>
<tr>
<td>ERV for MUSCLEPER w.r.t Uninsured</td>
<td>1.43**</td>
<td>0.3850</td>
<td>0.6827</td>
</tr>
<tr>
<td>ERV for SYMPTOMSPER w.r.t Uninsured</td>
<td>0.68</td>
<td>0.2944</td>
<td>0.1075</td>
</tr>
<tr>
<td>ERV for ACCIDENTPER w.r.t Uninsured</td>
<td>0.51</td>
<td>0.2869</td>
<td>-0.0450</td>
</tr>
<tr>
<td>ERV for OTHERPER w.r.t Uninsured</td>
<td>0.93</td>
<td>0.4096</td>
<td>0.1350</td>
</tr>
</tbody>
</table>

‘*’ indicates ‘Relatively Elastic’ (significant at 5 % level), ‘**’ indicates elastic (but not significant at 5 %), w.r.t represents ‘with respect to’ and ERV emergency room visits.

The signs of the elasticities for all categories of emergency room visits with respect to uninsured are positive, which shows that as the percentage of
uninsured population increases by 1 percent, the percentage of emergency room visits by category increases by respective coefficient values. For example, the percentage of emergency room visits for infective and parasitic diseases increases by 2.08 percent for a 1 percent increase in the percentage uninsured at mean level.

The 95 percent confidence intervals for elasticities of emergency room visits for neoplasms; diseases of digestive system; diseases of skin and subcutaneous tissues; and musculoskeletal, connective tissues with respect to the uninsured does include one, which indicates that elasticities are not significantly (5 percent level) greater than 1.

The elasticities of emergency room visits for blood and blood-forming organs and emergency room visits for complications of birth or pregnancy with respect to the population aged under 18 is negative and greater than one, but as 95 percent confidence interval includes one, it is concluded that elasticities were not significantly greater than 1 at 5 percent level.
Table 4.28: Elasticities of Emergency Room Utilization for selected Diagnoses Categories with respect to population aged under 18 at Means.

<table>
<thead>
<tr>
<th>Variable Names</th>
<th>Elasticities</th>
<th>Standard Error</th>
<th>[95 % Confidence Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERV for INFECPER w.r.t Aged under 18</td>
<td>0.09</td>
<td>1.2886</td>
<td>-2.4262 2.6253</td>
</tr>
<tr>
<td>ERV for NEOPER w.r.t aged under 18</td>
<td>0.33</td>
<td>1.0453</td>
<td>-1.7181 2.3796</td>
</tr>
<tr>
<td>ERV for ENDOPER w.r.t aged under 18</td>
<td>-0.35</td>
<td>1.2386</td>
<td>-2.7849 2.0705</td>
</tr>
<tr>
<td>ERV for BLOODPER w.r.t aged under 18</td>
<td>-1.71*</td>
<td>2.1554</td>
<td>-5.9372 2.5120</td>
</tr>
<tr>
<td>ERV for MENTALPER w.r.t aged under 18</td>
<td>0.62</td>
<td>1.1592</td>
<td>-1.6458 2.8984</td>
</tr>
<tr>
<td>ERV for NERVOUSPER w.r.t aged under 18</td>
<td>0.83</td>
<td>0.9962</td>
<td>-1.1195 2.7854</td>
</tr>
<tr>
<td>ERV for CIRCPER w.r.t aged under 18</td>
<td>0.27</td>
<td>0.8195</td>
<td>-1.3359 1.8767</td>
</tr>
<tr>
<td>ERV for RESPPER w.r.t aged under 18</td>
<td>0.36</td>
<td>0.9670</td>
<td>-1.5261 2.2644</td>
</tr>
<tr>
<td>ERV for DIGPER w.r.t aged under 18</td>
<td>0.00</td>
<td>1.0688</td>
<td>-2.0920 2.0978</td>
</tr>
<tr>
<td>ERV for GENITOPER w.r.t aged under 18</td>
<td>0.51</td>
<td>0.9251</td>
<td>-1.2975 2.3289</td>
</tr>
<tr>
<td>ERV for BIRTHPER w.r.t aged under 18</td>
<td>-1.10*</td>
<td>1.8059</td>
<td>-4.6467 2.4323</td>
</tr>
<tr>
<td>ERV SKINPER w.r.t aged under 18</td>
<td>-0.09</td>
<td>0.9233</td>
<td>-1.9053 1.7142</td>
</tr>
<tr>
<td>ERV for MUSCLEPER w.r.t aged under 18</td>
<td>-0.26</td>
<td>1.0034</td>
<td>-2.2282 1.7050</td>
</tr>
<tr>
<td>ERV for SYMPTOMS PER w.r.t aged under 18</td>
<td>0.57</td>
<td>0.7750</td>
<td>-0.9407 2.0972</td>
</tr>
<tr>
<td>ERV for ACCIDENTPER w.r.t aged under 18</td>
<td>0.91</td>
<td>0.7564</td>
<td>-0.5705 2.3947</td>
</tr>
<tr>
<td>ERV for OTHERPER w.r.t aged under 18</td>
<td>-0.22</td>
<td>1.0751</td>
<td>-2.3323 1.8820</td>
</tr>
</tbody>
</table>

*’’ indicates ‘Relatively Elastic’ but not significant at 5 percent, w.r.t represents ‘with respect to’ and ERV emergency room visits.
The elasticity of emergency room visits for all categories with respect to age 65 and over is relatively inelastic, except for neoplasm, but not significantly greater than one at the 5 percent level (Table 4.29).
Table 4.29: Elasticities of Emergency Room Utilization for selected Diagnoses Categories with respect to aged 65 and over at Means.

<table>
<thead>
<tr>
<th>Variable Names</th>
<th>Elasticities</th>
<th>Standard Error</th>
<th>[95 % Confidence Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELV for INFECPER w.r.t aged 65 and over</td>
<td>0.36</td>
<td>0.5927</td>
<td>-0.7970 1.5263</td>
</tr>
<tr>
<td>ELV for NEOPER w.r.t aged 65 and over</td>
<td>1.33*</td>
<td>0.4841</td>
<td>0.3872 2.2849</td>
</tr>
<tr>
<td>ELV for ENDOPER w.r.t aged 65 and over</td>
<td>0.66</td>
<td>0.5704</td>
<td>-0.4992 1.7867</td>
</tr>
<tr>
<td>ELV for BLOODPER w.r.t aged 65 and over</td>
<td>0.17</td>
<td>0.9883</td>
<td>-1.7629 2.1113</td>
</tr>
<tr>
<td>ELV for MENTALPER w.r.t aged 65 and over</td>
<td>0.77</td>
<td>0.5340</td>
<td>-0.2693 1.8242</td>
</tr>
<tr>
<td>ELV for NERVOUSPER w.r.t aged 65 and over</td>
<td>0.55</td>
<td>0.4582</td>
<td>-0.3407 1.4556</td>
</tr>
<tr>
<td>ELV for CIRCPER w.r.t aged 65 and over</td>
<td>0.94</td>
<td>0.3781</td>
<td>0.2000 1.6823</td>
</tr>
<tr>
<td>ELV for RESPPER w.r.t aged 65 and over</td>
<td>0.31</td>
<td>0.4446</td>
<td>-0.5559 1.1870</td>
</tr>
<tr>
<td>ELV for DIGPER w.r.t aged 65 and over</td>
<td>0.61</td>
<td>0.4921</td>
<td>-0.3471 1.5820</td>
</tr>
<tr>
<td>ELV for GENITOPER w.r.t aged 65 and over</td>
<td>0.51</td>
<td>0.4256</td>
<td>-0.3110 1.3575</td>
</tr>
<tr>
<td>ELV for BIRTHPER w.r.t aged 65 and over</td>
<td>0.35</td>
<td>0.8297</td>
<td>-1.2687 1.9836</td>
</tr>
<tr>
<td>ELV SKINPER w.r.t aged 65 and over</td>
<td>0.36</td>
<td>0.4247</td>
<td>-0.4678 1.1968</td>
</tr>
<tr>
<td>ELV for MUSCLEPER w.r.t aged 65 and over</td>
<td>0.54</td>
<td>0.4618</td>
<td>-0.3589 1.4513</td>
</tr>
<tr>
<td>ELV for SYMPTOMSPER w.r.t aged 65 and over</td>
<td>0.47</td>
<td>0.3565</td>
<td>-0.2244 1.1730</td>
</tr>
<tr>
<td>ELV for ACCIDENTPER w.r.t aged 65 and over</td>
<td>0.62</td>
<td>0.3480</td>
<td>-0.5898 1.3053</td>
</tr>
<tr>
<td>ELV for OTHERPER w.r.t aged 65 and over</td>
<td>0.39</td>
<td>0.4945</td>
<td>-0.5730 1.3655</td>
</tr>
</tbody>
</table>

* indicates ‘Relatively Elastic’ (but not significant at 5 % level), w.r.t represents ‘with respect to’ and ERV emergency room visits.
Table 4.30 shows that all categories of emergency room visits are relatively inelastic with respect to percentage of population living in urban areas.
Table 4.30: Elasticities of Emergency Room Utilization for selected Diagnoses Categories with respect to population living in Urban areas at Means.

<table>
<thead>
<tr>
<th>Variable Names</th>
<th>Elasticities</th>
<th>Standard Error</th>
<th>[95 % Confidence Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERV for INFECPER w.r.t URBANP</td>
<td>0.08</td>
<td>0.1309</td>
<td>-0.1683</td>
</tr>
<tr>
<td>ERV for NEOPER w.r.t URBANP</td>
<td>0.27</td>
<td>0.1068</td>
<td>0.0685</td>
</tr>
<tr>
<td>ERV for ENDOPER w.r.t URBANP</td>
<td>0.11</td>
<td>0.1258</td>
<td>-0.1303</td>
</tr>
<tr>
<td>ERV for BLOODPER w.r.t URBANP</td>
<td>0.35</td>
<td>0.2206</td>
<td>-0.0757</td>
</tr>
<tr>
<td>ERV for MENTALPER w.r.t URBANP</td>
<td>0.23</td>
<td>0.1182</td>
<td>0.0044</td>
</tr>
<tr>
<td>ERV for NERVIOUSPER w.r.t URBANP</td>
<td>0.14</td>
<td>0.1012</td>
<td>-0.0509</td>
</tr>
<tr>
<td>ERV for CIRCPER w.r.t URBANP</td>
<td>0.12</td>
<td>0.0833</td>
<td>-0.0386</td>
</tr>
<tr>
<td>ERV for RESPPER w.r.t URBANP</td>
<td>0.07</td>
<td>0.0981</td>
<td>-0.1186</td>
</tr>
<tr>
<td>ERV for DIGPER w.r.t URBANP</td>
<td>0.11</td>
<td>0.1086</td>
<td>-0.0982</td>
</tr>
<tr>
<td>ERV for GENITOPER w.r.t URBANP</td>
<td>0.15</td>
<td>0.0940</td>
<td>-0.0291</td>
</tr>
<tr>
<td>ERV for BIRTHPER w.r.t URBANP</td>
<td>0.33</td>
<td>0.1849</td>
<td>-0.0266</td>
</tr>
<tr>
<td>ERV SKINPER w.r.t URBANP</td>
<td>0.19</td>
<td>0.0940</td>
<td>0.0096</td>
</tr>
<tr>
<td>ERV for MUSCLEPER w.r.t URBANP</td>
<td>0.19</td>
<td>0.1021</td>
<td>-0.0066</td>
</tr>
<tr>
<td>ERV for SYMPTOMSPER w.r.t URBANP</td>
<td>0.14</td>
<td>0.0787</td>
<td>-0.0091</td>
</tr>
<tr>
<td>ERV for ACCIDENTPER w.r.t URBANP</td>
<td>0.18</td>
<td>0.0769</td>
<td>0.0293</td>
</tr>
<tr>
<td>ERV for OTHERPER w.r.t URBANP</td>
<td>0.37</td>
<td>0.1104</td>
<td>0.1593</td>
</tr>
</tbody>
</table>

w.r.t represents ‘with respect to’ and ERV represents emergency room visits.
CHAPTER 5
SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

The relationship between a lack of health insurance and socio-demographic characteristics and the relationship between the percentage of emergency room visits and the percentage of the population that is uninsured was studied for counties in the U.S. State of South Carolina (2000). In this study, the relationships between emergency room visits and socio-demographic, health, education, economic characteristics were observed for all general selected diagnoses categories.

Linear models for categorical variables predicted the relation between levels of (classified as HIGH vs. LOW compared to the average) uninsured and levels of selected socio-demographic variables (also, classified as HIGH vs. LOW compared to the average). The predicted probabilities and estimates of maximum likelihood analysis showed that a county with a HIGH median household income, or a HIGH percentage of the population with educational attainment beyond high school is less likely to be HIGH uninsured. The predicted probabilities and estimates also show that a county with a HIGH non-Whites percentage is more likely to have a HIGH uninsured rate. However, the negative sign on the coefficient of percentage of establishments with fewer than 50
employees shows that a county with a HIGH percentage of establishments is less likely to have a HIGH percentage of the uninsured, which does not corroborate previous studies. This may be a problem due to Simpson’s Paradox.

Linear models for categorical variables also predicted the association between levels (HIGH vs. LOW) of percentage of emergency room visits and levels (HIGH vs. LOW) of selected socio-demographic variables. The maximum likelihood estimates showed that a county with a HIGH proportion of the population that is uninsured, a HIGH non-Whites percentage, and a HIGH percentage of the population aged under 18 is more likely to have HIGH emergency room visits. Also, the negative coefficient showed that a county with HIGH median household income, HIGH percentage of population with education attainment beyond high school, HIGH urban population, and HIGH percentage of population aged 65 and over is less likely to have a HIGH emergency room visits. The p-values of the coefficients (χ² test) show that the influence of independent variables on the dependent variable (the percentage of the population that is uninsured), are significant at the 5 percent level for median household income, percentage of population with educational attainment beyond high school, and percentage of non-Whites. Meanwhile, the p-values are significant at the 5 percent level for the uninsured population, median household income, non-Whites, and population aged under 18, in the models.
predicting association between emergency room visits and independent variables.

The multiple linear regression models was analyzed using OLS, which resulted in the following estimates. The estimated coefficient on percentage of the population not categorized as White shows that, the percentage of uninsured increases by 0.0767 for every 1 percent increase in non-Whites when all other independent variables in the model held fixed. The sign of the coefficient was as expected. Similarly, the estimated coefficient of the percentage of business establishments with fewer than 50 employees was positive and as expected. The percentage of uninsured increases by 1.8741 for a 1 percent increase in the percentage of business establishments (with fewer than 50 employees) holding all other independent variables in the model fixed. The percentage of the population with educational attainment beyond high school had a negative sign on the estimated coefficient, as expected, and 1 percent increase in the population with educational attainment beyond high school was associated with a \[-0.53 + 0.00001 \times \text{MHHI}\] (i.e. -0.06 or less) percentage decrease in uninsured, for all values (in the data) of MHHI. The estimated coefficient on median household income was negative and as expected, for every $1 increase in median household income the percentage of uninsured decreases by \[-0.0005 + 0.00001 \times \text{EDUC}\] (i.e. -0.00001 or less) if the percentage of population with educational attainment
beyond high school in a county is less than 50%; otherwise it increases by-0.0005+0.00001*EDUC (i.e. 0.00001 or more) when all other variables in the model are held constant.

The instrumental variable regression models were estimated with 2SLS correcting for endogeneity, to assess the relationship between percentage of emergency room visits and socio-demographic variables. A Hausman test was conducted, which showed that OLS is inconsistent and hence 2SLS regression was performed. The test for over-identifying restrictions showed that the instruments used in the study are valid. In this study, the percentage of emergency room visits for each category is the dependent variable; the percentage of uninsured is an endogenous variable; and the percentage of population not categorized as White, median household income, educational attainment, and firm size are instruments; population by age and population living in urban areas are exogenous variables.

The instrumental variable regression results showed that the estimated coefficient on the percentage of uninsured is positive, as expected, and statistically significant at the 5 percent level of significance for all categories of emergency room visits (except for mental disorders which is significant at the 10 percent level). This study showed that as the percentage of uninsured increases, the percentage of emergency room visits increases, holding all other variables in
the model constant. A possible explanation is that the uninsured generally postpones care at initial stages of the disease and are more likely to visit emergency departments even for less serious problems. The estimated coefficient on the population living in urban areas is positive and significant at the 5 percent level for the neoplasms; diseases of blood and blood-forming organs; mental disorders; diseases of genitourinary system; complications of birth or pregnancy; diseases of skin and subcutaneous tissues; diseases of musculoskeletal system and connective tissues; symptoms and ill-defined conditions; and accidents, poison, and violence categories of emergency room visits. The estimated coefficient on the population aged 65 and over is positive and significant for the neoplasms; diseases of circulatory system; accidents, poison, and violence categories of emergency room visits. The estimated coefficient on the population aged under 18 is positive for some categories and negative for some categories, but it is not significant for any of the categories of emergency room visits even at the 10 percent level.

Seemingly unrelated regression was carried out to overcome the dependency of error disturbances between the set of equations. The Breusch-Pagan test of independence showed that there is correlation between error terms. The results of seemingly unrelated regression confirmed results of IV regression suggesting that there is positive influence of the percentage uninsured on the
percentage of emergency room visits at the 5 percent level of significance (except for mental disorders, which is significant at the 10 percent level). The estimated coefficients in both the regressions are same, except that standard errors are reduced in seemingly unrelated regression.

Elasticities were calculated, as that tool was widely used by policy makers due to the simplicity in interpretation. The results showed that the percentage of uninsured is relatively elastic (significant at the 5 percent level) with respect to changes in the median household income and the percentage of the population with educational attainment beyond high school. In addition, the percentage of emergency room visits for infective and parasitic diseases; endocrine; nutritional and metabolic diseases; diseases of the blood and blood-forming organs; and complications of pregnancy or birth are relatively elastic (significant at the 5 percent level) to changes in the percentage of uninsured.

**Policy Implications**

These results show that counties with high levels of non-White population and with a large percentage of business establishments that employ fewer than 50 workers should expect high numbers of uninsured residents. Counties with a high median household income and a high level of population with educational attainment beyond high school should expect a smaller share of the population to be uninsured. At the national level, these results imply that there is a need for
policy makers to study their options for enhancing access to health insurance for the groups that have traditionally been most likely to be uninsured. Decision makers should be given the information, and then they can decide on appropriate tactics.

The counties with high percentage of uninsured should expect high use of emergency room facilities for all the selected diagnoses categories (except mental disorders). Policy makers should be made aware of these factors and their implications for emergency needs. Then, they can allocate public efforts to reduce the impact or to absorb the impact as possible. This study can help policy makers to provide programs that increase access to routine medical care for that uninsured and create strategies to reduce emergency room utilization.

Identifying and characterizing group differences will inform intervention programs aimed at reducing the uninsured percentage of the population. In turn, this should reduce the percentage of emergency room visits by targeting the group with the highest marginal benefit for efficient resource allocation.

**Limitations of the Study**

This study has several limitations. One of the limitations is that the study was based on the data collected for one year (2000). The study would be more appropriate if trends over time were tested for emergency room visits according to insurance status. In addition, the data for the study are based on the 2000
census and are 8 years old. The variation in this study could have shifted in South Carolina in the last 8 years and the estimation of variable effects in the model could be different now. Nativity and employment status were excluded from the study due to correlation between other factors despite being identified as unique variables influencing uninsured, as were cited in other studies. The study could not take into account whether the same patient had one, two, or more visits and whether the visits were related to same problem or different problems. Instead, this study used all emergency room visits, which may lead to over identifying the relationship between emergency room visits and uninsured. The study does not contain the information about health status, regular source of care, access to care, and transportation barriers needed to adequately analyze whether uninsured status had the strongest association with emergency room utilization. (Alternatively, emergency room utilization could be explained based on these other variables.) The authors of future studies of the effects of health insurance coverage on emergency room utilization should take into consideration other characteristics thought to be associated with the use of emergency departments.
APPENDICES
A: DESCRIPTIVE STATISTICS
Table A.1: Descriptive Statistics of Variables

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Observations</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsured per (%)</td>
<td>46</td>
<td>15.88043</td>
<td>3.000712</td>
<td>10.7</td>
<td>23.1</td>
</tr>
<tr>
<td>Morehighsch (%)</td>
<td>46</td>
<td>38.71522</td>
<td>9.654981</td>
<td>25.8</td>
<td>63.6</td>
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<tr>
<td>Nonwhite per (%)</td>
<td>46</td>
<td>40.01845</td>
<td>15.94339</td>
<td>9.732117</td>
<td>72.63402</td>
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<tr>
<td>Estbl50 per (%)</td>
<td>46</td>
<td>1.903556</td>
<td>0.5946867</td>
<td>1.16805</td>
<td>3.492364</td>
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<tr>
<td>Medhhi ($)</td>
<td>46</td>
<td>33596.83</td>
<td>5757.056</td>
<td>20898</td>
<td>46992</td>
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<td>Under18 (%)</td>
<td>46</td>
<td>25.61304</td>
<td>1.921875</td>
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<td>29.1</td>
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<tr>
<td>Age65 and over (%)</td>
<td>46</td>
<td>12.7</td>
<td>1.766478</td>
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<tr>
<td>Urban (%)</td>
<td>46</td>
<td>43.07025</td>
<td>22.06659</td>
<td>0</td>
<td>87.16309</td>
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<tr>
<td>All Hedv per (%)</td>
<td>46</td>
<td>40.20435</td>
<td>10.11224</td>
<td>18.1</td>
<td>65.9</td>
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<tr>
<td>Infedper (%)</td>
<td>46</td>
<td>1.447826</td>
<td>0.6708996</td>
<td>0.5</td>
<td>3.4</td>
</tr>
<tr>
<td>Neoper (%)</td>
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<td>0.1586957</td>
<td>0.0617381</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>Endoper (%)</td>
<td>46</td>
<td>0.8630435</td>
<td>0.3623127</td>
<td>0.4</td>
<td>1.9</td>
</tr>
<tr>
<td>Blood per (%)</td>
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<td>0.2782609</td>
<td>0.2337264</td>
<td>0</td>
<td>1.4</td>
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<tr>
<td>Mental per (%)</td>
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<td>0.9934783</td>
<td>0.3362553</td>
<td>0.4</td>
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<tr>
<td>Nervous per (%)</td>
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<td>2.143478</td>
<td>0.6407122</td>
<td>0.7</td>
<td>3.6</td>
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<tr>
<td>Cirper (%)</td>
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<td>2.097826</td>
<td>0.5547729</td>
<td>1</td>
<td>3.3</td>
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<tr>
<td>Resper (%)</td>
<td>46</td>
<td>5.463043</td>
<td>1.583857</td>
<td>2.3</td>
<td>10</td>
</tr>
<tr>
<td>Digper (%)</td>
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<td>2.86087</td>
<td>0.9543999</td>
<td>1.1</td>
<td>5.1</td>
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<tr>
<td>Genitoper (%)</td>
<td>46</td>
<td>2.071739</td>
<td>0.5841092</td>
<td>0.8</td>
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<td>Birthper (%)</td>
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<td>0.7043478</td>
<td>0.438156</td>
<td>0.2</td>
<td>2.9</td>
</tr>
<tr>
<td>Skinper (%)</td>
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<td>1.01087</td>
<td>0.2758649</td>
<td>0.3</td>
<td>1.8</td>
</tr>
<tr>
<td>Muscle per (%)</td>
<td>46</td>
<td>2.530435</td>
<td>0.8055004</td>
<td>0.9</td>
<td>4.4</td>
</tr>
<tr>
<td>Symptoms per (%)</td>
<td>46</td>
<td>6.691304</td>
<td>1.617931</td>
<td>3</td>
<td>10</td>
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<tr>
<td>Accident per (%)</td>
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<td>9.921739</td>
<td>2.342355</td>
<td>4.4</td>
<td>15.4</td>
</tr>
<tr>
<td>Other per (%)</td>
<td>46</td>
<td>0.9217391</td>
<td>0.3258582</td>
<td>0.4</td>
<td>1.9</td>
</tr>
</tbody>
</table>
B: MAPS
B.1:

U.S. Map

Source: http://jobs.lawinfo.com/images/us-map.gif
B.2:

South Carolina Map

Source: http://www.capitolimpact.com/gw/maps/sc.gif
C: LIST OF DISEASES
According to National Center for Health Statistics (2000), ICD-9-CM (The International Classification of Diseases, Clinical Modification) classification of diagnostic categories was as follows:

**List of Diseases Under Each Category of Emergency Room Visits**

**INFECTION AND PARASITIC DISEASES**

**Intestinal infectious diseases (001-009)**
- 001 Cholera
- 002 Typhoid and paratyphoid fevers
- 003 Other salmonella infections
- 004 Shigellosis
- 005 Other food poisoning (bacterial)
- 006 Amoebiasis
- 007 Other protozoal intestinal diseases
- 008 Intestinal infections due to other organisms
- 009 Ill-defined intestinal infections

**Tuberculosis (010-018)**
- 010 Primary tuberculosis infection
- 011 Pulmonary tuberculosis
- 012 Other respiratory tuberculosis
- 013 Tuberculosis of meninges and central nervous system
- 014 Tuberculosis of intestines, peritoneum, and mesenteric glands
- 015 Tuberculosis of bones and joints
- 016 Tuberculosis of genitourinary system
- 017 Tuberculosis of other organs
- 018 Miliary tuberculosis

**Zoonotic bacterial diseases (020-027)**
- 020 Plague
- 021 Tularemia
- 022 Anthrax
- 023 Brucellosis
- 024 Glanders
- 025 Melioidosis
- 026 Rat-bite fever
- 027 Other zoonotic bacterial diseases

**Other bacterial diseases (030-041)**
- 030 Leprosy
- 031 Diseases due to other mycobacteria
- 032 Diphtheria
<table>
<thead>
<tr>
<th>Code</th>
<th>Disease Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>033</td>
<td>Whooping cough</td>
</tr>
<tr>
<td>034</td>
<td>Streptococcal sore throat and scarlet fever</td>
</tr>
<tr>
<td>035</td>
<td>Erysipelas</td>
</tr>
<tr>
<td>036</td>
<td>Meningococcal infection</td>
</tr>
<tr>
<td>037</td>
<td>Tetanus</td>
</tr>
<tr>
<td>038</td>
<td>Septicemia</td>
</tr>
<tr>
<td>039</td>
<td>Actinomycotic infections</td>
</tr>
<tr>
<td>040</td>
<td>Other bacterial diseases</td>
</tr>
<tr>
<td>041</td>
<td>Bacterial infection in conditions classified elsewhere and of unspecified site</td>
</tr>
</tbody>
</table>

**Human immunodeficiency virus (042)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Disease Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>042</td>
<td>Human immunodeficiency virus [HIV] disease</td>
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</tbody>
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**Poliomyelitis and other non-arthropod-borne viral diseases of central nervous system (045-049)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Disease Description</th>
</tr>
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<tbody>
<tr>
<td>045</td>
<td>Acute poliomyelitis</td>
</tr>
<tr>
<td>046</td>
<td>Slow virus infection of central nervous system</td>
</tr>
<tr>
<td>047</td>
<td>Meningitis due to enterovirus</td>
</tr>
<tr>
<td>048</td>
<td>Other enterovirus diseases of central nervous system</td>
</tr>
<tr>
<td>049</td>
<td>Other non-arthropod-borne viral diseases of central nervous system</td>
</tr>
</tbody>
</table>

**Viral diseases accompanied by exanthem (050-057)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Disease Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>050</td>
<td>Smallpox</td>
</tr>
<tr>
<td>051</td>
<td>Cowpox and paravaccinia</td>
</tr>
<tr>
<td>052</td>
<td>Chickenpox</td>
</tr>
<tr>
<td>053</td>
<td>Herpes zoster</td>
</tr>
<tr>
<td>054</td>
<td>Herpes simplex</td>
</tr>
<tr>
<td>055</td>
<td>Measles</td>
</tr>
<tr>
<td>056</td>
<td>Rubella</td>
</tr>
<tr>
<td>057</td>
<td>Other viral exanthemata</td>
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</table>

**Arthropod-borne viral diseases (060-066)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Disease Description</th>
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</thead>
<tbody>
<tr>
<td>060</td>
<td>Yellow fever</td>
</tr>
<tr>
<td>061</td>
<td>Dengue</td>
</tr>
<tr>
<td>062</td>
<td>Mosquito-borne viral encephalitis</td>
</tr>
<tr>
<td>063</td>
<td>Tick-borne viral encephalitis</td>
</tr>
<tr>
<td>064</td>
<td>Viral encephalitis transmitted by other and unspecified arthropods</td>
</tr>
<tr>
<td>065</td>
<td>Arthropod-borne hemorrhagic fever</td>
</tr>
<tr>
<td>066</td>
<td>Other arthropod-borne viral diseases</td>
</tr>
</tbody>
</table>

**Other diseases due to viruses and Chlamydiae (070-079)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Disease Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>070</td>
<td>Viral hepatitis</td>
</tr>
<tr>
<td>071</td>
<td>Rabies</td>
</tr>
<tr>
<td>072</td>
<td>Mumps</td>
</tr>
<tr>
<td>073</td>
<td>Ornithosis</td>
</tr>
<tr>
<td>074</td>
<td>Specific diseases due to Coxsackie virus</td>
</tr>
<tr>
<td>075</td>
<td>Infectious mononucleosis</td>
</tr>
<tr>
<td>076</td>
<td>Trachoma</td>
</tr>
<tr>
<td>077</td>
<td>Other diseases of conjunctiva due to viruses and Chlamydiae</td>
</tr>
<tr>
<td>078</td>
<td>Other diseases due to viruses and Chlamydiae</td>
</tr>
</tbody>
</table>
Viral infection in conditions classified elsewhere and of unspecified site

**Rickettsioses and other arthropod-borne diseases (080-088)**
- 080 Louse-borne [epidemic] typhus
- 081 Other typhus
- 082 Tick-borne rickettsioses
- 083 Other rickettsioses
- 084 Malaria
- 085 Leishmaniasis
- 086 Trypanosomiasis
- 087 Relapsing fever
- 088 Other arthropod-borne diseases

**Syphilis and other venereal diseases (090-099)**
- 090 Congenital syphilis
- 091 Early syphilis, symptomatic
- 092 Early syphilis, latent
- 093 Cardiovascular syphilis
- 094 Neurosyphilis
- 095 Other forms of late syphilis, with symptoms
- 096 Late syphilis, latent
- 097 Other and unspecified syphilis
- 098 Gonococcal infections
- 099 Other venereal diseases

**Other spirochetal diseases (100-104)**
- 100 Leptospirosis
- 101 Vincent's angina
- 102 Yaws
- 103 Pinta
- 104 Other spirochetal infection

**Mycoses (110-118)**
- 110 Dermatophytosis
- 111 Dermatomycosis, other and unspecified
- 112 Candidiasis
- 114 Coccidioidomycosis
- 115 Histoplasmosis
- 116 Blastomycotic infection
- 117 Other mycoses
- 118 Opportunistic mycoses

**Helminthiases (120-129)**
- 120 Schistosomiasis [bilharziasis]
- 121 Other trematode infections
- 122 Echinococcosis
- 123 Other cestode infection
- 124 Trichinosis
- 125 Filarial infection and dracontiasis
Ancylostomiasis and necatoriasis
Other intestinal helminthiases
Other and unspecified helminthiases
Intestinal parasitism, unspecified

Other infectious and parasitic diseases (130-136)
Toxoplasmosis
Trichomoniasis
Pediculosis and phthirus infestation
Acariasis
Other infestation
Sarcoidosis
Other and unspecified infectious and parasitic diseases

Late effects of infectious and parasitic diseases (137-139)
Late effects of tuberculosis
Late effects of acute poliomyelitis
Late effects of other infectious and parasitic diseases

NEOPLASMS
Malignant neoplasm of lip, oral cavity, and pharynx (140-149)
Malignant neoplasm of lip
Malignant neoplasm of tongue
Malignant neoplasm of major salivary glands
Malignant neoplasm of gum
Malignant neoplasm of floor of mouth
Malignant neoplasm of other and unspecified parts of mouth
Malignant neoplasm of oropharynx
Malignant neoplasm of nasopharynx
Malignant neoplasm of hypopharynx
Malignant neoplasm of other and ill-defined sites within the lip, oral cavity, and pharynx

Malignant neoplasm of digestive organs and peritoneum (150-159)
Malignant neoplasm of esophagus
Malignant neoplasm of stomach
Malignant neoplasm of small intestine, including duodenum
Malignant neoplasm of colon
Malignant neoplasm of rectum, rectosigmoid junction, and anus
Malignant neoplasm of liver and intrahepatic bile ducts
Malignant neoplasm of gallbladder and extrahepatic bile ducts
Malignant neoplasm of pancreas
Malignant neoplasm of retroperitoneum and peritoneum
Malignant neoplasm of other and ill-defined sites within the digestive organs and peritoneum

Malignant neoplasm of respiratory and intrathoracic organs (160-165)
Malignant neoplasm of nasal cavities, middle ear, and accessory sinuses
Malignant neoplasm of larynx
Malignant neoplasm of trachea, bronchus, and lung
Malignant neoplasm of pleura
Malignant neoplasm of thymus, heart, and mediastinum
Malignant neoplasm of other and ill-defined sites within the respiratory system and intrathoracic organs

Malignant neoplasm of bone, connective tissue, skin, and breast (170-176)
Malignant neoplasm of bone and articular cartilage
Malignant neoplasm of connective and other soft tissue
Malignant melanoma of skin
Other malignant neoplasm of skin
Malignant neoplasm of female breast
Malignant neoplasm of male breast
Kaposi’s sarcoma (176)
Kaposi’s sarcoma

Malignant neoplasm of genitourinary organs (179-189)
Malignant neoplasm of uterus, part unspecified
Malignant neoplasm of cervix uteri
Malignant neoplasm of placenta
Malignant neoplasm of body of uterus
Malignant neoplasm of ovary and other uterine adnexa
Malignant neoplasm of other and unspecified female genital organs
Malignant neoplasm of prostate
Malignant neoplasm of testis
Malignant neoplasm of penis and other male genital organs
Malignant neoplasm of bladder
Malignant neoplasm of kidney and other and unspecified urinary organs

Malignant neoplasm of other and unspecified sites (190-199)
Malignant neoplasm of eye
Malignant neoplasm of brain
Malignant neoplasm of other and unspecified parts of nervous system
Malignant neoplasm of thyroid gland
Malignant neoplasm of other endocrine glands and related structures
Malignant neoplasm of other and ill-defined sites
Secondary and unspecified malignant neoplasm of lymph nodes
Secondary malignant neoplasm of respiratory and digestive systems
Secondary malignant neoplasm of other specified sites
Malignant neoplasm without specification of site

Malignant neoplasm of lymphatic and hematopoietic tissue (200-208)
Lymphosarcoma and reticulosarcoma
Hodgkin’s disease
Other malignant neoplasm of lymphoid and histiocytic tissue
Multiple myeloma and immunoproliferative neoplasms
Lymphoid leukemia
Myeloid leukemia
206 Monocytic leukemia
207 Other specified leukemia
208 Leukemia of unspecified cell type

**Benign neoplasms (210-229)**
210 Benign neoplasm of lip, oral cavity, and pharynx
211 Benign neoplasm of other parts of digestive system
212 Benign neoplasm of respiratory and intrathoracic organs
213 Benign neoplasm of bone and articular cartilage
214 Lipoma
215 Other benign neoplasm of connective and other soft tissue
216 Benign neoplasm of skin
217 Benign neoplasm of breast
218 Uterine leiomyoma
219 Other benign neoplasm of uterus
220 Benign neoplasm of ovary
221 Benign neoplasm of other female genital organs
222 Benign neoplasm of male genital organs
223 Benign neoplasm of kidney and other urinary organs
224 Benign neoplasm of eye
225 Benign neoplasm of brain and other parts of nervous system
226 Benign neoplasm of thyroid gland
227 Benign neoplasm of other endocrine glands and related structures
228 Hemangioma and lymphangioma, any site
229 Benign neoplasm of other and unspecified sites

**Carcinoma in situ (230-234)**
230 Carcinoma in situ of digestive organs
231 Carcinoma in situ of respiratory system
232 Carcinoma in situ of skin
233 Carcinoma in situ of breast and genitourinary system
234 Carcinoma in situ of other and unspecified sites

**Neoplasms of uncertain behavior (235-238)**
235 Neoplasm of uncertain behavior of digestive and respiratory systems
236 Neoplasm of uncertain behavior of genitourinary organs
237 Neoplasm of uncertain behavior of endocrine glands and nervous system
238 Neoplasm of uncertain behavior of other and unspecified sites and tissues

**Neoplasms of unspecified nature (239)**
239 Neoplasm of unspecified nature

**ENDOCRINE, NUTRITIONAL AND METABOLIC DISEASES, AND IMMUNITY DISORDERS**

**Disorders of thyroid gland (240-246)**
240 Simple and unspecified goiter
241 Nontoxic nodular goiter
242 Thyrotoxicosis with or without goiter
243 Congenital hypothyroidism  
244 Acquired hypothyroidism  
245 Thyroiditis  
246 Other disorders of thyroid  

**Diseases of other endocrine glands (250-259)**  
250 Diabetes mellitus  
251 Other disorders of pancreatic internal secretion  
252 Disorders of parathyroid gland  
253 Disorders of the pituitary gland and its hypothalamic control  
254 Diseases of thymus gland  
255 Disorders of adrenal glands  
256 Ovarian dysfunction  
257 Testicular dysfunction  
258 Polyglandular dysfunction and related disorders  
259 Other endocrine disorders  

**Nutritional deficiencies (260-269)**  
260 Kwashiorkor  
261 Nutritional marasmus  
262 Other severe protein-calorie malnutrition  
263 Other and unspecified protein-calorie malnutrition  
264 Vitamin A deficiency  
265 Thiamine and niacin deficiency states  
266 Deficiency of B-complex components  
267 Ascorbic acid deficiency  
268 Vitamin D deficiency  
269 Other nutritional deficiencies  

**Other metabolic disorders and immunity disorders (270-279)**  
270 Disorders of amino-acid transport and metabolism  
271 Disorders of carbohydrate transport and metabolism  
272 Disorders of lipid metabolism  
273 Disorders of plasma protein metabolism  
274 Gout  
275 Disorders of mineral metabolism  
276 Disorders of fluid, electrolyte, and acid-base balance  
277 Other and unspecified disorders of metabolism  
278 Obesity and other hyperalimentation  
279 Disorders involving the immune mechanism  

**DISEASES OF BLOOD AND BLOOD-FORMING ORGANS**  

**Diseases of the blood and blood-forming organs (280-289)**  
280 Iron deficiency anemias  
281 Other deficiency anemias  
282 Hereditary hemolytic anemias  
283 Acquired hemolytic anemias
284 Aplastic anemia
285 Other and unspecified anemias
286 Coagulation defects
287 Purpura and other hemorrhagic conditions
288 Diseases of white blood cells
289 Other diseases of blood and blood-forming organs

Mental Disorders

Organic psychotic conditions (290-294)
290 Senile and presenile organic psychotic conditions
291 Alcoholic psychoses
292 Drug psychoses
293 Transient organic psychotic conditions
294 Other organic psychotic conditions (chronic)

Other psychoses (295-299)
295 Schizophrenic psychoses
296 Affective psychoses
297 Paranoid states
298 Other nonorganic psychoses
299 Psychoses with origin specific to childhood

Neurotic disorders, personality disorders, and other nonpsychotic mental disorders (300-316)
300 Neurotic disorders
301 Personality disorders
302 Sexual deviations and disorders
303 Alcohol dependence syndrome
304 Drug dependence
305 Nondependent abuse of drugs
306 Physiological malfunction arising from mental factors
307 Special symptoms or syndromes, not elsewhere classified
308 Acute reaction to stress
309 Adjustment reaction
310 Specific nonpsychotic mental disorders following organic brain damage
311 Depressive disorder, not elsewhere classified
312 Disturbance of conduct, not elsewhere classified
313 Disturbance of emotions specific to childhood and adolescence
314 Hyperkinetic syndrome of childhood
315 Specific delays in development
316 Psychic factors associated with diseases classified elsewhere

Mental retardation (317-319)
317 Mild mental retardation
318 Other specified mental retardation
319 Unspecified mental retardation
DISEASES OF THE NERVOUS SYSTEM AND SENSE ORGANS

Inflammatory diseases of the central nervous system (320-326)
320 Bacterial meningitis
321 Meningitis due to other organisms
322 Meningitis of unspecified cause
323 Encephalitis, myelitis, and encephalomyelitis
324 Intracranial and intraspinal abscess
325 Phlebitis and thrombophlebitis of intracranial venous sinuses
326 Late effects of intracranial abscess or pyogenic infection

Hereditary and degenerative diseases of the central nervous system (330-337)
330 Cerebral degenerations usually manifest in childhood
331 Other cerebral degenerations
332 Parkinson’s disease
333 Other extrapyramidal disease and abnormal movement disorders
334 Spinocerebellar disease
335 Anterior horn cell disease
336 Other diseases of spinal cord
337 Disorders of the autonomic nervous system

Other disorders of the central nervous system (340-349)
340 Multiple sclerosis
341 Other demyelinating diseases of central nervous system
342 Hemiplegia and hemiparesis
343 Infantile cerebral palsy
344 Other paralytic syndromes
345 Epilepsy
346 Migraine
347 Cataplexy and narcolepsy
348 Other conditions of brain
349 Other and unspecified disorders of the nervous system

Disorders of the peripheral nervous system (350-359)
350 Trigeminal nerve disorders
351 Facial nerve disorders
352 Disorders of other cranial nerves
353 Nerve root and plexus disorders
354 Mononeuritis of upper limb and mononeuritis multiplex
355 Mononeuritis of lower limb
356 Hereditary and idiopathic peripheral neuropathy
357 Inflammatory and toxic neuropathy
358 Myoneural disorders
359 Muscular dystrophies and other myopathies

Disorders of the eye and adnexa (360-379)
360 Disorders of the globe
361 Retinal detachments and defects
362 Other retinal disorders
363  Chorioretinal inflammations and scars and other disorders of choroid
364  Disorders of iris and ciliary body
365  Glaucoma
366  Cataract
367  Disorders of refraction and accommodation
368  Visual disturbances
369  Blindness and low vision
370  Keratitis
371  Corneal opacity and other disorders of cornea
372  Disorders of conjunctiva
373  Inflammation of eyelids
374  Other disorders of eyelids
375  Disorders of lacrimal system
376  Disorders of the orbit
377  Disorders of optic nerve and visual pathways
378  Strabismus and other disorders of binocular eye movements
379  Other disorders of eye

**Diseases of the ear and mastoid process (380-389)**
380  Disorders of external ear
381  Nonsuppurative otitis media and Eustachian tube disorders
382  Suppurative and unspecified otitis media
383  Mastoiditis and related conditions
384  Other disorders of tympanic membrane
385  Other disorders of middle ear and mastoid
386  Vertiginous syndromes and other disorders of vestibular system
387  Otosclerosis
388  Other disorders of ear
389  Hearing loss

**DISEASES OF THE CIRCULATORY SYSTEM**

**Acute rheumatic fever (390-392)**
390  Rheumatic fever without mention of heart involvement
391  Rheumatic fever with heart involvement
392  Rheumatic chorea

**Chronic rheumatic heart disease (393-398)**
393  Chronic rheumatic pericarditis
394  Diseases of mitral valve
395  Diseases of aortic valve
396  Diseases of mitral and aortic valves
397  Diseases of other endocardial structures
398  Other rheumatic heart disease

**Hypertensive disease (401-405)**
401  Essential hypertension
402  Hypertensive heart disease
403 Hypertensive renal disease
404 Hypertensive heart and renal disease
405 Secondary hypertension

**Ischemic heart disease (410-414)**
410 Acute myocardial infarction
411 Other acute and subacute form of ischemic heart disease
412 Old myocardial infarction
413 Angina pectoris
414 Other forms of chronic ischemic heart disease

**Diseases of pulmonary circulation (415-417)**
415 Acute pulmonary heart disease
416 Chronic pulmonary heart disease
417 Other diseases of pulmonary circulation

**Other forms of heart disease (420-429)**
420 Acute pericarditis
421 Acute and subacute endocarditis
422 Acute myocarditis
423 Other diseases of pericardium
424 Other diseases of endocardium
425 Cardiomyopathy
426 Conduction disorders
427 Cardiac dysrhythmias
428 Heart failure
429 Ill-defined descriptions and complications of heart disease

**Cerebrovascular disease (430-438)**
430 Subarachnoid hemorrhage
431 Intracerebral hemorrhage
432 Other and unspecified intracranial hemorrhage
433 Occlusion and stenosis of precerebral arteries
434 Occlusion of cerebral arteries
435 Transient cerebral ischemia
436 Acute but ill-defined cerebrovascular disease
437 Other and ill-defined cerebrovascular disease
438 Late effects of cerebrovascular disease

**Diseases of arteries, arterioles, and capillaries (440-448)**
440 Atherosclerosis
441 Aortic aneurysm and dissection
442 Other aneurysm
443 Other peripheral vascular disease
444 Arterial embolism and thrombosis
446 Polyarteritis nodosa and allied conditions
447 Other disorders of arteries and arterioles
448 Diseases of capillaries
Diseases of veins and lymphatics, and other diseases of circulatory system (451-459)

451 Phlebitis and thrombophlebitis
452 Portal vein thrombosis
453 Other venous embolism and thrombosis
454 Varicose veins of lower extremities
455 Hemorrhoids
456 Varicose veins of other sites
457 Noninfective disorders of lymphatic channels
458 Hypotension
459 Other disorders of circulatory system

DISEASES OF THE RESPIRATORY SYSTEM

Acute respiratory infections (460-466)

460 Acute nasopharyngitis [common cold]
461 Acute sinusitis
462 Acute pharyngitis
463 Acute tonsillitis
464 Acute laryngitis and tracheitis
465 Acute upper respiratory infections of multiple or unspecified sites
466 Acute bronchitis and bronchiolitis

Other diseases of upper respiratory tract (470-478)

470 Deviated nasal septum
471 Nasal polyps
472 Chronic pharyngitis and nasopharyngitis
473 Chronic sinusitis
474 Chronic disease of tonsils and adenoids
475 Peritonsillar abscess
476 Chronic laryngitis and laryngotracheitis
477 Allergic rhinitis
478 Other diseases of upper respiratory tract

Pneumonia and influenza (480-487)

480 Viral pneumonia
481 Pneumococcal pneumonia [Streptococcus pneumoniae pneumonia]
482 Other bacterial pneumonia
483 Pneumonia due to other specified organism
484 Pneumonia in infectious diseases classified elsewhere
485 Bronchopneumonia, organism unspecified
486 Pneumonia, organism unspecified
487 Influenza

Chronic obstructive pulmonary disease and allied conditions (490-496)

490 Bronchitis, not specified as acute or chronic
491 Chronic bronchitis
492 Emphysema
493 Asthma
Bronchiectasis
Extrinsic allergic alveolitis
Chronic airways obstruction, not elsewhere classified

Pneumoconioses and other lung diseases due to external agents (500-508)
Coalworkers’ pneumoconiosis
Asbestosis
Pneumoconiosis due to other silica or silicates
Pneumoconiosis due to other inorganic dust
Pneumopathy due to inhalation of other dust
Pneumoconiosis, unspecified
Respiratory conditions due to chemical fumes and vapors
Pneumonitis due to solids and liquids
Respiratory conditions due to other and unspecified external agents

Other diseases of respiratory system (510-519)
Empyema
Pleurisy
Pneumothorax
Abscess of lung and mediastinum
Pulmonary congestion and hypostasis
Postinflammatory pulmonary fibrosis
Other alveolar and parietoalveolar pneumopathy
Lung involvement in conditions classified elsewhere
Other diseases of lung
Other diseases of respiratory system

DISEASES OF THE DIGESTIVE SYSTEM

Diseases of oral cavity, salivary glands, and jaws (520-529)
Disorders of tooth development and eruption
Diseases of hard tissues of teeth
Diseases of pulp and periapical tissues
Gingival and periodontal diseases
Dentofacial anomalies, including malocclusion
Other diseases and conditions of the teeth and supporting structures
Diseases of the jaws
Diseases of the salivary glands
Diseases of the oral soft tissues, excluding lesions specific for gingiva and tongue
Diseases and other conditions of the tongue

Diseases of esophagus, stomach, and duodenum (530-537)
Diseases of esophagus
Gastric ulcer
Duodenal ulcer
Peptic ulcer, site unspecified
Gastrojejunal ulcer
Gastritis and duodenitis
Disorders of function of stomach
Other disorders of stomach and duodenum

Appendicitis (540-543)
Acute appendicitis
Appendicitis, unqualified
Other appendicitis
Other diseases of appendix

Hernia of abdominal cavity (550-553)
Inguinal hernia
Other hernia of abdominal cavity, with gangrene
Other hernia of abdominal cavity, with obstruction, but without mention of gangrene
Other hernia of abdominal cavity without mention of obstruction or gangrene

Noninfective enteritis and colitis (555-558)
Regional enteritis
Ulcerative colitis
Vascular insufficiency of intestine
Other noninfective gastroenteritis and colitis

Other diseases of intestines and peritoneum (560-569)
Intestinal obstruction without mention of hernia
Diverticula of intestine
Functional digestive disorders, not elsewhere classified
Anal fissure and fistula
Abscess of anal and rectal regions
Peritonitis
Other disorders of peritoneum
Other disorders of intestine

Other diseases of digestive system (570-579)
Acute and subacute necrosis of liver
Chronic liver disease and cirrhosis
Liver abscess and sequelae of chronic liver disease
Other disorders of liver
Cholelithiasis
Other disorders of gallbladder
Other disorders of biliary tract
Diseases of pancreas
Gastrointestinal hemorrhage
Intestinal malabsorption

DISEASES OF THE GENITOURINARY SYSTEM

Nephritis, nephrotic syndrome, and nephrosis (580-589)
Acute glomerulonephritis
Nephrotic syndrome
Chronic glomerulonephritis
Nephritis and nephropathy, not specified as acute or chronic
Acute renal failure
Chronic renal failure
Renal failure, unspecified
Renal sclerosis, unspecified
Disorders resulting from impaired renal function
Small kidney of unknown cause

Other diseases of urinary system (590-599)
Infections of kidney
Hydronephrosis
Calculus of kidney and ureter
Other disorders of kidney and ureter
Calculus of lower urinary tract
Cystitis
Other disorders of bladder
Urethritis, not sexually transmitted, and urethral syndrome
Urethral stricture
Other disorders of urethra and urinary tract

Diseases of male genital organs (600-608)
Hyperplasia of prostate
Inflammatory diseases of prostate
Other disorders of prostate
Hydrocele
Orchitis and epididymitis
Redundant prepuce and phimosis
Infertility, male
Disorders of penis
Other disorders of male genital organs

Disorders of breast (610-611)
Benign mammary dysplasias
Other disorders of breast

Inflammatory disease of female pelvic organs (614-616)
Inflammatory disease of ovary, fallopian tube, pelvic cellular tissue, and peritoneum
Inflammatory diseases of uterus, except cervix
Inflammatory disease of cervix, vagina, and vulva

Other disorders of female genital tract (617-629)
Endometriosis
Genital prolapse
Fistula involving female genital tract
Noninflammatory disorders of ovary, fallopian tube, and broad ligament
Disorders of uterus, not elsewhere classified
Noninflammatory disorders of cervix
Noninflammatory disorders of vagina
Noninflammatory disorders of vulva and perineum
Pain and other symptoms associated with female genital organs
Disorders of menstruation and other abnormal bleeding from female genital tract
Menopausal and postmenopausal disorders
Infertility, female
Other disorders of female genital organs

COMPLICATIONS OF PREGNANCY, CHILDBIRTH, AND THE PUERPERIUM

Ectopic and molar pregnancy and other pregnancy with abortive outcome (630-639)
- Hydatidiform mole
- Other abnormal product of conception
- Missed abortion
- Ectopic pregnancy
- Spontaneous abortion
- Legally induced abortion
- Illegally induced abortion
- Unspecified abortion
- Failed attempted abortion
- Complications following abortion and ectopic and molar pregnancies

Complications mainly related to pregnancy (640-648)
- Hemorrhage in early pregnancy
- Antepartum hemorrhage, abruptio placentae, and placenta previa
- Hypertension complicating pregnancy, childbirth, and the puerperium
- Excessive vomiting in pregnancy
- Early or threatened labor
- Prolonged pregnancy
- Other complications of pregnancy, not elsewhere classified
- Infective and parasitic conditions in the mother classifiable elsewhere but complicating pregnancy, childbirth, and the puerperium
- Other current conditions in the mother classifiable elsewhere but complicating pregnancy, childbirth, and the puerperium

Normal delivery, and other indications for care in pregnancy, labor, and delivery (650-659)
- Normal delivery
- Multiple gestation
- Malposition and malpresentation of fetus
- Disproportion
- Abnormality of organs and soft tissues of pelvis
- Known or suspected fetal abnormality affecting management of mother
- Other fetal and placental problems affecting management of mother
- Polyhydramnios
- Other problems associated with amniotic cavity and membranes
- Other indications for care or intervention related to labor and delivery and not elsewhere classified

Complications occurring mainly in the course of labor and delivery (660-669)
- Obstructed labor
- Abnormality of forces of labor
Complications of labor and delivery

- Long labor
- Umbilical cord complications
- Trauma to perineum and vulva during delivery
- Other obstetrical trauma
- Postpartum hemorrhage
- Retained placenta or membranes, without hemorrhage
- Complications of the administration of anesthetic or other sedation in labor and delivery
- Other complications of labor and delivery, not elsewhere classified

Complications of the puerperium (670-677)

- Major puerperal infection
- Venous complications in pregnancy and the puerperium
- Pyrexia of unknown origin during the puerperium
- Obstetrical pulmonary embolism
- Other and unspecified complications of the puerperium, not elsewhere classified
- Infections of the breast and nipple associated with childbirth
- Other disorders of the breast associated with childbirth, and disorders of lactation
- Late effect of complication of pregnancy, childbirth, and the puerperium

DISEASES OF THE SKIN AND SUBCUTANEOUS TISSUE

Infections of skin and subcutaneous tissue (680-686)

- Carbuncle and furuncle
- Cellulitis and abscess of finger and toe
- Other cellulitis and abscess
- Acute lymphadenitis
- Impetigo
- Pilonidal cyst
- Other local infections of skin and subcutaneous tissue

Other inflammatory conditions of skin and subcutaneous tissue (690-698)

- Erythemosquamous dermatosis
- Atopic dermatitis and related conditions
- Contact dermatitis and other eczema
- Dermatitis due to substances taken internally
- Bullous dermatoses
- Erythematous conditions
- Psoriasis and similar disorders
- Lichen
- Pruritus and related conditions

Other diseases of skin and subcutaneous tissue (700-709)

- Corns and callosities
- Other hypertrophic and atrophic conditions of skin
- Other dermatoses
- Diseases of nail
- Diseases of hair and hair follicles
- Disorders of sweat glands
DISEASES OF THE MUSCULOSKELETAL SYSTEM AND CONNECTIVE TISSUE

Arthropathies and related disorders (710-719)
710 Diffuse diseases of connective tissue
711 Arthropathy associated with infections
712 Crystal arthropathies
713 Arthropathy associated with other disorders classified elsewhere
714 Rheumatoid arthritis and other inflammatory polyarthropathies
715 Osteoarthrosis and allied disorders
716 Other and unspecified arthropathies
717 Internal derangement of knee
718 Other derangement of joint
719 Other and unspecified disorder of joint

Dorsopathies (720-724)
720 Ankylosing spondylitis and other inflammatory spondylopathies
721 Spondylosis and allied disorders
722 Intervertebral disc disorders
723 Other disorders of cervical region
724 Other and unspecified disorders of back

Rheumatism, excluding the back (725-729)
725 Polymyalgia rheumatica
726 Peripheral enthesopathies and allied syndromes
727 Other disorders of synovium, tendon, and bursa
728 Disorders of muscle, ligament, and fascia
729 Other disorders of soft tissues

Osteopathies, chondropathies, and acquired musculoskeletal deformities (730-739)
730 Osteomyelitis, periostitis, and other infections involving bone
731 Osteitis deformans and osteopathies associated with other disorders classified elsewhere
732 Osteochondropathies
733 Other disorders of bone and cartilage
734 Flat foot
735 Acquired deformities of toe
736 Other acquired deformities of limbs
737 Curvature of spine
738 Other acquired deformity
739 Nonallopathic lesions, not elsewhere classified

CONGENITAL ANOMALIES

Congenital anomalies (740-759)
740 Anencephalus and similar anomalies
741 Spina bifida
742 Other congenital anomalies of nervous system
743 Congenital anomalies of eye
744 Congenital anomalies of ear, face, and neck
745 Bulbus cordis anomalies and anomalies of cardiac septal closure
746 Other congenital anomalies of heart
747 Other congenital anomalies of circulatory system
748 Congenital anomalies of respiratory system
749 Cleft palate and cleft lip
750 Other congenital anomalies of upper alimentary tract
751 Other congenital anomalies of digestive system
752 Congenital anomalies of genital organs
753 Congenital anomalies of urinary system
754 Certain congenital musculoskeletal deformities
755 Other congenital anomalies of limbs
756 Other congenital musculoskeletal anomalies
757 Congenital anomalies of the integument
758 Chromosomal anomalies
759 Other and unspecified congenital anomalies

CERTAIN CONDITIONS ORIGINATING IN THE PERINATAL PERIOD

Maternal causes of perinatal morbidity and mortality (760-763)
760 Fetus or newborn affected by maternal conditions which may be unrelated to present pregnancy
761 Fetus or newborn affected by maternal complications of pregnancy
762 Fetus or newborn affected by complications of placenta, cord, and membranes
763 Fetus or newborn affected by other complications of labor and delivery

Other conditions originating in the perinatal period (764-779)
764 Slow fetal growth and fetal malnutrition
765 Disorders relating to short gestation and unspecified low birthweight
766 Disorders relating to long gestation and high birthweight
767 Birth trauma
768 Intrauterine hypoxia and birth asphyxia
769 Respiratory distress syndrome
770 Other respiratory conditions of fetus and newborn
771 Infections specific to the perinatal period
772 Fetal and neonatal hemorrhage
773 Hemolytic disease of fetus or newborn, due to isoimmunization
774 Other perinatal jaundice
775 Endocrine and metabolic disturbances specific to the fetus and newborn
776 Hematological disorders of fetus and newborn
777 Perinatal disorders of digestive system
778 Conditions involving the integument and temperature regulation of fetus and newborn
779 Other and ill-defined conditions originating in the perinatal period
SYMPTOMS, SIGNS, AND ILL-DEFINED CONDITIONS

Symptoms (780-789)
780 General symptoms
781 Symptoms involving nervous and musculoskeletal systems
782 Symptoms involving skin and other integumentary tissue
783 Symptoms concerning nutrition, metabolism, and development
784 Symptoms involving head and neck
785 Symptoms involving cardiovascular system
786 Symptoms involving respiratory system and other chest symptoms
787 Symptoms involving digestive system
788 Symptoms involving urinary system
789 Other symptoms involving abdomen and pelvis

Nonspecific abnormal findings (790-796)
790 Nonspecific findings on examination of blood
791 Nonspecific findings on examination of urine
792 Nonspecific abnormal findings in other body substances
793 Nonspecific abnormal findings on radiological and other examination of body structure
794 Nonspecific abnormal results of function studies
795 Nonspecific abnormal histological and immunological findings
796 Other nonspecific abnormal findings

Ill-defined and unknown causes of morbidity and mortality (797-799)
797 Senility without mention of psychosis
798 Sudden death, cause unknown
799 Other ill-defined and unknown causes of morbidity and mortality

INJURY AND POISONING

Fracture of skull (800-804)
800 Fracture of vault of skull
801 Fracture of base of skull
802 Fracture of face bones
803 Other and unqualified skull fractures
804 Multiple fractures involving skull or face with other bones

Fracture of spine and trunk (805-809)
805 Fracture of vertebral column without mention of spinal cord lesion
806 Fracture of vertebral column with spinal cord lesion
807 Fracture of rib(s), sternum, larynx, and trachea
808 Fracture of pelvis
809 Ill-defined fractures of bones of trunk

Fracture of upper limb (810-819)
810 Fracture of clavicle
811 Fracture of scapula
812 Fracture of humerus
813 Fracture of radius and ulna
814 Fracture of carpal bone(s)
815 Fracture of metacarpal bone(s)
816 Fracture of one or more phalanges of hand
817 Multiple fractures of hand bones
818 Ill-defined fractures of upper limb
819 Multiple fractures involving both upper limbs, and upper limb with rib(s) and sternum

**Fracture of lower limb (820-829)**
820 Fracture of neck of femur
821 Fracture of other and unspecified parts of femur
822 Fracture of patella
823 Fracture of tibia and fibula
824 Fracture of ankle
825 Fracture of one or more tarsal and metatarsal bones
826 Fracture of one or more phalanges of foot
827 Other, multiple, and ill-defined fractures of lower limb
828 Multiple fractures involving both lower limbs, lower with upper limb, and lower limb(s) with rib(s) and sternum
829 Fracture of unspecified bones

**Dislocation (830-839)**
830 Dislocation of jaw
831 Dislocation of shoulder
832 Dislocation of elbow
833 Dislocation of wrist
834 Dislocation of finger
835 Dislocation of hip
836 Dislocation of knee
837 Dislocation of ankle
838 Dislocation of foot
839 Other, multiple, and ill-defined dislocations

**Sprains and strains of joints and adjacent muscles (840-848)**
840 Sprains and strains of shoulder and upper arm
841 Sprains and strains of elbow and forearm
842 Sprains and strains of wrist and hand
843 Sprains and strains of hip and thigh
844 Sprains and strains of knee and leg
845 Sprains and strains of ankle and foot
846 Sprains and strains of sacroiliac region
847 Sprains and strains of other and unspecified parts of back
848 Other and ill-defined sprains and strains

**Intracranial injury, excluding those with skull fracture (850-854)**
850 Concussion
851 Cerebral laceration and contusion
852 Subarachnoid, subdural, and extradural hemorrhage, following injury
853 Other and unspecified intracranial hemorrhage following injury
854 Intracranial injury of other and unspecified nature
Internal injury of chest, abdomen, and pelvis (860-869)
- 860 Traumatic pneumothorax and hemothorax
- 861 Injury to heart and lung
- 862 Injury to other and unspecified intrathoracic organs
- 863 Injury to gastrointestinal tract
- 864 Injury to liver
- 865 Injury to spleen
- 866 Injury to kidney
- 867 Injury to pelvic organs
- 868 Injury to other intra-abdominal organs
- 869 Internal injury to unspecified or ill-defined organs

Open wound of head, neck, and trunk (870-879)
- 870 Open wound of ocular adnexa
- 871 Open wound of eyeball
- 872 Open wound of ear
- 873 Other open wound of head
- 874 Open wound of neck
- 875 Open wound of chest (wall)
- 876 Open wound of back
- 877 Open wound of buttock
- 878 Open wound of genital organs (external), including traumatic amputation
- 879 Open wound of other and unspecified sites, except limbs

Open wound of upper limb (880-887)
- 880 Open wound of shoulder and upper arm
- 881 Open wound of elbow, forearm, and wrist
- 882 Open wound of hand except finger(s) alone
- 883 Open wound of finger(s)
- 884 Multiple and unspecified open wound of upper limb
- 885 Traumatic amputation of thumb (complete) (partial)
- 886 Traumatic amputation of other finger(s) (complete) (partial)
- 887 Traumatic amputation of arm and hand (complete) (partial)

Open wound of lower limb (890-897)
- 890 Open wound of hip and thigh
- 891 Open wound of knee, leg [except thigh], and ankle
- 892 Open wound of foot except toe(s) alone
- 893 Open wound of toe(s)
- 894 Multiple and unspecified open wound of lower limb
- 895 Traumatic amputation of toe(s) (complete) (partial)
- 896 Traumatic amputation of foot (complete) (partial)
- 897 Traumatic amputation of leg(s) (complete) (partial)

Injury to blood vessels (900-904)
- 900 Injury to blood vessels of head and neck
- 901 Injury to blood vessels of thorax
- 902 Injury to blood vessels of abdomen and pelvis
166

Late effects of injuries, poisonings, toxic effects, and other external causes (905-909)

905 Late effects of musculoskeletal and connective tissue injuries
906 Late effects of injuries to skin and subcutaneous tissues
907 Late effects of injuries to the nervous system
908 Late effects of other and unspecified injuries
909 Late effects of other and unspecified external causes

Superficial injury (910-919)

910 Superficial injury of face, neck, and scalp except eye
911 Superficial injury of trunk
912 Superficial injury of shoulder and upper arm
913 Superficial injury of elbow, forearm, and wrist
914 Superficial injury of hand(s) except finger(s) alone
915 Superficial injury of finger(s)
916 Superficial injury of hip, thigh, leg, and ankle
917 Superficial injury of foot and toe(s)
918 Superficial injury of eye and adnexa
919 Superficial injury of other, multiple, and unspecified sites

Contusion with intact skin surface (920-924)

920 Contusion of face, scalp, and neck except eye(s)
921 Contusion of eye and adnexa
922 Contusion of trunk
923 Contusion of upper limb
924 Contusion of lower limb and of other and unspecified sites

Crushing injury (925-929)

925 Crushing injury of face, scalp, and neck
926 Crushing injury of trunk
927 Crushing injury of upper limb
928 Crushing injury of lower limb
929 Crushing injury of multiple and unspecified sites

Effects of foreign body entering through orifice (930-939)

930 Foreign body on external eye
931 Foreign body in ear
932 Foreign body in nose
933 Foreign body in pharynx and larynx
934 Foreign body in trachea, bronchus, and lung
935 Foreign body in mouth, esophagus, and stomach
936 Foreign body in intestine and colon
937 Foreign body in anus and rectum
938 Foreign body in digestive system, unspecified
939 Foreign body in genitourinary tract

Burns (940-949)
167

940 Burn confined to eye and adnexa
941 Burn of face, head, and neck
942 Burn of trunk
943 Burn of upper limb, except wrist and hand
944 Burn of wrist(s) and hand(s)
945 Burn of lower limb(s)
946 Burns of multiple specified sites
947 Burn of internal organs
948 Burns classified according to extent of body surface involved
949 Burn, unspecified

Injury to nerves and spinal cord (950-957)
950 Injury to optic nerve and pathways
951 Injury to other cranial nerve(s)
952 Spinal cord injury without evidence of spinal bone injury
953 Injury to nerve roots and spinal plexus
954 Injury to other nerve(s) of trunk excluding shoulder and pelvic girdles
955 Injury to peripheral nerve(s) of shoulder girdle and upper limb
956 Injury to peripheral nerve(s) of pelvic girdle and lower limb
957 Injury to other and unspecified nerves

Certain traumatic complications and unspecified injuries (958-959)
958 Certain early complications of trauma
959 Injury, other and unspecified

Poisoning by drugs, medicinals and biological substances (960-979)
960 Poisoning by antibiotics
961 Poisoning by other anti-infectives
962 Poisoning by hormones and synthetic substitutes
963 Poisoning by primarily systemic agents
964 Poisoning by agents primarily affecting blood constituents
965 Poisoning by analgesics, antipyretics, and antirheumatics
966 Poisoning by anticonvulsants and anti-Parkinsonism drugs
967 Poisoning by sedatives and hypnotics
968 Poisoning by other central nervous system depressants and anesthetics
969 Poisoning by psychotropic agents
970 Poisoning by central nervous system stimulants
971 Poisoning by drugs primarily affecting the autonomic nervous system
972 Poisoning by agents primarily affecting the cardiovascular system
973 Poisoning by agents primarily affecting the gastrointestinal system
974 Poisoning by water, mineral, and uric acid metabolism drugs
975 Poisoning by agents primarily acting on the smooth and skeletal muscles and respiratory system
976 Poisoning by agents primarily affecting skin and mucous membrane, ophthalmological, otorhinolaryngological, and dental drugs
977 Poisoning by other and unspecified drugs and medicinals
978 Poisoning by bacterial vaccines
979 Poisoning by other vaccines and biological substances
Toxic effects of substances chiefly nonmedicinal as to source (980-989)

980 Toxic effect of alcohol
981 Toxic effect of petroleum products
982 Toxic effect of solvents other than petroleum-based
983 Toxic effect of corrosive aromatics, acids, and caustic alkalis
984 Toxic effect of lead and its compounds (including fumes)
985 Toxic effect of other metals
986 Toxic effect of carbon monoxide
987 Toxic effect of other gases, fumes, or vapors
988 Toxic effect of noxious substances eaten as food
989 Toxic effect of other substances, chiefly nonmedicinal as to source

Other and unspecified effects of external causes (990-995)

990 Effects of radiation, unspecified
991 Effects of reduced temperature
992 Effects of heat and light
993 Effects of air pressure
994 Effects of other external causes
995 Certain adverse effects, not elsewhere classified

Complications of surgical and medical care, not elsewhere classified (996-999)

996 Complications peculiar to certain specified procedures
997 Complications affecting specified body systems, not elsewhere classified
998 Other complications of procedures, not elsewhere classified
999 Complications of medical care, not elsewhere classified

SUPPLEMENTARY CLASSIFICATION OF FACTORS INFLUENCING HEALTH STATUS AND CONTACT WITH HEALTH SERVICES

Persons with potential health hazards related to communicable diseases (V01-V09)

V01 Contact with or exposure to communicable diseases
V02 Carrier or suspected carrier of infectious diseases
V03 Need for prophylactic vaccination and inoculation against bacterial diseases
V04 Need for prophylactic vaccination and inoculation against certain viral diseases
V05 Need for other prophylactic vaccination and inoculation against single diseases
V06 Need for prophylactic vaccination and inoculation against combinations of diseases
V07 Need for isolation and other prophylactic measures
V08 Asymptomatic human immunodeficiency virus [HIV] infection status
V09 Infection with drug-resistant microorganisms

Persons with potential health hazards related to personal and family history (V10-V19)

V10 Personal history of malignant neoplasm
V11 Personal history of mental disorder
V12 Personal history of certain other diseases
V13 Personal history of other diseases
V14 Personal history of allergy to medicinal agents
V15 Other personal history presenting hazards to health
V16 Family history of malignant neoplasm
V17  Family history of certain chronic disabling diseases
V18  Family history of certain other specific conditions
V19  Family history of other conditions

Persons encountering health services in circumstances related to reproduction and development (V20-V29)
V20  Health supervision of infant or child
V21  Constitutional states in development
V22  Normal pregnancy
V23  Supervision of high-risk pregnancy
V24  Postpartum care and examination
V25  Encounter for contraceptive management
V26  Procreative management
V27  Outcome of delivery
V28  Antenatal screening
V29  Observation and evaluation of newborns and infants for suspected condition not found

Liveborn infants according to type of birth (V30-V39)
V30  Single liveborn
V31  Twin, mate liveborn
V32  Twin, mate stillborn
V33  Twin, unspecified
V34  Other multiple, mates all liveborn
V35  Other multiple, mates all stillborn
V36  Other multiple, mates live- and stillborn
V37  Other multiple, unspecified
V39  Unspecified

Persons with a condition influencing their health status (V40-V49)
V40  Mental and behavioral problems
V41  Problems with special senses and other special functions
V42  Organ or tissue replaced by transplant
V43  Organ or tissue replaced by other means
V44  Artificial opening status
V45  Other postsurgical states
V46  Other dependence on machines
V47  Other problems with internal organs
V48  Problems with head, neck, and trunk
V49  Problems with limbs and other problems

Persons encountering health services for specific procedures and aftercare (V50-V59)
V50  Elective surgery for purposes other than remedying health states
V51  Aftercare involving the use of plastic surgery
V52  Fitting and adjustment of prosthetic device
V53  Fitting and adjustment of other device
V54  Other orthopedic aftercare
V55  Attention to artificial openings
V56  Encounter for dialysis and dialysis catheter care
V57 Care involving use of rehabilitation procedures
V58 Other and unspecified aftercare
V59 Donors

**Persons encountering health services in other circumstances (V60-V69)**
V60 Housing, household, and economic circumstances
V61 Other family circumstances
V62 Other psychosocial circumstances
V63 Unavailability of other medical facilities for care
V64 Persons encountering health services for specific procedures, not carried out
V65 Other persons seeking consultation without complaint or sickness
V66 Convalescence and palliative care
V67 Follow-up examination
V68 Encounters for administrative purposes
V69 Problems related to lifestyle

**Persons without reported diagnosis encountered during examination and investigation of individuals and populations (V70-V82)**
V70 General medical examination
V71 Observation and evaluation for suspected conditions
V72 Special investigations and examinations
V73 Special screening examination for viral and chlamydial diseases
V74 Special screening examination for bacterial and spirochetal diseases
V75 Special screening examination for other infectious diseases
V76 Special screening for malignant neoplasms
V77 Special screening for endocrine, nutritional, metabolic, and immunity disorders
V78 Special screening for disorders of blood and blood-forming organs
V79 Special screening for mental disorders and developmental handicaps
V80 Special screening for neurological, eye, and ear diseases
V81 Special screening for cardiovascular, respiratory, and genitourinary diseases
V82 Special screening for other conditions

**SUPPLEMENTARY CLASSIFICATION OF EXTERNAL CAUSES OF INJURY AND POISONING**

**Railway accidents (E800-E807)**
E800 Railway accident involving collision with rolling stock
E801 Railway accident involving collision with other object
E802 Railway accident involving derailment without antecedent collision
E803 Railway accident involving explosion, fire, or burning
E804 Fall in, on, or from railway train
E805 Hit by rolling stock
E806 Other specified railway accident
E807 Railway accident of unspecified nature

**Motor vehicle traffic accidents (E810-E819)**
E810 Motor vehicle traffic accident involving collision with train
E811 Motor vehicle traffic accident involving re-entrant collision with another motor vehicle
E812 Other motor vehicle traffic accident involving collision with another motor vehicle
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E813</td>
<td>Motor vehicle traffic accident involving collision with other vehicle</td>
</tr>
<tr>
<td>E814</td>
<td>Motor vehicle traffic accident involving collision with pedestrian</td>
</tr>
<tr>
<td>E815</td>
<td>Other motor vehicle traffic accident involving collision on the highway</td>
</tr>
<tr>
<td>E816</td>
<td>Motor vehicle traffic accident due to loss of control, without collision on the highway</td>
</tr>
<tr>
<td>E817</td>
<td>Noncollision motor vehicle traffic accident while boarding or alighting</td>
</tr>
<tr>
<td>E818</td>
<td>Other noncollision motor vehicle traffic accident</td>
</tr>
<tr>
<td>E819</td>
<td>Motor vehicle traffic accident of unspecified nature</td>
</tr>
</tbody>
</table>

**Motor vehicle nontraffic accidents (E820-E825)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E820</td>
<td>Nontraffic accident involving motor-driven snow vehicle</td>
</tr>
<tr>
<td>E821</td>
<td>Nontraffic accident involving other off-road motor vehicle</td>
</tr>
<tr>
<td>E822</td>
<td>Other motor vehicle nontraffic accident involving collision with moving object</td>
</tr>
<tr>
<td>E823</td>
<td>Other motor vehicle nontraffic accident involving collision with stationary object</td>
</tr>
<tr>
<td>E824</td>
<td>Other motor vehicle nontraffic accident while boarding and alighting</td>
</tr>
<tr>
<td>E825</td>
<td>Other motor vehicle nontraffic accident of other and unspecified nature</td>
</tr>
</tbody>
</table>

**Other road vehicle accidents (E826-E829)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E826</td>
<td>Pedal cycle accident</td>
</tr>
<tr>
<td>E827</td>
<td>Animal-drawn vehicle accident</td>
</tr>
<tr>
<td>E828</td>
<td>Accident involving animal being ridden</td>
</tr>
<tr>
<td>E829</td>
<td>Other road vehicle accidents</td>
</tr>
</tbody>
</table>

**Water transport accidents (E830-E838)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E830</td>
<td>Accident to watercraft causing submersion</td>
</tr>
<tr>
<td>E831</td>
<td>Accident to watercraft causing other injury</td>
</tr>
<tr>
<td>E832</td>
<td>Other accidental submersion or drowning in water transport accident</td>
</tr>
<tr>
<td>E833</td>
<td>Fall on stairs or ladders in water transport</td>
</tr>
<tr>
<td>E834</td>
<td>Other fall from one level to another in water transport</td>
</tr>
<tr>
<td>E835</td>
<td>Other and unspecified fall in water transport</td>
</tr>
<tr>
<td>E836</td>
<td>Machinery accident in water transport</td>
</tr>
<tr>
<td>E837</td>
<td>Explosion, fire, or burning in watercraft</td>
</tr>
<tr>
<td>E838</td>
<td>Other and unspecified water transport accident</td>
</tr>
</tbody>
</table>

**Air and space transport accidents (E840-E845)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E840</td>
<td>Accident to powered aircraft at takeoff or landing</td>
</tr>
<tr>
<td>E841</td>
<td>Accident to powered aircraft, other and unspecified</td>
</tr>
<tr>
<td>E842</td>
<td>Accident to unpowered aircraft</td>
</tr>
<tr>
<td>E843</td>
<td>Fall in, on, or from aircraft</td>
</tr>
<tr>
<td>E844</td>
<td>Other specified air transport accidents</td>
</tr>
<tr>
<td>E845</td>
<td>Accident involving spacecraft</td>
</tr>
</tbody>
</table>

**Vehicle accidents, not elsewhere classifiable (E846-E849)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E846</td>
<td>Accidents involving powered vehicles used solely within the buildings and premises of an industrial or commercial establishment</td>
</tr>
<tr>
<td>E847</td>
<td>Accidents involving cable cars not running on rails</td>
</tr>
<tr>
<td>E848</td>
<td>Accidents involving other vehicles, not elsewhere classifiable</td>
</tr>
<tr>
<td>E849</td>
<td>Place of occurrence</td>
</tr>
</tbody>
</table>

**Accidental poisoning by drugs, medicinal substances, and biologicals (E850-E858)**
E850 Accidental poisoning by analgesics, antipyretics, and antirheumatics
E851 Accidental poisoning by barbiturates
E852 Accidental poisoning by other sedatives and hypnotics
E853 Accidental poisoning by tranquilizers
E854 Accidental poisoning by other psychotropic agents
E855 Accidental poisoning by other drugs acting on central and autonomic nervous systems
E856 Accidental poisoning by antibiotics
E857 Accidental poisoning by anti-infectives
E858 Accidental poisoning by other drugs

Accidental poisoning by other solid and liquid substances, gases, and vapors (E860-E869)
E860 Accidental poisoning by alcohol, not elsewhere classified
E861 Accidental poisoning by cleansing and polishing agents, disinfectants, paints, and varnishes
E862 Accidental poisoning by petroleum products, other solvents and their vapors, not elsewhere classified
E863 Accidental poisoning by agricultural and horticultural chemical and pharmaceutical preparations other than plant foods and fertilizers
E864 Accidental poisoning by corrosives and caustics, not elsewhere classified
E865 Accidental poisoning from poisonous foodstuffs and poisonous plants
E866 Accidental poisoning by other and unspecified solid and liquid substances
E867 Accidental poisoning by gas distributed by pipeline
E868 Accidental poisoning by other utility gas and other carbon monoxide
E869 Accidental poisoning by other gases and vapors

Misadventures to patients during surgical and medical care (E870-E876)
E870 Accidental cut, puncture, perforation, or hemorrhage during medical care
E871 Foreign object left in body during procedure
E872 Failure of sterile precautions during procedure
E873 Failure in dosage
E874 Mechanical failure of instrument or apparatus during procedure
E875 Contaminated or infected blood, other fluid, drug, or biological substance
E876 Other and unspecified misadventures during medical care

Surgical and medical procedures as the cause of abnormal reaction of patient or later complication, without mention of misadventure at the time of procedure (E878-E879)
E878 Surgical operation and other surgical procedures as the cause of abnormal reaction of patient, or of later complication, without mention of misadventure at the time of operation
E879 Other procedures, without mention of misadventure at the time of procedure, as the cause of abnormal reaction of patient, or of later complication

Accidental falls (E880-E888)
E880 Fall on or from stairs or steps
E881 Fall on or from ladders or scaffolding
E882 Fall from or out of building or other structure
E883 Fall into hole or other opening in surface
E884 Other fall from one level to another
E885 Fall on same level from slipping, tripping, or stumbling
E886 Fall on same level from collision, pushing or shoving, by or with other person
E887 Fracture, cause unspecified
E888 Other and unspecified fall

**Accidents caused by fire and flames (E890-E899)**
E890 Conflagration in private dwelling
E891 Conflagration in other and unspecified building or structure
E892 Conflagration not in building or structure
E893 Accident caused by ignition of clothing
E894 Ignition of highly inflammable material
E895 Accident caused by controlled fire in private dwelling
E896 Accident caused by controlled fire in other and unspecified building or structure
E897 Accident caused by controlled fire not in building or structure
E898 Accident caused by other specified fire and flames
E899 Accident caused by unspecified fire

**Accidents due to natural and environmental factors (E900-E909)**
E900 Excessive heat
E901 Excessive cold
E902 High and low air pressure and changes in air pressure
E903 Travel and motion
E904 Hunger, thirst, exposure, and neglect
E905 Venomous animals and plants as the cause of poisoning and toxic reactions
E906 Other injury caused by animals
E907 Lightning
E908 Cataclysmic storms, and floods resulting from storms
E909 Cataclysmic earth surface movements and eruptions

**Accidents caused by submersion, suffocation, and foreign bodies (E910-E915)**
E910 Accidental drowning and submersion
E911 Inhalation and ingestion of food causing obstruction of respiratory tract or suffocation
E912 Inhalation and ingestion of other object causing obstruction of respiratory tract or suffocation
E913 Accidental mechanical suffocation
E914 Foreign body accidentally entering eye and adnexa
E915 Foreign body accidentally entering other orifice

**Other accidents (E916-E928)**
E916 Struck accidentally by falling object
E917 Striking against or struck accidentally by objects or persons
E918 Caught accidentally in or between objects
E919 Accidents caused by machinery
E920 Accidents caused by cutting and piercing instruments or objects
E921 Accident caused by explosion of pressure vessel
E922 Accident caused by firearm missile
E923 Accident caused by explosive material
E924 Accident caused by hot substance or object, caustic or corrosive material, and steam
E925 Accident caused by electric current
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E926</td>
<td>Exposure to radiation</td>
</tr>
<tr>
<td>E927</td>
<td>Overexertion and strenuous movements</td>
</tr>
<tr>
<td>E928</td>
<td>Other and unspecified environmental and accidental causes</td>
</tr>
</tbody>
</table>

**Late effects of accidental injury (E929)**
- E929  Late effects of accidental injury

**Drugs, medicinal and biological substances causing adverse effects in therapeutic use (E930-E949)**
- E930  Antibiotics
- E931  Other anti-infectives
- E932  Hormones and synthetic substitutes
- E933  Primarily systemic agents
- E934  Agents primarily affecting blood constituents
- E935  Analgesics, antipyretics, and antirheumatics
- E936  Anticonvulsants and anti-Parkinsonism drugs
- E937  Sedatives and hypnotics
- E938  Other central nervous system depressants and anesthetics
- E939  Psychotropic agents
- E940  Central nervous system stimulants
- E941  Drugs primarily affecting the autonomic nervous system
- E942  Agents primarily affecting the cardiovascular system
- E943  Agents primarily affecting gastrointestinal system
- E944  Water, mineral, and uric acid metabolism drugs
- E945  Agents primarily acting on the smooth and skeletal muscles and respiratory system
- E946  Agents primarily affecting skin and mucous membrane, ophthalmological, otorhinolaryngological, and dental drugs
- E947  Other and unspecified drugs and medicinal substances
- E948  Bacterial vaccines
- E949  Other vaccines and biological substances

**Suicide and self-inflicted injury (E950-E959)**
- E950  Suicide and self-inflicted poisoning by solid or liquid substances
- E951  Suicide and self-inflicted poisoning by gases in domestic use
- E952  Suicide and self-inflicted poisoning by other gases and vapors
- E953  Suicide and self-inflicted injury by hanging, strangulation, and suffocation
- E954  Suicide and self-inflicted injury by submersion [drowning]
- E955  Suicide and self-inflicted injury by firearms and explosives
- E956  Suicide and self-inflicted injury by cutting and piercing instruments
- E957  Suicide and self-inflicted injuries by jumping from high place
- E958  Suicide and self-inflicted injury by other and unspecified means
- E959  Late effects of self-inflicted injury

**Homicide and injury purposely inflicted by other persons (E960-E969)**
- E960  Fight, brawl, and rape
- E961  Assault by corrosive or caustic substance, except poisoning
- E962  Assault by poisoning
- E963  Assault by hanging and strangulation
E964 Assault by submersion [drowning]
E965 Assault by firearms and explosives
E966 Assault by cutting and piercing instrument
E967 Child and adult battering and other maltreatment
E968 Assault by other and unspecified means
E969 Late effects of injury purposely inflicted by other person

Legal intervention (E970-E978)
E970 Injury due to legal intervention by firearms
E971 Injury due to legal intervention by explosives
E972 Injury due to legal intervention by gas
E973 Injury due to legal intervention by blunt object
E974 Injury due to legal intervention by cutting and piercing instruments
E975 Injury due to legal intervention by other specified means
E976 Injury due to legal intervention by unspecified means
E977 Late effects of injuries due to legal intervention
E978 Legal execution

Injury undetermined whether accidentally or purposely inflicted (E980-E989)
E980 Poisoning by solid or liquid substances, undetermined whether accidentally or purposely inflicted
E981 Poisoning by gases in domestic use, undetermined whether accidentally or purposely inflicted
E982 Poisoning by other gases, undetermined whether accidentally or purposely inflicted
E983 Hanging, strangulation, or suffocation, undetermined whether accidentally or purposely inflicted
E984 Submersion [drowning], undetermined whether accidentally or purposely inflicted
E985 Injury by firearms and explosives, undetermined whether accidentally or purposely inflicted
E986 Injury by cutting and piercing instruments, undetermined whether accidentally or purposely inflicted
E987 Falling from high place, undetermined whether accidentally or purposely inflicted
E988 Injury by other and unspecified means, undetermined whether accidentally or purposely inflicted
E989 Late effects of injury, undetermined whether accidentally or purposely inflicted

Injury resulting from operations of war (E990-E999)
E990 Injury due to war operations by fires and conflagrations
E991 Injury due to war operations by bullets and fragments
E992 Injury due to war operations by explosion of marine weapons
E993 Injury due to war operations by other explosion
E994 Injury due to war operations by destruction of aircraft
E995 Injury due to war operations by other and unspecified forms of conventional warfare
E996 Injury due to war operations by nuclear weapons
E997 Injury due to war operations by other forms of unconventional warfare
E998 Injury due to war operations but occurring after cessation of hostilities
E999 Late effects of injury due to war operations


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