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A Geographical Examination of Social, Behavioral, and Demographic Determinants Association with Hepatitis C Viral Infection in the State of Georgia

Terran A. Terrell
Georgia State University

A Geographical Examination of social, behavioral, and demographic determinants association with Hepatitis C Viral Infection in the State of Georgia

By Terran A. Terrell

B.A., University of Michigan

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Abstract

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(Under the direction of Dr. Richard Rothenberg, Faculty Member)

Background: Approximately 170 million persons are infected with the hepatitis C viral infection (HCV), globally. Of this number, 3.2 – 4 million persons in the U. S. are infected with HCV. Although previous research has indicated a decrease in the rates of Hepatitis C in the U.S. approximately 12,000 deaths occur annually from those who suffer from chronic liver disease, as a result of being chronic carriers of HCV. Being a recipient of blood transfusions prior to 1992, intravenous drug users (IDUs), or persons with multiple sex partners are associated with increased risk for HCV infection. IDUs constitute the largest cohort for those infected with HCV. Due to the few clinical manifestations HIV and HCV share and HIV patients living longer due to Highly Active Antiretroviral Therapy (HAART), Many individuals infected with HIV are discovering co-morbidities with HCV.

Methods: Secondary Data from the State Electronic Notifiable Disease Surveillance System (SENDSS) were used to analyze all confirmed cases of hepatitis C in the state of Georgia for the year 2009. All subjects in this analysis were confirmed as Hepatitis C infected. Descriptive frequencies for all categorical data were tested and analyzed, which included: gender, race, geographic region, disease status, age distribution, risk factor data such as injection drug use, blood transfusion prior to 1992, long term hemodialysis, accidental needle stick, tattoo, sexual contacts, and incarceration. Binary logistic regression for univariate and multivariate analysis was used to test the associations between geographic region of all HCV cases and their demographic characteristics.

Results: Descriptive analysis of the prevalence of HCV cases in Georgia in 2009 reveal higher rates of HCV in rural regions (GOA) of the state among White males of non-Hispanic origin. In this same region, these cases were more likely to report risk factors involving injection drug use, blood transfusions prior to 1992, incarceration, or tattoos. Prevalence of most cases of HCV in Georgia for the year 2009 are seen in those age 20 – 30 and those 40 – 60. A higher number of those reporting intravenous drug use in metropolitan Atlanta (MSA) are Black of non-Hispanic origin. Bivariate logistic regression reveals that White Non-Hispanics living in rural areas of Georgia (GOA) have a 3.48 higher odds of being infected with Hepatitis C than Black Non-Hispanics (OR = 3.48, $p < 0.001$, CI 2.54 – 4.77).

Conclusion: Resources for prevention of Hepatitis C should be directed to marginalized communities within Georgia regions outside of the Atlanta Metropolitan Statistical Area. The primary focus of prevention should also be tailored to new initiates of intravenous drug use and those 20 – 30 and 40 – 60 years of age. Further knowledge and understanding of behaviors that put individuals at risk for acquiring Hepatitis C, such as intravenous drug use, in rural Georgia may warrant interventions tailored to benefit these communities from acquiring or spreading Hepatitis C.

Key Words: Hepatitis C, Intravenous Drug Use, Georgia, Ethnicity, Risk Factors

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By

Terran A. Terrell

Approved:

Michael P. Eriksen, SC.D.

Committee Chair:

Richard Rothenberg, MD, MPH, FACP

Committee Member

Sheryl Strasser, PhD

Committee Member

Ike Okosun, M.S., MPH, PhD, FRIPH, FRSH

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The author of this thesis is:

Terran Terrell
1668 Brentwood Xing S.E.
Conyers, GA 30013

The Chair of the committee for this thesis is:

Dr. Richard Rothenberg
140 Decatur St.
PO Box 3995
Atlanta, GA 30302-3995

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Curriculum Vitae

Terran A. Terrell
1668 Brentwood Crossing SE • Conyers, GA • 30013
248-219-1523 • E-Mail Terran.Terrell@gmail.com

Education:

The University of Michigan — 2002 – 2006
Bachelor of Arts in Music — Ann Arbor, MI
(With emphasis in Musicology)

Everest Technical Institute — 2006 - 2007
Patient Care Technician/Nursing Assistant — Jonesboro, GA

Masters of Public Health — 2008 - Present
(Emphasis in Prevention Science/Epidemiology) — Atlanta, GA
Georgia State University
Outreach Coordinator of Public Health Institute Student Association (PHISA)

Experience & Employment History:

Cobb & Douglas County Public Health (Division of Public Health -- Epidemiology)
September 2010 - Present

- Surveillance and case investigation for all Enteric Gastrointestinal Infections and Non-Perinatal Hepatitis cases
- Maintaining Quarterly Performance Reports
- Insurance of accurate collection of data and vital statistics for the purpose of reporting, evaluating, and investigating foodborne disease.
- Maintaining an enhanced and working knowledge of Microsoft Office Suite (excel, word, power-point, and access) SPSS, SAS, and GIS

Georgia Department of Community Health (Division of Public Health -- Epidemiology)
September 2009 - September 2010

- Surveillance, case reporting, and interviewing of food-borne diseases within the state of Georgia
- Upkeep of Georgia Public Health Laboratory Records and outbreak confirmation of salmonella cases within Georgia
- Insurance of accurate collection of data and vital statistics for the purpose of reporting, evaluating, and investigating foodborne disease outbreaks in the state of Georgia.
- Maintaining an enhanced and working knowledge of Microsoft Office Suite (excel, word, power-point, and access) and SPSS and SAS

Georgia Department of Community Health (Division of Public Health -- Epidemiology)
August 2008 - September 2009

- Surveillance and Database Entry of Hepatitis C cases in the state of Georgia.
- Insurance of accurate collection of data and vital statistics for the purpose of reporting, evaluating, and investigating Hepatitis C outbreaks in the state of Georgia.
- Enhanced knowledge of Microsoft office Suite including power-point, word, excel, and access and SPSS.

Table of Contents

ACKNOWLEDGEMENTS iv

LIST OF TABLES ix

LIST OF FIGURES x

INTRODUCTION 1
1.1 Background 1
1.2 Purpose of Study 3
1.3 Research Questions 3
1.4 Hypothesis 4

REVIEW OF THE LITERATURE (Hepatitis C Viral Infection) 5
Case definitions and Clinical Manifestations of HCV 5
A Global Overview of the Prevalence and Burden of HCV 10
United States Overview of the Prevalence and Burden of HCV 14
State of Georgia Overview of the Prevalence and Burden of HCV 18
Geographical and Cultural Overview and Conception of HCV 23

METHODS 28
3.1 Data Sources 28
3.2 Study Variables 29
3.3 Study Population 31
3.4 Statistical Analysis 31

RESULTS 33

DISCUSSION AND CONCLUSION 37
5.1 Discussion 37
5.2 Study Limitations 38
5.3 Recommendations 40
5.4 CONCLUSION 41

REFERENCES 44
APPENDIX 1 47
APPENDIX 2 53

List of Tables

Table 1.1: Number and percentage of patients with acute hepatitis C who reported selected epidemiologic characteristics, by age group — United States, 2007 …………………………………………………………27
Table 1.2: Surveillance for Acute Viral Hepatitis – United States, 2007…………………………………….48
Table 1.3: Disease Burden from Viral Hepatitis C in the United States………………………………..48
Table 1.4: Incidence of Hepatitis C, United States……………………………………………………..49
Table 1.5: Percentage of acute hepatitis cases that included risk factor data, by state/area --- United States, 2007…………………………………………………………………………………...51
Table 2.1: Basic Descriptive Characteristics of Hepatitis C Subjects in the State of Georgia (2009).....53
Table 2.2: Age Characteristics and Age Distribution Characteristics for Hepatitis C Subjects in the State of Georgia (2009)……………………………………………………………………………..55
Table 2.3: Geographic Distribution of Basic Descriptive Characteristics of Hepatitis C Subjects in the State of Georgia (2009)………………………………………………………………………….56
Table 2.4: Geographic Distribution of Hepatitis C Risk Factor Data for the State of Georgia (2009)…56
Table 2.5: Geographic Distribution Age Distribution for Hepatitis C Subjects in the State of Georgia (2009)……………………………………………………………………………………….58
Table 2.6: Ethnic Distribution of Basic Descriptive Characteristics for Hepatitis C Subjects in the State of Georgia (2009) …………………………………………………………………………… 58
Table 2.7: Ethnic Distribution of the Age Distribution for Hepatitis C Subjects in the State of Georgia (2009)………………………………………………………………………………………60
Table 2.8: Association Among Selected Descriptive and Risk Factor Variables and Geographic Region for the State of Georgia (2009): Univariate Analysis…………………………………………...61
Table 2.9: Descriptive Characteristics of Hepatitis C Risk Factors for Hepatitis C Subjects in the State of Georgia (2009)…………………………………………………………………………......54
Table 2.10: Association Among Selected Descriptive and Risk Factor Variables and Geographic Region for the State of Georgia (2009): Multivariate Analysis………………………………………62

List of Figures

Figure 1.1: Incidence of Acute Hepatitis C, by year, United States, 1980 – 2007…………………..49

Figure 1.2: Georgia EIP Regional Map………………………………………………………...52

Figure 2.1: Age Distribution Characteristics for Hepatitis C Subjects in the State of Georgia, 2009……………………………………………………………………………………………..55

CHAPTER I
INTRODUCTION

1.1 Background

Hepatitis, inflammation of the liver, is a disease that results from the infection of the Hepatitis A virus (HAV), Hepatitis B virus (HBV), the hepatitis C virus (HCV) or even the Hepatitis D and Hepatitis E virus. Hepatitis C is the leading cause of death and reason for liver transplantation in the United States and is even identified as a global issue with some three percent of the world's population infected with the virus (World Health Organization Global Alert and Response, 2002) (Benoit, et al., 2007). According to the Centers for Disease Control & Prevention, 2.7 – 3.9 million people are chronically infected with HCV in the U.S. and approximately 12,000 deaths are reported annually from chronic liver disease resulting from HCV infection.

Chronic Hepatitis C is a serious long term illness from the virus that can result in end stage liver disease, cirrhosis, severe liver inflammation, or even death (Daniels, Grytdal, & Wasley, 2007). Reasons for such results from chronic HCV infection are either due to lack of prophylaxis (no vaccines exist for HCV) or lack of treatment and detection of the diseases during two to six months following exposure (Georgia Division of Public Health -- Epidemiology, 2005).

HCV prevention primarily relies on early detection, testing, surveillance, and avoiding behaviors that can put an individual at risk for infection (Daniels, Grytdal, & Wasley, 2007) (Georgia Division of Public Health -- Epidemiology, 2005). Adding to the burgeoning issue of detection and treatment of HCV is the difficult task of the healthcare practitioner, specialist, or even patient to recognize a disease that may remain asymptomatic for some time (especially for children) (Georgia Division of Public Health -- Epidemiology, 2005).

Acute Hepatitis C is a short term onset of the disease (usually the first six months after exposure) when the classic symptoms of the HCV infection are seen, which include: abdominal pain, fatigue, jaundice, and through clinical diagnosis and detection high levels of aminotransferase (ALT/AST) (Georgia Division of Public Health -- Epidemiology, 2005) (Seef, Strader, Thomas, & Wright, 2004).

Each year 17,000 new cases of HCV infection are seen in the U.S. (Centers for Disease Control and Prevention, 2007). The prevalence of chronic HCV infection is nearly three times that of the HIV infection and is expected to get worse in the coming years (Benoit, et al., 2007). The previous figure is probably an underestimate of actual cases (Thomson, 2009) (Georgia Division of Public Health -- Epidemiology, 2005). Some of the underreporting may arise from the difficulty of identifying the HCV infection in those that remain asymptomatic for the disease.

Many cases infected with the Human Immunodeficiency virus are living longer due to the advent of highly – active antiretroviral therapy (HAART), resulting in the reduction of morbidity and mortality of those infected with HIV (Benoit, et al., 2007) (Oramasionwu, et al., 2009). On the other hand, many of these cases are discovering that they are co-infected with the HCV infection because the spread of both viruses are caused by similar common risk factors such as Intravenous Drug Use (IDU), blood transfusions in patients before 1992, and certain sexual acts and behaviors (Benoit, et al., 2007).

As of 2003 there was a plateau in the rates of Hepatitis C in the state of Georgia, which followed a sharp decline in the rates after a high peak in 1992. Hepatitis A and B rates in Georgia have exceeded the national rate, while Hepatitis C rates have been difficult to determine and provided with estimates, due to poor reporting and surveillance by clinical practitioners and patients. This dilemma can be due to patients and practitioners' limited understanding of the HCV infection, lack of availability of HCV informative resources and testing, or lack of funding and resources for state surveillance programs for Hepatitis (Georgia Division of Public Health -- Epidemiology, 2005).

Taking the previous issues into account, Georgia faces an issue in identifying true and accurate reportable numbers of Hepatitis C cases, when in reality we could already be experiencing rates that parallel or exceed that of the national rate of HCV cases. Such numbers and investigation of where the disease is prevalent in Georgia, and who is experiencing most of the burden of this disease will also show where most of the states resources should be allocated for the diagnosis, treatment, and prevention of the disease (cf. recent Doonesbury). Through further study and investigation of such areas and populations can help public health practitioners identify risk factors and behaviors unique to these areas and populations that cause the spread of the Hepatitis C Virus.

1.2 Purpose of Study

The purpose of this study is to determine the association of geography, race/ethnicity, and other demographic factors with Hepatitis C rates in the state of Georgia. Hepatitis C is believed to be a growing burden in the U.S. While Hepatitis A & B rates in Georgia have been reported to exceed the national Hepatitis A & B rates, Hepatitis C rates have been *estimated* to plateau in Georgia after 1992. Such "estimates" of rates are either due to poor reporting, lack of surveillance programs, availability clinical information and resources to providers, and patients on HCV infection, and limited awareness and prevention efforts among high-risk populations (Georgia Division of Public Health -- Epidemiology, 2005). Through studying and understanding the various risks for HCV among various populations and geographical arenas in Georgia, a lucid understanding of where resources for diagnosis, treatment, and prevention should be focused on in Georgia and identifying various unique aspects which set such populations and geographical regions at more risk for HCV infection than others.

1.3 Research Questions

This investigation will add to any existing literature on Hepatitis C morbidity and mortality in Georgia. Questions addressed in this research will include: Are White non – Hispanic individuals living in Georgia are more at risk for Hepatitis C than Black non-Hispanic individuals living in Georgia? Does this difference in risk correlate with geographic region in which the cases reside whether it is in the

Atlanta Metropolitan Statistical area (MSA) or Georgia Outside of Atlanta (GOA)? Are age and gender associated in a difference in risk for Hepatitis C. Finally, is there an association between geographic regions and certain social and behavioral activities that may put individuals at risk for Hepatitis C?

1.4 Hypothesis

Georgia, as well as the U.S., shows a plateau in estimated rates of HCV infection, but limitations hinder public health officials in investigating further into the activities and risk taking behaviors involved in populations most at risk for infections. What prevents such further investigation is that most of the risk taking behaviors associated with the transmission of HCV infection is caused by behaviors that are considered criminal, such as intravenous drug use. With the lack of resources and funding in public health in Georgia, lack of access to primary care, minimal active surveillance, risk taking behaviors, methamphetamine use, in rural Georgia, and Georgia as a major drug trafficking hub Georgia will experience a rise in HCV infection rates especially in white non-hispanic males living in rural Georgia or Georgia Outside of Atlanta (GOA).

With the lack of resources and funding, lack of access to primary care, and risk taking behaviors in urban areas around and in Atlanta, and Atlanta being one of the major drug trafficking hubs in America, there will be a rise in HCV infection rates in black non-hispanic individuals living in Atlanta's Metropolitan Statistical Area (MSA). Rates of HCV infection differ significantly based on race and ethnicity in accordance to various demographic regions in the state of Georgia. Whatever rates of HCV infection one ethnic group may experience in Metro Atlanta could differ for the same ethnic group in rural Georgia, therefore Geography plays a critical role in further investigating the burden of HCV infection in Georgia.

CHAPTER II
REVIEW OF THE LITERATURE

The purpose of this study is to determine the association between Hepatitis C Viral Infection rates in the state of Georgia in accordance to demographic factors such as race/ethnicity, gender, and geography. Further investigation on injection drug use (IDU), the number one risk factor for HCV Infection, within the Atlanta Metropolitan Statistical Area (MSA) and Georgia Outside of Atlanta (GOA) regions of Georgia as well as ethnic/racial makeup of these respective regions were needed to determine which populations and regions in Georgia are experiencing higher rates of HCV infection. From this information and further analysis it could also be concluded which population of individuals and regions in Georgia are more at risk for seeing an increase in rates of HCV infection, therefore revealing the regions and populations in Georgia where public health officials should focus their prevention strategies.

2.1 Hepatitis C Viral Infection: Case definitions and Clinical Manifestations

Non – A hepatitis, non – B hepatitis, as the Hepatitis C Viral (HCV) Infection was originally called, was first identified in the 1960s (Benoit, et al., 2007) (Georgia Division of Public Health -- Epidemiology, 2005). The virus was first seen in the post-transfusion population prior to 1992. Since 1992 screening is now mandatory prior to any process involving blood transfusions and blood donations, thus lowering the risk of acquiring HCV (Benoit, et al., 2007).

The Hepatitis C Viral infection is the leading cause of chronic liver disease and is a virus in which the magnitude of infection is difficult to determine and is underestimated due to various clinical manifestations of the virus (Thomson, 2009) (Georgia Division of Public Health -- Epidemiology, 2005). 85% of those infected develop chronic infection (Georgia Division of Public Health -- Epidemiology, 2005). The hepatitis virus is a small enveloped virus containing a positive single stranded RNA genome (9600 nucleotides in length) (Thomson, 2009). The virus attacks the adaptive immune response of the individual, thus making it more likely for individuals exposed to develop the chronic illness of HCV. It is not uncommon for those infected with HIV to be co-infected with HCV. In such a case the consequences of HCV infection are more severe. This occurrence is common due to the shared risk factors the viruses have (Chung & Kim, 2009).

Due to HAART therapies and other multidrug treatments for HIV, those infected and clearing HIV are suffering less mortality, but cannot rule out the chance of co-infection with HCV (Georgia Division of Public Health -- Epidemiology, 2005) (Chung & Kim, 2009) (Alter, et al., 1999). Due to the implementation of therapies for HIV, such as HAART, the once known fatal disease of HIV has transformed itself into a debilitating chronic infection (Chung & Kim, 2009). Since the introduction of highly active antiretroviral therapy (HAART) and the improved survival rate for HIV infected patients, HCV and its complications (such as progressive acceleration of liver disease) have become the main source of morbidity and mortality in the IDU population of person's infected with HIV, therefore HIV patients should be screened for HCV infection, a practice that has not yet been widely implemented due to the slow progression of the clinical nature of HCV (Chung & Kim, 2009) (Alter, et al., 1999) (Dienstag, 2006).

Co-Infection with HIV and HCV increases the morbidity and mortality experienced by infected patients. A prospective observational cohort known as HOPS studies and analyzes patients receiving care at ten outpatients public and private clinics in Chicago, IL, Denver, CO, Long Island, NY, Oakland, CA, Philadelphia, PA, San Leandro, CA, Tampa, FL, and Washington DC. This is an ongoing and open cohort where patients, after a diagnosis with HIV, can enter the study and leave the study at any time. From 1996 to 2007, of 7618 patients who were active in HOPS, the proportion of patients with positive

HCV diagnosis increase from 10.7% - 76.6% in the clinics (8-fold increase), taking into account that the number of active patients in HOPS during 1996 – 2007 varied (Spradling, et al., 2010). These results show that by following the 1999 guidelines of testing all HIV infected individuals for HCV, regardless of risk, a significant number of co-infected cases can be identified and treated promptly to reduce morbidity and mortality.

Acute HCV is a discrete onset of symptoms such as Jaundice, elevated amino transferase levels (>400 IU/L) (Daniels, Grytdal, & Wasley, 2007). Several methods can be used in detecting HCV which include testing for antibodies to HCV with EIA (enzyme immunoassay) and using HCV RNA to measure the presence of viremia. Amino-transferase (ALT/AST) levels higher than normal account for the presence for acute HCV infection. Those infected with acute HCV may go through a 2 to 6 week phase of the virus being undetected (asymptomatic) and such acute infections, due to the lack of pre-prophylactic actions unlike Hepatitis A and Hepatitis B (no vaccine exists for Hepatitis C), and lack of detectability, can lead to chronic infection, cirrhosis, and severe liver inflammation (Georgia Division of Public Health -- Epidemiology, 2005) (Daniels, Grytdal, & Wasley, 2007).

Those who develop chronic hepatitis C may experience a serious progression of illness leading to severe long term liver scaring and inflammation. Seventy to 90 percent of individuals infected with HCV fail to clear the virus during the acute phase (Daniels, Grytdal, & Wasley, 2007) (World Health Organization Global Alert and Response, 2002). Five -20 percent may develop cirrhosis while 5% of those infected with HCV may die from long term infection (World Health Organization Global Alert and Response, 2002). Intravenous Drug use is the number one risk factor for acquiring HCV infection and intravenous drug users (IDUs) constitute the largest population of those infected with the virus in developed nations (Thomson, 2009). Injection drug use has also been the number one public health concern for the spread of infectious disease such as HIV, HBV, HCV, and the co-infections of both HBV and HCV with HIV (Tempalski, 2007).

Hepatitis C is known to be hyper-endemic in the IDU population with a prevalence reaching 90% at times (Lelutiu-Weinberger, et al., 2009). Other risk factors include receiving blood transfusions prior to 1992, long term hemodialysis, health care work, sexual contact with those infected, multiple sex partners, men who have sex with men (MSM), infants born to infected women, incarcerated individuals, and receiving tattoos administered with unsterilized equipment (Georgia Division of Public Health -- Epidemiology, 2005). According to a prevalence study done in the United States from 1988 – 1994, among all racial and ethnic groups, on HCV infection, increased prevalence of the virus was reported to be associated with persons who had a history of cocaine or marijuana use, early stage of first sexual intercourse, higher number of sexual partner, infection with herpes simplex virus II, and were engaged in intravenous drug use and high-risk sexual behavior (Chung & Kim, 2009) (Alter, et al., 1999) (Garfein, Vlahov, Galai, Doherty, & Nelson, 1996).

Higher rates of HCV infection were found among non-hispanic blacks and non-hispanic white male subjects, this in turn projects a visual stigma upon non-Hispanic Blacks, due to the higher distribution of disease seen in such populations, along with these same subjects testing positive for HIV (Garfein, Vlahov, Galai, Doherty, & Nelson, 1996) (Alter, et al., 1999). Higher prevalence of HCV infection was found in those 30 – 49 years of age and those living below the poverty level; no association was found between the prevalence of HCV infection and geographic region of residence for an individual (Alter, et al., 1999). Although IDUs are primarily responsible for the increase in prevalence for HCV infection, initiates to injection drug use are at higher risk for HCV infection than experienced drug users, due to high rates of viremia occurring within the first few months of initiation (Garfein, Vlahov, Galai, Doherty, & Nelson, 1996). New initiates and short term drug users, although at increased risk compared to their counterparts who are more experienced IDUs, do not display high risk sexual activity or higher risk injection practices that will further increase their risk for HCV infection (Garfein, Vlahov, Galai, Doherty, & Nelson, 1996).

Since 2004 the incidence of HCV has hit a plateau for all racial and ethnic populations except for American Indians and Alaskan Natives. In 2007 rates were similar across all racial and ethnic population. In that same year, the most common risk factor reported for HCV was Intravenous Drug Use (48%) (Daniels, Grytdal, & Wasley, 2007) (Centers for Disease Control and Prevention, 2007). 42% reported having multiple sex partners, while 10% reported having contact with another known HCV infected individual, 10% were MSM, and 2% reported occupational exposure to blood infected with HCV. After rates for HCV hit a peaked in the late 1980s and early 1990s there was a decline in the incidence through the rest of the 1990s due to recognition of intravenous drug use (IDU) as the number one risk factor for HCV and the decline of IDU activity through the rest of the 1990s. Required screening for blood products and donors in the early 1990s also contributed to the decline of HCV rates.

A long term prospective study of HCV showed among 895 monogamous heterosexual partners of individuals chronically infected with the virus (total follow p period of more than 8000 person-years) found a low or null risk of sexual transmission (Alter, et al., 1999) (Thomson, 2009). Men who have sex with men (MSM) are experiencing an increase in acute HCV infection, especially among those in this population already infected with HIV (Thomson, 2009). Transmission in this group can be correlated with per-mucosal as opposed to per-cutaneous methods of transmission, number of sexual partners, sharing of drugs through nasal route, a high number of sexual partners, and high risk sexual activity (Thomson, 2009) (World Health Organization Global Alert and Response, 2002). Most studies still show less than a 5% risk of mother to infant transmission, with those co-infected with HCV and HIV twice as likely to transmit HCV than those infected with HCV alone. Screening, testing blood donors, viral inactivation of plasma-derived products, risk-reduction counseling, screening of persons at risk for HCV infection, and routine practice of infection control in health care settings are examples of ways to address primary prevention practices to reduce the risk of HCV Transmission.

National surveillance for viral hepatitis started in 1966. During 1995-2007, rates for all three types of acute hepatitis declined due to effective surveillance of the virus and effectiveness of the Hepatitis A and Hepatitis B vaccines (World Health Organization Global Alert and Response, 2002). Co-factors for disease progression of HCV include increased age at disease progression, alcohol intake, and MSM practices. Natural history in the progression of HCV shows that in the U.S. HCV will rise and the some of the same models predict that deaths from HCV will rise by the year 2030 (Thomson, 2009). Accurate and reliable surveillance of HCV is critical in altering this projected trend. Surveillance detects outbreaks and identifies those in need of post exposure prophylaxis, provides information on trends occurring due to the infection and within the cohorts infected, the collection of risk data, and the development of prevention strategies.

2.2 Hepatitis C Viral Infection: A Global Overview of the Prevalence and Burden of HCV

Hepatitis C is a major issue in both Developing and Developed nations around the world (Alavian, Ahmadzad-Asi, Lankarani, Shahbabaie, Ahmadi, & Kabir, 2009). IDUs account anywhere from 30% - 60% of the global HCV infection rate. Many studies have estimated the incidence of new infections for HCV globally to be approximately 40 per 100 person-years at risk (Rhodes & Treloar, 2008). A case-control study that was conduced in four counties in china, through data collected from HCV screening, showed how HCV infection prevalence differ based on geographic region, time, and behavioral changes (Cai, et al., 2009). Prevalence of HCV in China was approximately 3.2% of the country's population, but studies have placed the prevalence of HCV in China anywhere from 0% - 30% depending upon the region.

In developing countries the main risks for HCV infection are iatrogenic factors like inadequate sterilization, reuse of medical equipment, or blood transfusion (Reeler, 2000). This trend can be seen in many developing nations where injections are given with faulty and unsatisfactory sterilization practices due to insufficient knowledge or lack of equipment (Reeler, 2000). In the previous study in Anyang, China persons who were sero-positive for HCV were enrolled in a case-control study where the association between three risk factors for HCV known in this region were examined: esophageal balloon examination (OR=3.78), blood transfusion (OR=4.55), Intravenous drug use (OR=5.83).In some developing countries there have been no overall estimate of HCV infection prevalence, or no review of published evidence related to HCV for the purpose of providing an accurate estimation of the prevalence of HCV infection of the general population. Iran is an example of one such country; until a formal systematic review of all HCV related reports from were collected from various research and medical related institutions (Alavian, Ahmadzad-Asi, Lankarani, Shahbabaie, Ahmadi, & Kabir, 2009).

Transmission through exposure to infected blood or blood products, infected medical equipment, intravenous drug use, hemodialysis, and organ transplantations were associated with risk of infection for Hepatitis C in both developing and developed nations globally, including countries such as Iran, an infection that affects approximately 170 million world wide (Alavian, Ahmadzad-Asi, Lankarani, Shahbabaie, Ahmadi, & Kabir, 2009). In Iran, 0.08%-1.3% of the general population in 2006 was infected with HCV (Alavian, Ahmadzad-Asi, Lankarani, Shahbabaie, Ahmadi, & Kabir, 2009). Rate of occurrence in groups such as IDUs, and patients undergoing long term hemodialysis was seen in such a group in Iran and even for other nations globally. This study also proved that epidemiologic evidence is one main strategy that is crucial in attaining information on prevalence of such an infection, for the purpose of prevention.

Accurate and efficient data collection on HCV infected cases are important to public health for the purpose of establishing rational strategies in order to further comprehend the morbidity and mortality associated with chronic HCV infection throughout various known cohorts at risk for the infection (Thomson, 2009). In this study, prevalence varied according to province in Iran as opposed to the study in Anyang, China which shows no correlation of HCV infection with geography. In Iran, provinces bordering neighboring countries encountered a higher risk and prevalence of HCV infection than those more populous and centered within the country (Alavian, Ahmadzad-Asi, Lankarani, Shahbabaie, Ahmadi, & Kabir, 2009). In a cohort study in Trent, England (N = 2285) participants from various secondary care clinics were matched to other representative HCV-infected populations in England. From this study, it was found that HCV-infected persons experience a death rate three times higher than that of their age matched population due to Chronic drug use (Thomson, 2009).

A national survey, conducted ten years ago, showed the prevalence of antibodies (anti-HCV) of individuals in metropolitan France, ages 20 – 29 years, to be approximately 1.05% (500,000 – 600,000 persons when extrapolated to the French population) (Meffre, et al., 2010). Due to the national health insurance system set up in France, demographics information was collected from participants based on a five region stratified and multistage sampling design. This study shows that in metropolitan France anti-HCV prevalence in 2004 was 0.84% (95% Confidence Interval (CI): 0.65 – 1.10) for individuals ages 18 – 80 (Meffre, et al., 2010). Prevalence was not statistically different for males and females.

An increase in prevalence was seen in those individuals with less than 12 years of education, low socioeconomic status, and those unemployed. For both males and females, prevalence of anti-HCV was highest for those ages 40 – 80 years of age (Meffre, et al., 2010). An increase in prevalence was seen in those who were recipients of blood transfusion prior to 1992, those who reported ever injecting drugs, and for those reporting nasal drug use, (3.7%, $p = 0.02$), (55.7%, $p = 0.01$), and (9.3%, $p = 0.01$) respectively (Meffre, et al., 2010). Prevalence was also high in those reporting previously having surgery, needle stick injury, tattooing, and more than 10 sex partners. This population based seroprevalence survey demonstrates another global case in which HCV presents itself as a burden to a developed nation.

Most HCV infections are asymptomatic or mildly symptomatic with a continual progression in infection seen in 85% of cases (World Health Organization Global Alert and Response, 2002). Risk of Hepatocellular Carcinoma (HCC) can be seen mainly in groups living with cirrhosis. One-third of all cases of HCC in the U.S. and 90% of cases HCC in Japan are associated with chronic HCV (World Health Organization Global Alert and Response, 2002) (Meffre, et al., 2010). Chronic Hep C progresses at different rates depending on the infected individual. Antiviral Therapy should be advised for patients suffering or at risk of developing chronic HCV. Liver biopsy is usually necessary to uncover the histologic stage of the disease progression for determining what therapies are needed. Injection drug users constitute the largest group of those infected with Hepatitis C. Some studies have shown that Blacks have less favorable antiviral kinetics than whites, therefore they experience a lower than normal response rates to antiviral treatment. Some of these disparities have yet to be explained.

Seroprevalence of HCV can vary based on geography globally and specific risk factors in association with the infection in a particular region, as the study in Iran tried to prove (Hepburn & Lawitz, 2004). A study in Haiti on the seroprevalence of HCV tried to further investigate geographical and risk factor data in its association with the prevalence of HCV in the country. Intravenous Drug Use ($r = 0.26$, $p < 0.001$), intranasal cocaine use ($r = 0.29$, $p < 0.001$) and the number of lifetime sex partners ($r = 0.24$, $p < 0.001$) were all found to be statistically significant in their positive correlation with respect to HCV prevalence. In such a model, intravenous drug use and the number of sexual partners were associated with HCV infection (OR 3.7, 1.52 - 9.03 95% CI; OR 1.1, 1.04 - 1.20 95% CI, respectively) (Hepburn & Lawitz, 2004).

These data were representative of the urban population of Haiti, which has been the focus of many studies globally. Limited data and risk factor information in rural populations and high risk populations globally and in the U.S. limit further investigation of the burden and prevalence of hepatitis C. Although the incidence of infection is falling in some countries the burden of chronic infection from

HCV continues to rise. Intervention strategies proven through much evidence from studies, such as syringe exchange and distribution programs, are needed to prevent this trend from occurring or else a considerable rise in morbidity and mortality from HCV may be experience by the year 2030 (Thomson, 2009) (Rhodes & Treloar, 2008). However, barriers still exist against the enhancement of prevention methods against HCV such as national policies that prevent the delivery of care to those infected with HCV, such as IDUs (Thomson, 2009).

2.3 Hepatitis C Viral Infection: United States Overview of the Prevalence and Burden of HCV

As of 2007, 849 Acute HCV cases (0.3 cases /100,000 people) were reported nationally from an estimated 2800 cases (Centers for Disease Control and Prevention, 2007). In the U.S. in 1982 the reported number of cases were 2629 (1.1 cases/100,000 persons), 1991 there were 3582 reported cases (1.4 cases/100,000 persons) in the U.S., 1992 there were 6010 reported cases (2.4 cases/100,000 persons) in the U.S., and in 2001 there were 1640 reported cases (0.7 cases/100,000 persons) in the U.S. Cases of acute HCV are reported *voluntarily* to CDC through state Health Departments via CDC's National Notifiable Disease Surveillance System (NNDSS) (Daniels, Grytdal, & Wasley, 2007). For cases each cases reported data is collected on the event date, source of report, demographics, laboratory test results, clinical information, and exposure history.

In 2007 cases were required through CDC to meet a standard clinical definition for acute hepatitis and laboratory criteria for diagnosis had to be met based on guidelines set by CDC. The clinical guidelines are as follows: discrete onset of symptoms such as nausea, anorexia, malaise, or abdominal pain, jaundice, and elevated serum amino-transferase levels above 400 (Daniels, Grytdal, & Wasley, 2007). Laboratory Guidelines for acute HCV diagnosis include IgM anti-HAV and IgM anti HBV are both negative and one of the following, anti-HCV (antibody) or HCV RIBA are positive (Centers for

Disease Control and Prevention, 2007) (Daniels, Grytdal, & Wasley, 2007). In the U.S. acute viral hepatitis C (non-A, non-B hepatitis became reportable in 1982, from 1982-1991 the prevalence of reported hepatitis C were unreliable reflecting inaccuracy, error in the methods for reporting and surveillance (Daniels, Grytdal, & Wasley, 2007).

Many individuals living in the U.S. with Hepatitis C are asymptomatic, which accounts for an overall prevalence of HCV in the U.S. that was 1.8%, corresponding to approximately 3.9 million persons living with HCV in the U.S. (95% CI, 3.1-4.8 million persons). Sixty-five percent of HCV infections occur in those individuals 30-49 years of age, 74% of these cases are chronically infected (approximately 2.7 million persons, 95% CI 2.4-3.0 million) (Alter, et al., 1999). The incidence of acute Hepatitis C can be traced through a trend which reach a peak in 1992 then declined rapidly after 1992, attributable to a decrease in incidence of IDUs as well as a change in behaviors and practices of IDUs. As of 2003 rates have hit a plateau. In 2007 a total of 849 (0.3 cases/100000) cases of acute Hepatitis C were reported nationally. Rates HCV hit a plateau in 2003 only to experience a slight increase in 2007 within the age group of 25 – 39 year olds (0.5 cases/100000) and those over 40 years of age (Daniels, Grytdal, & Wasley, 2007). Before such an increase in rates in 2007, there was a 90% decrease in HCV infection rates in 25 – 39 year olds from 1990 – 2007, a cohort that has historically seen the highest rates of disease for HCV (Daniels, Grytdal, & Wasley, 2007). Few cases are reported in those 15 years of age and younger, possibly due to those in the cohort experiencing a high rate of asymptomatic characteristics of HCV.

In 2007, the reported rate of HCV was higher in males than in females for persons 15-34 years of age (0.5 : 0.8 : 1.0 for 15-19 year olds, 20-24 year olds, 25-29 year olds, and 30-34 year olds respectively) (MMWR).Among those 17-59 years of age, the strongest independent factors that are associated HCV infection include illegal drug use and high-risk sexual behavior, having 12 or less years of education, having been divorced or separated (Alter, et al., 1999). In the U.S., of the 2.7 million persons chronically infected with HCV, with most of these persons involved in illegal drug activities and high risk sexual behavior (Alter, et al., 1999). Approximately one-half of the new cases of HCV and one-third of the HIV/AIDS cases reported are attributable directly or indirectly to injection drug use in the U.S. (Jones, Burris, Junge, Sterk, & Taussig, 2002). The prevalence of patients with acute Hepatitis viral infection in accordance to selected epidemiological characteristics, by age group, are reported in table (2.1).

In a U.S. study conducted in association with University of Cincinnati School of Medicine and the Harvard School of Medicine a cohort of patients was studied based on various demographic characteristics and the prevalence of Hepatitis C infections among those co-infected with HIV. Data from this study shows 650,000 - 900,000 persons in the U.S. infected with HIV, the HCV prevalence within this cohort was 1.8% (approximately 3.9 million residents of the U.S, with 65% of those co-infected being between the ages of 30 - 49 (Sherman, Rouster, Chung, & Rajicic, 2002). Required HCV screening for those already infected with HIV is beneficial, and CDC supports this guideline in accordance to the evidence previously mentioned (Sherman, Rouster, Chung, & Rajicic, 2002). Treatment and therapy for injection drug users is treated on a case by case basis. Clinical trials have been used to determine the most effective treatment and prevention methods fore patients infected with HCV. With IDUs composing most of the population of those infected with HCV, this population should be considered as the main focus of such clinical trials and research in testing preventive measure against HCV and treatment and therapy for HCV.

Hepatitis C in the US accounts for approximately 40% of all chronic liver disease with 8000-10000 deaths reported annually from the infection (Dienstag, 2006). The most common cause for liver transplantation is due to infection from Chronic Hepatitis C with the prevalence higher among 40-59 year olds and Blacks of non-hispanic decent (Dienstag, 2006). Results of from many studies and surveillance fail to capture the true number of those infected, turning out low estimates of the disease prevalence, because they fail to capture high risk (marginalized) populations such as injection drug users (IDUs), incarcerated persons, and the homeless. Based on computer cohort simulation models, the U.S. is expected to experience $10.7 billion in direct medical expenditures for HCV related treatment between 2010-2019 (Dienstag, 2006). Without pre-prophylactic treatment for HCV, prevention is centered upon proper blood screening of blood and organ supplies and changes in behaviors that put individuals at risk for the infection. Most diagnosis of chronic Hepatitis C is made by medical serendipity, due to asymptomatic individuals participating in blood drives or other various medical exams.

Public Health practitioners have seen the need for further prevention of HCV through counseling and educating non-infected persons at risk for the infection, a strategy that is in great demand in high risk populations (Daniels, Grytdal, & Wasley, 2007). Post-exposure prophylaxis is needed along with these prevention strategies to reduce the rate of transmission and development of sequelae from chronic liver disease. National surveillance data Hepatitis C provides necessary information to develop prevention strategies and monitor effectiveness of such prevention strategies. Accurate and completed data only reflects accurate reporting from labs, health care providers, and public health practitioners, therefore education and knowledge on recognition and diagnosis of hepatitis C is crucial.

Primary care, social service, and syringe exchange programs provide direct clinical intervention in the prevention of the spread of infectious disease. Federal law has been the reason for cause for dispute against such social and intervention programs. Federal law tends to ignore benefits of these multifaceted programs and state governments are left with the decision of analyzing, based on geography, the benefit and placement of these interventions (Tempalski, 2007). Accurate and completed data only reflects accurate reporting from labs, health care providers, and public health practitioners, therefore education and knowledge on recognition and diagnosis of hepatitis C is crucial. As of the year

2000 154 SEP programs were operating in the U.S. with major concentration in geographic clusters within the Northeastern U.S. and West (Tempalski, 2007).

2.4 Hepatitis C Viral Infection: State of Georgia Overview of the Prevalence and Burden of HCV

Of all the acute hepatitis C cases reported in Georgia in 2007, only 0 – 10% included risk factor data based on case investigation and follow up (Daniels, Grytdal, & Wasley, 2007). Georgia's rates of acute Hepatitis A and B have exceeded national rates, but rates for Hepatitis C remain difficult to determine due to a number of factors such as poor reporting, limited clinical information on Hepatitis C, health care practitioners and patients lack of understanding and recognition of symptoms, especially for those asymptomatic or Co-infected with HIV (Georgia Division of Public Health -- Epidemiology, 2005). Limited options for free or low cost testing exist in the state of Georgia which adds to the lack of capturing exact numbers of those infected. Lack of Hepatitis C awareness among medical providers, limited options for inmates whose parole is scheduled before treatment is completed, and insufficient prevention efforts among high risk populations have proven to be issues in Georgia especially in capturing the prevalence of Hepatitis C cases.

In 2001 Georgia saw approximately 151,302 cases of Hepatitis C, which accounted for 1.8% of its population (Georgia Division of Public Health -- Epidemiology, 2005). In 2002 and 2003 Georgia saw approximately 153,114 cases and 156,324 cases respectively (Georgia Division of Public Health -- Epidemiology, 2005). Table (2.2) provides an overview of the number of cases per 100000 persons from 1995-2007 in the state of Georgia.

Georgia has and continues to make efforts in the prevention and accurate reporting of viral hepatitis C cases through emphasizing and prioritizing resources that are placed on the burgeoning issues of hepatitis C. Plans have been placed to target populations that are at risk for the virus for the sake of prevention. In January of 2004 the Georgia Department of Public Health was notified by the Council of State and Territorial Epidemiologists (CSTE) that it was one of the six states to be awarded with funds to develop programs for the prevention, reporting, and recognition of the state's viral hepatitis issues. Prioritization criteria were formulated through this plan which included: length of implementation, impact on target audience, and goals/evaluation measures.

Prevention strategies in various regions around the U.S., such as syringe exchange programs, are highly debated and create a barrier to the enhancement and education of utilizing prevention strategies due to discrepancies in laws and regulations on a state by state basis. Georgia is an example of a state where no lawexist on banning the exchange of syringes (Jones, Burris, Junge, Sterk, & Taussig, 2002). The debate reflects on whether health care professionals and pharmacists should possess the decision on prescribing or exchanging syringes to individuals who partake in risk taking behaviors for HCV and HIV, in order to prevent the reuse of such drug injection equipment. There are also opinions on whether law making officials, through their bureaucratic agendas, should hold up critical public health issues and leave the issue as a state and congressional law making decision (Jones, Burris, Junge, Sterk, & Taussig, 2002). Some state governments have refused to ever fund syringe exchange programs (SEPs), even though these programs have shown to reduce the burden transmission of infectious diseases such as HCV (Tempalski, 2007).

Georgia, like many of its southern neighbors such as Alabama consists of at least one major metropolitan region, Atlanta, a rural mountainous region a part of the Appalachian mountain chain, and an outlying region of rural counties in the southern region of the state. Many of its southern rural counties are identified as a part of the *Black Belt*, a region that stretches from the Carolinas through Georgia, Alabama, Mississippi, and Louisiana (Lichtenstein, 2007). This region, quoted as being home to some of the "richest" soil and poorest people in the U.S. was once home to large thriving cotton plantation in the 19th century. This region is also over 50% African American, many of whom are descendents of slaves who have never left the region after the American Civil War (Lichtenstein, 2007). Since the Civil War this region has been plagued with a lack of industry, employment, and healthcare. This region is also a venue to the largest disparity seen in infectious disease transmission such as HIV and HCV and marginalized populations in risk taking behaviors promoting the transmission of infectious diseases (Lichtenstein, 2007).

Studies in HIV and HCV infection rates and risk factors have been carried out some communities and healthcare clinics in these rural and poverty stricken areas of the American South. Studies in HIV clinics in rural Alabama have been used in analysis in defining the rates of infectious diseases such as HIV and HCV and how they correlate to illicit drug use in rural areas within the black belt region. Poverty and health disparities were also taken into account for such analysis. Transmission of infectious diseases such as HIV has been shown to vary by geography and demographics. One illustration of this trend can be seen in the 1980s where the disease was primarily seen in Whites in urban regions and cities within the U.S. (Lichtenstein, 2007). Of the HIV cases reported in Alabama in 2004, Blacks represented 70% of that number. IDU was *not* recognized as the number one risk factor for the transmission of the disease (Lichtenstein, 2007).

An HIV/AIDS clinic in rural Alabama was the focus of a study in 2004 where 27 men and 20 women, approximately five-percent out of a total of 1,189 patients, identified themselves as IDUs, most of whom were white (Lichtenstein, 2007). Studies also show that crack-cocaine use and sex-for-drug exchange was the number one risk factor for HIV transmission for African American Women living in rural Alabama. In rural Alabama, in a region such as the black belt, such multifaceted trends of drug use and risk factors are highly likely to be represented in regions of similar make-up in Georgia (Lichtenstein, 2007). Small isolated pockets of population also contribute to risk behaviors and sexual practices that put this disproportionate population of African Americans and even some White Americans at risk for infectious diseases like HIV and HCV.

Georgia, just like its neighboring states to the north, consists of a rural Appalachian mountainous region, a region known for excessive risk behaviors such as IDU and methamphetamine use. In this region exists cases of HBV and HCV, reported to their respective state health departments, sharing the same risk factor of intravenous drug use (Christian, Hopenhayn, Christian, McIntosh, & Koch, 2010). Kentucky, which has published a report on IDU through its rural health department, has had cases reported to their state department, CDC, and NNDSS, reporting clinical and epidemiological manifestations for the increase in the incidence of HBV and HCV cases seen in the eastern regions of the state (the Appalachian region). Small cities in Eastern Kentucky such as Hazard, Kentucky (population of 4,867 in 2006) experience high poverty and unemployment rates and are the center of a location that experiences high HCV rates (Christian, Hopenhayn, Christian, McIntosh, & Koch, 2010).

For this study in Kentucky, surveys and pre-screening questionnaires were administered to health departments who saw HCV cases routinely receiving any testing. With such a small number of participants within the study and the descriptive analytic nature of this study descriptive statistics was the focus for the study. Of the 92 participants in this study approximately 45% of these individuals were 18 – 29 years of age and approximately 43.5% were 30 – 49 years of age (Christian, Hopenhayn, Christian, McIntosh, & Koch, 2010). 32.6% reported having less than a high school education while 70.7% of respondents reported being unemployed (Christian, Hopenhayn, Christian, McIntosh, & Koch, 2010). Approximately 63% receive some form of government assistants (Christian, Hopenhayn, Christian, McIntosh, & Koch, 2010). 53 participants were patients referred to their respective health department clinics in Eastern Kentucky, due to reported risk factors. Of this number, approximately 15% tested positive for HCV (Christian, Hopenhayn, Christian, McIntosh, & Koch, 2010).

While no descriptive analytical literature on HCV infection, its risk factor, and demographic characteristics exist in Georgia, the state does share similar characteristic social and behavioral trends, as seen in the Alabama and Kentucky studies, that put its population at risk for the Hepatitis C viral infection (Rural Substance Abuse Partnership, 2010). Georgia also remains as a significant drug distribution center in the Southeastern United States, and as a result the Georgia Bureau of Investigation (GBI) and Drug Enforcement Administration (DEA) has made numerous drug violation arrests (804 arrests of drug violators) and task force efforts resulted in 2,618 arrests of drug offenders from 2001 – 2002 (Office of National Drug Control Policy, 2009). In 2000 the National Household Survey reported approximately 1.2% of citizens in Georgia are dependent on illicit drugs (Rural Substance Abuse Partnership, 2010) (Office of National Drug Control Policy, 2009).

Cocaine, Heroin, Methamphetamines, and Marijuana are Georgia's principal drug threat. What the first three have in common is the choice of the user to dissolve the drug and inject it, a risk factor in itself for HCV, especially when the injection equipment is being reused (Office of National Drug Control Policy, 2009). The transport of such drugs are possible due to Georgia's highway system where all major North to South and East to West thoroughfares traverse through rural areas of Georgia and either cross or converge within Atlanta. Georgia boasts a major international airport in Atlanta as well as major sea ports in Savannah and along its coast, making Georgia accessible to drugs being smuggled into the states and as a major drug trafficking state (Office of National Drug Control Policy, 2009). Georgia is also a destination en route from major cities such as Miami and has seen an influx Hispanic population growth, which has helped in the ease of transporting illegal drugs from Mexico into the states (Office of National Drug Control Policy, 2009). This activity does nothing to abate the risk and behaviors for infectious diseases such as HCV and will promote the increase in cases of HCV in Georgia (Office of National Drug Control Policy, 2009).

2.5 Hepatitis C Viral Infection: Geographical and Cultural Overview and Conception of HCV

Social geography for Injection Drug Users (IDUs) defines the constructions place and space, whether it is through activities and behaviors, economics, and political and social influences such as establishment and movement of space (impact of police drug crackdown). Place can be defined as space (in the terms of geography) with meaning and time (Tempalski, 2007) (Cooper et al, 2004; Cresswell, 2004; Kearns and Joseph, 1993) Injection drug users also define what public health officials call a marginalized or “hidden” population in which one or more common attributes are shared and among such a population and hidden from public scrutiny and surveillance due to the stigma and legality associated with the activity (Poon, et al., 2009). As a result this makes it difficult to measure and find true effects and associations in a behavior and its associated risks (Poon, et al., 2009). Such hidden populations are the focus of the transmission of infectious diseases such as HCV, surveillance, and social networks for intervention of risk factors such as intravenous drug use.

One example can be analyzed in the year 2000, the 46th precinct in the Bronx, NYC was selected as a site for qualitative observation and research involving the study of IDUs behaviors and practices in injection drug use as well as social and geographic structure of the community. According to the 2000 census, over 90% of the precinct identified themselves as African American and/or Latino, 40% lived under the federal poverty level (Cooper, Gruskin, Krieger, & Moore, 2005). In this study population most individuals were African American or Latino, most of whom had never obtained more than a high school level education. One-third of the participants considered themselves homeless (Cooper, Gruskin, Krieger, & Moore, 2005). Most participants reported engaging in one or more unsafe injection practices including re-using their own syringes and borrowing previously used syringes and other injection equipment, the primary cause for Hepatitis C viral infection.

Approximately one-third of the participants lived in the public sphere in areas controlled by the precincts affected by drug crackdowns and Injection drug use (Cooper, Gruskin, Krieger, & Moore, 2005). Those living in these areas were either homeless or living in overcrowded home and would inject outside the area of heavy police trafficking or minimize the time spent injecting through unsafe injection practices that posed a health risk for Hepatitis C and HIV (Cooper, Gruskin, Krieger, & Moore, 2005). This was all done to evade police prosecution.

A qualitative study in a New York City police precinct in 2000, which involved 40 illicit drug injecting residents, illustrates how IDUs hesitate to engage in safe injection practices as a result of fear from police crackdowns and legal fallout (Cooper, Gruskin, Krieger, & Moore, 2005). IDUs are more likely to endanger their own health, through borrowing injection equipment, and not cleaning the equipment or injection site prior to injection; IDUs were more likely and willing to risk their own health than face the legal consequences of their actions. Ethnicity also played a critical role in the perception of safe injection practices versus legal prosecution. African Americans are more fearful of arrest and are more likely to engage in unsafe injection practices as opposed to their Caucasians (Cooper, Gruskin, Krieger, & Moore, 2005). Arrests from drug possession in the U. S. more than doubled from 1982 – 2001 (540,000 – 1,279,000) as opposed to the 1960s – 1980s where upper level drug distributers had a monopoly on the trade of drugs (Cooper, Gruskin, Krieger, & Moore, 2005) .

Today street and local level distributors nationwide are more prevalent and as a result surveillance, arrests, and policing strategies have been heightened to counteract this behavior (Cooper, Gruskin, Krieger, & Moore, 2005). Public Health has tried to take on the controversial role in advocating and supporting efforts in reducing the morbidity and mortality for IDUs in various communities in the U.S., as a result of unsafe injection practices. Through the concept of *harm reduction*, public health practitioners involved in the 2000 New York City police precinct crackdown study were interested in how to protect the health of IDUs living in those particular communities as well as preventing transmission of the infection to non-using communities. One practice in harm reduction involves proper access of treatment and education for drug users in the community (Cooper, Gruskin, Krieger, & Moore, 2005). To further illustrate the practices and behaviors of IDUs under geographical and social constraints of a precinct under heavy prosecution and surveillance for drug crackdowns, testimonies from similar qualitative studies were provided.

> Participant: I have a little bottle of water [I] stick the syringe in it , put the syringe [in the cooker]… that's it.
> Interviewer: And no time to cook?
> Participant: No, no time for nothing. Whether it's good or bad I'm going to be taking a chance.
>
> 38 year old black woman

Due to HIV and HCV sharing similar clinical manifestations and transmission routes, research has tried to determine whether the same disparities seen in HIV cases which are unevenly distributed by race and ethnicity hold similar to that of HCV cases. With limited studies on HCV and such analysis on demographic variability when it comes to the HCV infection it has been difficult to say that Blacks and Hispanics, as in HIV cases, are disproportionately infected with HCV as well (Lelutiu-Weinberger, et al., 2009). Disproportionality of race and ethnicity within the IDU population and other risk taking behaviors for HCV may explain the variability in transmission rates in certain populations infected with HCV. Further investigation is needed to identify various levels and positions in society, such as race, social, risk/social networks of IDUs, economic, and cultural and how such ecological models impose variability in transmission rates among certain populations. In turn, through analysis of such models intervention strategies can identify clear foci.

As a result of such studies public health has intensified its study of the transmission of infectious diseases various ecological levels and networks in the clinical, social, and behavioral sciences. Public health has also taken and included the concept of *risk environment* in further analyzing how geography (defined by place, persons, and time) and the various economic, social, and political conditions define such space and influence the dynamics of disease (Cooper, Bossak, Tempalski, Des Jarlais, & Friedman, 2009).

One such subcultural observation can be seen in inner city (urban) areas across the U.S. which harbors a disproportionate number of blacks. Intolerable conditions, hopelessness, alienation, and racial discrimination have been only a few factors that perpetuate the risk behavior in such communities, such as the sale and trade of drugs for either the financial reward or an escape from intolerable realities facing such individuals (Joseph & Pearson, 2002). This environmental exposure induces the risk for HCV, HBV, or HIV infection (Joseph & Pearson, 2002). Public health has also addressed the issues of the disproportionate numbers of blacks incarcerated within the U.S. especially due to non-violent drug related offenses. This brings up the issue of whether law enforcement surveillance underreport drug use and possession within suburban and outlying communities as opposed to their urban counterparts. Drug related behaviors that put individuals at risk for HCV is about the same for blacks (7.4%) and whites (7.2%) and a little less for Latinos (6.4%), but the question always remains why black (60% of the incarcerated population in the U.S.) and other persons of color make up most of the prison population (Elkavich & Moore, 2008)? Are other areas, that contain high drug trafficking routes and manifest high drug use being overlooked, such as the outlying areas and bedroom communities of a metropolis that we least expect.

Meta-ethnographic approaches through review of various qualitative studies on IDUs have also been used account for the risk perception injecting drugs and the possibilities of acquiring Hepatitis C. In a study conducted through the University of London’s Centre for Research on Drugs and Health Behaviour, seven themes were created through analysis across a number of literature on the risk perception on Injection drug use and acquiring Hepatitis C. Regular IDUs who belong to social network that consistently demonstrate risky injection behavior are more likely to be less concerned of their risk of acquiring HCV and adopt a role of HCV and Intravenous Drug Use as their identity, as opposed to their counterparts who are less engaged in Intravenous drug use; those persons tend to harbor more of a concern for acquiring HCV infection (Rhodes & Treloar, 2008).Another concern through Rhode’s &

Treloar's study is the issue of HCV taking a back seat to HIV when it comes to the knowledge and importance of concern.

Many individuals and IDUs create a *relative viral risk* between HIV and HCV, which distorts the importance of one infection over the other. HIV receives the greater attention clinically and through the media is viewed as the more stigmatic (Rhodes & Treloar, 2008). Lack of knowledge on HCV also creates a perception for many individuals, in which these individuals see HCV not being as great of a concern as HIV. These individuals harbor that attitude of, "It doesn't matter whether *I* acquire Hepatitis C, *I* am more concerned of HIV", an attitude that can be dangerous and life threatening (Rhodes & Treloar, 2008).Certain folk medicine and cultural practices have been linked to the transmission of HCV within various populations such as acupuncture, ritual scarification, body piercing, tattoos, and commercial barbering (Daniels, Grytdal, & Wasley, 2007). The lack of awareness, education, and ability to properly sterilize and dispose of equipment used in such practices propagates the spread for HCV infection in these populations and within others.

High risk individuals not only include IDUs, transfusion recipients prior to 1992, or those with multiple sex partners, but also refugees from countries with high rates of HCV infection (Daniels, Grytdal, & Wasley, 2007). Efforts have been continuously made to ensure that this population is screened and properly documented through the national surveillance system. An uneven geographic distribution of infectious diseases such as HCV in the U.S. can be seen as a result of the lack of public health initiative to assess the geographic variability through analysis with HCV risk factors and demographics (Tempalski, 2007).

Chapter III

METHODOLOGY

3.1 Data Sources

The State Electronic Notifiable Disease Surveillance System (SENDSS) for the state of Georgia was the source for data collection and secondary data extraction for the purpose of this research. The unit of analysis for this study was each confirmed hepatitis C case within the state of Georgia for the year 2009. For the purpose of this study, the study design that was considered and best suited for the research was conducting a descriptive analysis by taking this cross-section (the year 2009) for all confirmed cases of HCV for the state of Georgia and analyzing all descriptive characteristics for confirmed HCV cases such as gender, race, disease status, geographic region, and all risk factors such as injection drug use, blood transfusion prior to 1992, long term hemodialysis, accidental needle stick, tattoos, sexual contact with HCV infected individual, and incarceration. For the purpose of this study only Non-Hispanic Blacks and Whites were included.

A query was performed through SENDSS in order to obtain all variables of interest for both Confirmed Acute and Chronic Viral Hepatitis C cases in the state of GA, for the year(s): 2009. Data were collected for 2009 Hepatitis C cases through laboratory reports mailed or faxed from laboratories such as Quest, Laboratory Corporation of America (Labcorp), the Georgia State Public Health Lab, and other various microbiology laboratories in Hospitals throughout the state of Georgia. Demographic information such as race, ethnicity, age, gender, patient identification, date of birth, county, address, laboratory information, and other clinical information was extracted from each report and entered into their respective variables in SENDSS. The ability to update and enter in new cases of HCV infected individuals in SENDSS is dependent upon the resources, time, and the capacity of staff in hospitals, doctor's offices or even laboratories.

Information not included in lab reports sent to the state health department was therefore considered missing. Disease status was also crucial to collect in order to receive accurate reporting and numbers of which Hepatitis C cases in the state of Georgia for a given period of time were considered acute or chronic. In order to receive such information Hospital Infection Control Practitioners and private practice nursing staff were contacted for the receipt of vital clinical information such as signs, symptoms, and laboratory measures (amino-transferase, RIBA, HCV RNA, anti-HCV) and tests not indicated on the lab in order to confirm whether the case was acute and chronic. CDC guidelines for interpretation of HCV test results were utilized by state and local health departments to confirm a case as chronic, acute, or infected (needing further testing). Also, other demographic information not indicated on labs faxed into the state health department was received through contacting the clinical personnel previously mentioned.

All HCV cases confirmed as acute or chronic were subjected to immediate attention by district public health practitioners for follow up, case reviewing, and case reporting for the sake of receiving risk factor and behavior information as well as communication of prevention measures to those infected and interviewed. Such risk factor questions contained in the follow-up case reporting forms on SENDSS for the purpose of this study included: Have you ever been or are currently an injection drug user, Have you ever received a blood transfusion prior to 1992, have you undergone long term hemodialysis, have you received any tattoos, Have you ever been accidentally stuck by a needle, have you had sexual contact with someone infected with HCV, have you ever been incarcerated. These questions were provided for all cases infected with HCV in the state of Georgia in 2009 via local, district, and state health offices for follow-up.

3.2 Study Variables

Variables of interest include: Patient ID, Zip Code, Address, County, Gender, Age, Race, Disease Status, Confirmed Cases, Year(s) of Onset, and risk factor data. Risk factor data were collected through case reports the respective Georgia Health District in which a confirmed acute or chronic HCV case reside. risk factor data of interest include: injection drug use, blood transfusion before 1992, long term hemodialysis, accidental needle stick, tattoo, sexual contact, and incarceration.

A query was conducted on the State Electronic Notifiable Disease Surveillance System to extract all confirmed Hepatitis C cases in all 159 Counties in GA. Of all these cases, cases for only the year 2009 were extracted from the raw data, as well as cases only confirmed as chronic, acute, and infected. Both Males and Females, and all ethnicities and races were selected from the query criteria.

For geographical analysis purposes, zip code and street address for each case were collected, as well as county of residence. Of Georgia's 159 counties, a specific code was assigned to each county based on Georgia's Emerging Infectious Disease Program (GA-EIP). GA-EIP is a collaborative project with Emory, CDC, and other state health Departments, who take part in active surveillance and research studies on infectious diseases and outbreaks. GA-EIP activities are geographically divided in to two regions that consist of specific counties, Atlanta and the surrounding Metropolitan Statistical Area (MSA) and Georgia Outside of Atlanta and its surrounding metropolitan statistical area (GOA). MSA counties were assigned a code of '1' while the remaining counties, GOA, were assigned a code of '2'

For this study other metropolitan statistical areas outside of Atlanta such as Macon (Bibb County), Augusta (Richmond County), Savannah (Chatham County), Columbus (Muscogee County), and Athens-Clarke County, were not considered as MSA in order to retain consistency within the study based on Georgia's EIP guidelines for what is considered MSA and GOA.

Gender was coded as follows, Male = 1, Female =2. Race was coded as, Whites = 1, Blacks = 2, Others = 3 (include Hispanic, Asian, American Indian/Alaskan Native, Hawaiian/Pacific Islander, and Multiracial). Those cases remaining unknown or with no data available for race were coded as '9'. All cases coded as '9' (Unknown) and '3' (Other races) were treated as missing cases for the sake of the analysis, this included race, geographic region, disease status, and all risk factor variables.

Risk factor case report questions including: Injection Drug Use, Blood Transfusion before 1992, Long Term Hemodialysis, Accidental Needle Stick, Tattoo, Sexual Contact, and Incarceration were provided with answers such as No, Yes, and Unknown. All questions marked as No under each risk factor case report question was coded as '0'. All questions marked as Yes were coded as '1'. Those questions marked as Unknown or not answered were coded as '9'.

3.3 Study Population

The study population consisted of all confirmed cases of Hepatitis C Viral Infection reported to the state of Georgia in 2009. These cases included all confirmed chronic and acute cases. *"Infected"* cases were also included, infected cases were those who were confirmed as having HCV but not enough information was collected on follow up of the case to proceed in confirming the case as chronic or acute. All races were considered in this population. Both Male (N = 525) and Female (N = 330) were included in the study population, and geography for the study population consisted of all counties within Georgia. All ages were included in the study population, from birth to 88 years of age.

3.4 Statistical Analysis

Once the query was produced, the file containing all variables of interest was imported in Microsoft excel 2003, recoded, and imported into the statistical software package SPSS 16.0, which was utilized for the purpose for data analysis. All variables coded as 'Unknown' or 'Other' were treated as missing cases. Normality for the distribution of each variable was confirmed through P-P plotting through SPSS 16.0, from these results normality was assumed for age and parametric statistics were utilized for the purpose of analysis.

Descriptive statistics were run for all risk factor variables and all descriptive characteristics of the study population which included gender, race, geographic region, and disease status. All variable for descriptive characteristics and risk factors analyzed based on all data considered not missing, therefore valid percents and totals were taken into account for all variables. Descriptive characteristics for all HCV cases in Georgia were then illustrated through a bar graph (figure 1) which shows a proportion (out of a total of 100%) for each number representative for a descriptive variable in the study. Risk factor data were recorded for mostly acute cases as opposed to all other chronic or infected cases, again reflecting the capability and resources necessary to complete follow-up and case reporting forms for all HCV cases through the local health departments in Georgia.

All variables, except disease status, were coded as categorical data. Gender was coded as male (1) and female (2). Race was coded as White Non-Hispanic (1), Black Non-Hispanic (2). Age was distributed in 10-year age groups through 59, and 60+. Geographic region was coded based on county designation as either being GOA or MSA based on Georgia EIP guidelines (MSA = 1, GOA = 2). Risk Factor data such as injection drug use, tattoo, long term hemodialysis, blood transfusion prior to 1992, sexual contact with infected individual, accidental needle stick, and incarceration were coded categorically as either Yes = 1, No = 0, Unknown = 9. A chi-square test was run for all categorical risk factor data and descriptive data, including age distribution, by geographic region. A chi-square test was also run for these same descriptive characteristics, risk factors, and their distributions by Race (White Non-Hispanic and Black Non-Hispanic) and geographic region (MSA and GOA).

Univariate and multivariate regression analysis was run for all descriptive characteristics and risk factors as independent to geographic region as the dependent variable for the sake of controlling for confounding within the analysis. Odds ratios and their 95% confidence intervals were then calculated and tabulated in accordance to specified reference groups (Table 2.10, 2.11 respectively).

Chapter IV

RESULTS

Of 855 persons infected with the Hepatitis C Viral Infection in the state of Georgia in 2009, 713 were chronically infected, 31 persons (based on CDC laboratory guidelines) were considered acute infection, and 111 persons were infected without any confirmation on disease status on whether they were chronic or acute. Males accounted for approximately two-thirds (61.4%) of the population. Of that same cohort, White non-Hispanic individuals made up 55.4% while Black non-Hispanics made up 41.4% of the cohort. Within the year 2009 in the state of Georgia, of the confirmed HCV cases that were reported, 55.9% of those reported cases were residents within areas outside of the Atlanta statistical area (Georgia outside of Atlanta or GOA) while the remaining 44.1 were residents within the Atlanta 28 county metropolitan statistical area. Table 2.1 shows the descriptive figures previously mentioned for the 855 confirmed cases of HCV reported to the state of Georgia for 2009.

Of the total population in the study, 20% were reported as intravenous drug users or having tattoos while approximately 4% reported being on long term hemodialysis. Sixteen and seven-tenths of a percent reported receiving blood transfusions prior to 1992 while approximately 10% of those infected with HCV reported having an accidental needle stick. Of the total population 10.6% reported sexual contact with multiple partners. Of the total population, 12.5% are currently or had been incarcerated in the past. Table 2.9 illustrates the various risk factors for the Hepatitis C Viral Infection and the figures from confirmed reported cases for HCV, for Georgia in 2009, within this study identifiable within each of the specified risk factors.

Age was treated as a continuous and categorical variable for this study. As a continuous variable mean age for our all confirmed cases of Hepatitis C Viral infection in the state of Georgia for the year

2009 was just under 50 years of age (47.4 years of age). As illustrated in table 2.3, each age category was descriptively analyzed for 2009 confirmed cases of HCV in the state of Georgia. These data show that approximately 13% of the cohort for confirmed HCV cases fall in the age range of 20 – 29, while the age groups below this group (birth – 19) range anywhere from 0.6% - 1.6% of the total population of confirmed HCV cases in Georgia for 2009. Individuals 30 – 39 years of age account for only 8% of this cohort while ages 40 – 59 account for 23.4% and the age group of 50 – 59 years old accounting for 40.5%, largest percentage of confirmed HCV infected individuals in the state of GA for the year 2009. Figure 2.1 illustrates the trend seen in table 2.2 for the Age distribution for individuals in 2009 in the state of Georgia with confirmatory diagnosis of HCV.

Each descriptive characteristic chosen for this study (gender, ethnicity, and disease status) was tested against the two regions of Georgia that were of focus for this study, Metropolitan Statistical Area of Atlanta (MSA) and Georgia Outside of Atlanta (GOA), by using chi – square analysis. For previous descriptive characteristics mentioned, Table 2.3 shows the distribution of Ethnicity, between White Non-Hispanic and Black Non-Hispanic individuals, is statistically significant in accordance to residence in either MSA or GOA ($p < 0.001$). Disease status, based on confirmation on whether the individual is infected with acute, chronic, and undetermined status of HCV, is statistically significant in accordance to residence in either MSA or GOA ($p = 0.001$). Gender was the only descriptive not statistically significant in accordance to region of residence as either MSA or GOA ($p = 0.15$).

These results show us that there exists a significant difference in ethnicity (between White Non-Hispanic and Black Non-Hispanic individuals) based on region of residence in the state of Georgia, beit MSA or GOA, in the state of Georgia in 2009. There also exists a significant difference in disease status, whether an individual is diagnosed as chronic, acute, or undetermined (infected but confirmed) disease status, based on region (GOA or MSA) or residence.

Across all risk factors analyzed in this study which included Injection drug use, blood transfusion prior to 1992, long term hemodialysis, accidental needle stick, tattoo, sexual contact, and incarceration, not one showed any statistical significant value based on region of residence (MSA and GOA) in the state of Georgia for the year 2009. Acute cases in the state of Georgia (N = 31; for the year 2009) require immediate follow-up and case reporting, which entails identification of risk factor data, where as chronic cases in Georgia (N = 713; for the year 2009) which are the majority of cases require case reporting, but the capacity to accomplish such a task is reflected upon the man-power and funding from which the respective state grants to the district or state health office to carry out such a job.

Only 31 (acute) cases have a complete record of risk factor data. The results shown in table 2.8 reflects on how a large number of incomplete recorded risk factor data may show lack of statistical significance based in accordance to certain dependent variables such as Geographic region. Across the age distributions of ten years from birth to 60 years of age and older there exists no statistical significant difference in accordance to the geographic regions of MSA and GOA.

Bivariate logistic regression was performed for various descriptive characteristics (dependent variables) in their association with geographic region (independent variable). Considering all confirmed HCV cases in the state of Georgia for 2009, results from Table 2.9 show that the only demographic variable to show a significant association between geographic region was race (OR = 3.48, $p < 0.001$, CI 2.54 – 4.77). This result shows White non-Hispanic individuals infected with Hepatitis C have a 3.48 increased odds compare to Blacks of non-Hispanic origin to of residence in regions of Georgia outside the Atlanta metropolitan statistical area.

Other demographic and risk factor variables that showed increased odds in their association to geographic region were, Injection Drug Use (OR = 2.78, CI 0.68 – 11.44) and Tattoos (OR = 1.27, 0.32

– 5.08) (Table 2.9). After adjusting for demographic and risk factor variables for reduction of confounding, a statistical significant association ceased to exist between race and geographic region as well as a decrease in odds (OR = 2.20, $p < 0.001$, CI 1.14 – 25.6), while an increase in odds, not statistically significant was seen in Gender in its association with geographic region (OR = 2.98, CI 0.27 – 33.5). Risk factor data including injection drug use, hemodialysis, blood transfusion prior to 1992, accidental needle stick, sexual contact, tattoos, and incarceration showed little to no association to geographic region (0.999 – 1.00), while only blood transfusion prior to 1992, accidental needle stick, and incarceration displayed increased odds in with no association to geographic region (Table 2.10).

Chapter V

DISCUSSION AND CONCLUSION

5.1 Discussion

Prevalence studies conducted in various geographic regions within developing countries and in the U. S. indicate that minorities such as Blacks, Hispanics, and American Indian/Alaskan Natives are experiencing the highest numbers of rates for HCV infection (Alter, et al., 1999) (Daniels, Grytdal, & Wasley, 2007) (Oramasionwu, et al., 2009). This study indicates that geography plays a critical role in determining who is truly at risk for HCV infection. Individuals infected with the hepatitis C viral infection in regions of Georgia outside of the Atlanta metropolitan statistical area for the year 2009 were more likely to be Whites of non-Hispanic origin. In rural Georgia, those infected with HCV most likely were involved in risk factors that included injection drug use.

In order to further analyze the causes that justify these results, the demographic characteristics within the geographic regions should be assessed. In the state of Georgia in 2009 there were two times as many reported cases of HCV among males than females, while most cases were among white males of non-Hispanic origin and chronic in nature. Most cases of HCV were reported among those individuals residing in areas outside of metro Atlanta and of reported risk factors, tattoos, blood transfusions prior to 1992, and intravenous drug use were the most common risk factors.

Previous literature has shown that young adults (18 – 30 years of age) predominate as acute carriers of HCV while most of the chronic carriers are seen in age groups 40 – 60 years of age. This trend mainly reflects the availability, understanding, and focus of HCV testing prior to when guidelines and recommendations were set in the 1990s. Those 40 – 60 years of age were possibly infected before the advent of guidelines and testing for Hepatitis C, possibly before HCV was known as a clinical and public health concern. Younger adults are exposed to recommedations and guidelines for testing as well as education in recognition of the symptomology of acute hepatitis. A higher percentage of white-Non Hispanic males infected with HCV reside in the GOA region, while a higher percentage of those reporting intravenous drug use, reside in the MSA region of Georgia.

In accordance to the hypothesis previously stated in the study, analysis of the descriptive characteristics support the hypothesis. Of those individuals infected with Hepatitis C in Georgia, a majority of them happen to be male and of White non-Hispanic origin living in GOA. There exists a significant difference based on race Compared to their counterparts living in MSA. Of all hepatitis C cases in Georgia for 2009, although not significant in association, there exists an increased risk of Injection drug use in GOA. Based on the review of literature many theories can account for the reason for increased drug use and its cause in the increased prevalence of HCV infected individuals living in GOA. Further analysis of drug trafficking routes and distribution points within the state of Georgia and the demographic analysis of those active in the this risk taking behavior may just as well reveal the reason for these trends.

5.2 Study Limitations

In determining prevalence and etiology of a disease a cross-sectional study has been used. In this study various demographic variables were analyzed in their association with the prevalence of confirmed HCV cases within the state of Georgia in the year 2009. These data just capture a given number of cases in a given period of time, therefore descriptive analysis in cross sectional study was utilized. In such a study design, limitations do exist. This data utilized in this study are not representative of every case including new (incident) cases, therefore when analyzing risk estimates we are not observing a true and accurate association in what is really occurring (Gordis, 2009). Also, in a study such as this, there is a loss of temporal relationship causing a discrepancy in the relationship of a given risk factor and its association with HCV. We are left with wondering whether those infected with HCV, who have displayed certain risks or behaviors that put others in danger of HCV, are the cause of various trends presented in the data for this study and vice-versa (Gordis, 2009).

In conducting this research, review of previous literature pertaining to the social, geographical, and ecological aspects on hepatitis C viral infection was crucial for proceeding to further analysis. Existing literature on HCV highlights treatment, therapy, and the dynamics HIV has on the co-infection with HCV, rather than the social, behavioral, or geographical variability of HCV. The limited amount of literature similar in context to this study is only highlighted mainly on the national level rather than the state level. Demographic characteristics within a national HCV cohort may not compare to what is seen on a state wide, local, or community cohort for the same disease. Also, as in the case of this study analysis on demographic characteristics in accordance to geographical associations on state level data cannot be generalized on a national scale. Standardizing and weighting the data are both methods that could've assured meaningful results for the sake of comparing local to national data and results of descriptive HCV prevalence.

Utilizing secondary data presents a limitation on this research. The source of this data was provided through the State Electronic Notifiable Disease Surveillance System (SENDSS). First, data retrieved from either laboratories or providers requires requests for sensitive patient information. Not all staff within laboratories, clinics, or doctor's offices are familiar with the Health Insurance Portability and Accountability Act (HIPAA) guidelines on reporting notifiable diseases to local and state public health officials in a times in a timely, accurate, and efficient manner. By utilizing these secondary data, inaccuracies in associations in the data may be reflected upon by missing data, inaccuracies, and human error in data entry into the states surveillance system. Table 1.5 illustrates the proportion of Acute Hepatitis C cases with reported risk factor data, Georgia falls in the 0 – 10% range of Acute Hepatitis C cases with reported risk factor data.

The growth of metropolitan and various geographic regions within Georgia indicates an issue in delineating whether a certain area, based on population and availability of resources, should be considered metropolitan or rural outside of Atlanta. The 10 – 20 county designation for metropolitan Atlanta may vary based on personal opinion or standard guidelines such as the Georgia EIP guidelines. This variability in county designation as MSA and GOA can cause discrepancies in the data and thus the results when it comes to determining any associations between the variables and outcomes of interest when analyzing disease prevalence and rates. Also, rural and urban distinction should have been taken into account when analyzing the data. The data is not representative of the rural counties which contain urban areas outside of Atlanta.

Due to inconsistencies in interpreting results for and disease status for confirmed HCV cases information bias and misclassification of the subjects of study is seen within this study. Human judgment and error as well as consistently following established guidelines set by the CDC for disease status classification cause misclassified information in the surveillance database. With such surveillance data, as presented in this research, too much focus for the confirmed HCV cases is placed on risk factors, based on literature, known to promote the spread of HCV infection, such as intravenous drug use, multiple sex partners, and blood transfusions. Not as much emphasis and analysis is placed on other risk factors such as medical or surgical procedures that present a risk for HCV infection (Hepburn & Lawitz, 2004).

5.3 Recommendations

For the purpose of comparing data from state to national level and from national to state level data, direct and indirect methods of standardizing the results that are analyzed is needed. This provides a clear understanding how state representative data compares to national data. Also national level data is represented through national level studies through CDC's Division of viral hepatitis; an element lacking in state and local level literature on social, behavioral, and geographic aspects of the HCV infection. Literature pertaining to the Social and ecological aspects on the role Intravenous drug users play in the community also highlights social and geographical dynamics HCV may play on the local and state level.

Through careful and accurate study of consistent and reliable surveillance data, reliable results on future research for HCV can be produced as well as studies considering other risk behaviors attributable to the spread of HCV that were never considered for previous study. Another method in ensuring consistent and accurate data input occurs is consistent guidelines and recommendations in disease status confirmation through CDC based the results of diagnostics used to test for the presence of the hepatitis C virus. For future descriptive analytical studies on Hepatitis C standardizing the data, for it be more representative of the population or region being studied, is critical when comparing the data to the national data that is analyzing the same research question.

5.4 Conclusion

With injection drug use being the number one risk factor and public health concern for the spread of infectious diseases such as HBV, HCV, HIV, and the co-infection of HIV with HBV or HCV, prevention by using a collaborative effort of many strategies have to be made (Tempalski, 2007). Such multi-faceted strategies include detoxification treatment programs, primary care, social service, and outreach networks for IDUs, and syringe exchange (SEP) programs (Tempalski, 2007). For these programs to benefit the populations affected by the burden of HCV, geographical variability of the disease has to be taken into account.

As analyzed in this study, a significant number of White non-Hispanic individuals reside in Communities outside of Metro Atlanta. This cohort is also experiences greater odds of contracting Hepatitis C infection due to Intravenous Drug Use. Understanding the dynamics and social behavior of such communities may warrant possible strategies for intervention. It may take decisions based on the opinions of those professionals within clinical medicine such as primary care practitioners, allied health care practitioners, and pharmacists to advocate decisions such as the distribution of clean and sterile syringes to such populations in order to reduce the burden of infectious diseases such as HCV.

Consistent, accurate, and reliable surveillance in rural Georgia regions also warrants the ability to identify outbreaks, prevalence, rates of disease, and target a population in need of intervention and i the case of HCV post-prophylaxis prevention strategies (Georgia Division of Public Health -- Epidemiology, 2005). This also helps in the prevention in the development of chronic liver disease and sequelae resulting from chronic infection of HCV. Methods to prevent this include identifying behaviors that put an individual at risk for HCV infection and what initiates those behaviors such as intravenous drug use, and risky sexual behaviors and establishing counseling and other post-prophylaxis strategies to decrease the spread or initiation of HCV infection (Alter, et al., 1999) (Georgia Division of Public Health -- Epidemiology, 2005).

Intervention for HCV should focus on new initiates in starting to inject drugs or display behaviors that put them at risk for possible infection with HCV. Intervention for HCV should also be focused on a specific target population that is at greater risk for HCV infection for the sake of more cost effective prevention strategies, more focus in rural Georgia for males between the ages of 40 – 60 and younger initiates to intravenous drug use. It has been noted in previous literature that one known method in preventing the spread of the infection is to educate those who are already IDUs on safe injection techniques in order for them to carry out these practices to new IDUs (Rhodes & Treloar, 2008). Populations who display such behaviors as injection drug use, and other taboo or risky behaviors that put them at risk for HCV, have been known to be difficult contact, analyze, treat, and educate due to the stigma or legal repercussions associated with their self identity as IDUs as being taboo, or their sexual practices or sexual orientation.

A significant difference exists among ethnicity/race and gender, where White non-Hispanics experienced more morbidity from Hepatitis C in rural Georgia counties and males experiences more morbidity from Hepatitis C than females overall in Georgia in 2009. Identifying the dynamics, social and ecological forces, disparities, and complexities plaguing various populations at risk for HCV is crucial in the implementation and evaluation of Interventions prevention strategies to further decrease rates of HCV and to eliminate the burden of the infection (Lelutiu-Weinberger, et al., 2009) (Reeler, 2000) (Cooper, Gruskin, Krieger, & Moore, 2005). It is important to understand how risk factors and behaviors, known to put individuals at risk for HCV, are unique amongst various populations. Once these behaviors are identified, prevention strategies then be evaluated and established once they are tailored with respect to the culture, economic, and social climate of such societies and groups (Reeler, 2000). Although national rates for HCV have fallen in the U.S. certain populations such as IDUs warrant particular attention for such prevention strategies to reduce the morbidity and mortality of HCV.

REFERENCES

Alavian, S. M., Ahmadzad-Asi, M., Lankarani, B. K., Shahbabaie, M. A., Ahmadi, A. B., & Kabir, A. (2009). Hepatitis C Infection in the General Population of Iran: A systematic Review. *Hepatitis Monthly , 9* (3), 211-223.

Alter, M., Kruszon-Moran, D., Nainan, O., McQuillan, G., Gao, F., Moyer, L. A., et al. (1999). The Prevalence of Hepatitis C Virus Infection in the United States, 1988 through 1994. *The New England Journal of Medicine , 8* (341), 556-562.

Benoit, T. J., Cline, K., Daniel, J., Langford, P., Osborn, M. K., Pearlman, B., et al. (2007). *Hep C Handbook: A Resource Guide for Georgians* (2nd ed.).

Cai, H., Chen, K., He, Z., Ke, Y., Liu, F., Ning, T., et al. (2009). Hepatitis C Seroprevalence and Associated Risk Factors, . *Hepatitis C Seroprevalence and Associated Risk Factor, Anyang, China , 15* (11), 1819-1822.

Centers for Disease Control and Prevention. (2007). *Disease Burden from Viral Hepatitis A,B,and C in the United STates.* Retrieved February 2010, from Centers for Disease Control and Prevention: http://www.cdc.gov/hepatitis/HCV/StatisticsHCV.htm

Christian, W. J., Hopenhayn, C., Christian, A., McIntosh, D., & Koch, A. (2010). Viral Hepatitis and Injection Drug Use in Appalachian Kentucky: A Survey of Rural Health Deparment Clients. *Public Health Reports: Kentucky Department of Public Health , 125*, 121-128.

Chung, R. T., & Kim, A. Y. (2009). Reviews in Basic and Clinical Gastroenterology: Coinfection with HIV-1 and HCV -- A one-two Punch. *Journal of Gastroenterology , 137*, 795-814.

Cooper, H. L., Bossak, B., Tempalski, B., Des Jarlais, D., & Friedman, S. R. (2009). Geographic Appraoches to Quantifying the risk Environment: Drug - Related Law Enforcement and Access to Syringe Exchange Programmes . *International Journal of Drug Policy , 20*, 217-226.

Cooper, H., Gruskin, S., Krieger, N., & Moore, L. (2005). The Impact of a Police Crackdown on Drug Injectors' Ability to Practice Harm Reduction. *Social Science & Medicine , 61*, 673-684.

Daniels, D., Grytdal, S., & Wasley, A. (2007). *Surveillance for Acute Viral Hepatitis --- United States, 2007 (MMWR).* Atlanta: Division of Viral Hepatitis, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, CDC.

Dienstag, J. L. (2006). American Gastroenterological Association Technical Review on the Management of Hepatitis C. *Gastroenterology , 130*, 231-264.

Elkavich, A., & Moore, L. D. (2008). Who's Using and Who's Doing Time; the War on Drugs and Public Health . *American Journal of Public Health , 98* (5), 782-786.

Garfein, R. S., Vlahov, D., Galai, N., Doherty, M. C., & Nelson, K. E. (1996). Viral Infections in Short-Term Injection Drug Users: The Prevalence of the Hepatitis C, Hepatitis B, Human Immunodeficiency, and Human T-Lymphotropic Viruses. *American Journal of Public Health , 86* (5), 655-661.

Georgia Division of Public Health -- Epidemiology. (2005). *Georgia Viral Hepatitis Strategic Plan.*

Gordis, L. (2009). *Epidemiology* (4 ed.). Philadelphia, PA: Saunders Elsevier.

Hepburn, M. J., & Lawitz, E. J. (2004). Seroprevalence of Hepatitis C and associated Risk Factors Among an Urban Population in Haiti. *BioMed Central: Gastroenterology , 4* (31), 1-4.

Johnson, T. D. (2008, December). Theme of "Public Health Without Borders" Resonates with Presenters. *American Public Health Association , 38* (10), p. 26.

Jones, S. T., Burris, S., Junge, B., Sterk, C. E., & Taussig, J. (2002). Individual and Structural Influences Shaping Pharmacists' Decisions to Sell Syringes to Injection Drug Users in Atlanta, Georgia. *Journal of the American Pharmaceutical Association , 42* (6), s40-s45.

Joseph, J., & Pearson, P. G. (2002). Black Youths and Illegal Drugs. *Journal of Black Studies , 32* (4).

Lelutiu-Weinberger, C., Pouget, E. R., Des Jarlais, D. D., Cooper, H. L., Schenmann, R., Stern, R., et al. (2009). A Meta-Analysis of the hepatitis C Virus Distribution in Diverse Racial/Ethnic Drug Injector Groups. *Social Science & Medicine , 68*, 579-590.

Lichtenstein, B. (2007). Illicit Drug Use and the Social Context of HIV/AIDS in Alabama's Black Belt. *The Journal of Rural Health , 23*, 68-72.

Lok, A. S., Sami, S., Tocco, R., & Volk, M. L. (2009). Public Health Impact of Antiviral Therapy for Hepatitis C in the United States. *Hepatology , 50* (6), pp. 1750-1755.

Meffre, C., Le Strat, Y., Delarocque-Astagneau, E., Dubois, F., Antona, D., Lemasson, J.-M., et al. (2010). Prevalence of Hepatitis B and Hepatitis C Virus Infections in France in 2004: Social Factors are Important Predictors After Adjusting for Known Risk Factors. *Journal of Medical Virology , 82*, 546-555.

Office of National Drug Control Policy. (2009). *Georgia Drug Trends.* Retrieved May 2010, from State of Georgia: Profile of Drug Indicators: www.usdrugtrends.com/georgia.htm

Oramasionwu, C. U., Hunter, J. M., Skinner, J., Ryan, L., Lawson, K. A., Brown, C. M., et al. (2009). Black Race as a Predictor of Poor Health Outcomes Among a National Cohort of HIV/AIDS Patients Admitted to U.S. Hospitals: A Cohort Study. *BioMed Central (BMC) Infectious Diseases , 9*, 1-12.

Poon, A. F., Brouwer, K. C., Strathlee, S. A., Firestone-Cruz, M., Lozada, R. M., Kosakovsky Pond, S. L., et al. (2009). Parsing Social Network Survey Data from Hidden Populations Using Stochastic Context-Free Grammars. *PLoS ONE , 4* (9).

Reeler, A. (2000). Anthropological Perspectives on Injections: A Review. *Bulletin of the World Health Organization , 78* (1), 135-143.

Rhodes, T., & Treloar, C. (2008). The Social Production of Hepatitis C Risk Among Injection Drug User: A Qualitative Synthesis. *Addiction , 103*, 1593-1603.

Rural Substance Abuse Partnership. (2010). *United States Drug Trends.*

Seef, L., Strader, D., Thomas, D., & Wright, T. (2004). Diagnosis, Management, and Treatment of Hepatitis C. *Hepatology , 50* (1), 1-22.

Sherman, K., Rouster, S. D., Chung, R. T., & Rajicic, N. (2002). Hepatitis C Virus Prevalence Among Patients Infected with Human Immunodeficiency Virus: A Cross-Sectional Analysis of the U.S. Adult AIDS Clinical Trials Group. . *Clinical Infectious Diseases HIV/AIDS , 34*, 831-837.

Spradling, P. R., Richardson, J. T., Buchacz, K., Moorman, A. C., Finelli, L., Bell, B. P., et al. (2010). Trends in Hepatitis C Virus Infections Among Patients in the HIV Outpatient Study, 1996-2007. *Journal of Acquired Immune Deficiency Syndrome , 53* (3), 388-396.

Tempalski, B. (2007). Placing the Dynamics of Syringe Exchange Programs in the United States. *Health & Places , 13*, 417-431.

Thomson, B. J. (2009). Hepatitis C: The Growing Challenge. *British Medical Bulletin , 89*, 153-167.

World Health Organization Global Alert and Response. (2002). Retrieved February 12, 2010, from World Health Organization: www.who.int/csr/disease/hepatitis/whocdscsrlyo2003/en/index.html

Appendix 1

Table 1.1

TABLE 10. Number and percentage* of patients with acute hepatitis C who reported selected epidemiologic characteristics, by age group — United States, 2007

Characteristic†	**Age group (yrs)**					
	<40§		**≥40**		**Total**	
	No.	**(%)**	**No.**	**(%)**	**No.**	**(%)**
Cases reported with risk factor data						
Injection-drug use	130/217	(59.9)	38/135	(28.1)	**168/352**	**(47.7)**
Sexual contact with hepatitis C patient	8/51	(15.7)	1/39	(2.6)	**9/90**	**(10.0)**
Household contact of hepatitis C patient	2/51	(3.9)	3/39	(7.7)	**5/90**	**(5.6)**
Homosexual activity (male)¶	5/33	(15.2)	1/25	(4.0)	**6/58**	**(10.3)**
Medical employee with blood contact	2/215	(0.9)	6/143	(4.2)	**8/358**	**(2.2)**
Hemodialysis	0/200	(0)	2/136	(1.5)	**2/336**	**(0.6)**
>1 sex partner	67/140	(47.9)	30/91	(33.0)	**97/231**	**(42.0)**
Blood transfusion	0/204	(0)	0/135	(0)	**0/339**	**(0)**
Surgery	23/181	(12.7)	39/123	(31.7)	**62/304**	**(20.4)**
Percutaneous injury (e.g., needlestick)	15/164	(9.1)	6/111	(5.4)	**21/275**	**(7.6)**
Unknown	71/243	(29.2)	71/163	(43.6)	**142/406**	**(35.0)**
Cases with no reported risk factor data available		221		217		438
Total cases reported		**464**		**380**		**844**

* The percentage of cases for which a specific risk factor was reported was calculated on the basis of the total number of cases for which any information for that exposure was reported. Percentages might not total 100% because multiple risk factors might have been reported for a single case.
† Exposures that occurred during the 6 weeks–6 months before onset of illness.
§ A total of 34 (4%) patients were aged <19 years.
¶ Among males, 19% reported homosexual behavior.

Centers for Disease Control and Prevention. (2007). *Disease Burden from Viral Hepatitis A,B,and C in the United STates.* Retrieved February 2010, from Centers for Disease Control and Prevention: http://www.cdc.gov/hepatitis/HCV/StatisticsHCV.htm

Table 1.2

Surveillance for Acute Viral Hepatitis – United States, 2007 (CDC/MMWR)

	Years (1995 - 2007)												
State	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Georgia	0.4	N/A	N/A	0.1	0.1	0	N/A	0.7	0.1	0.2	0.1	0.1	0.2

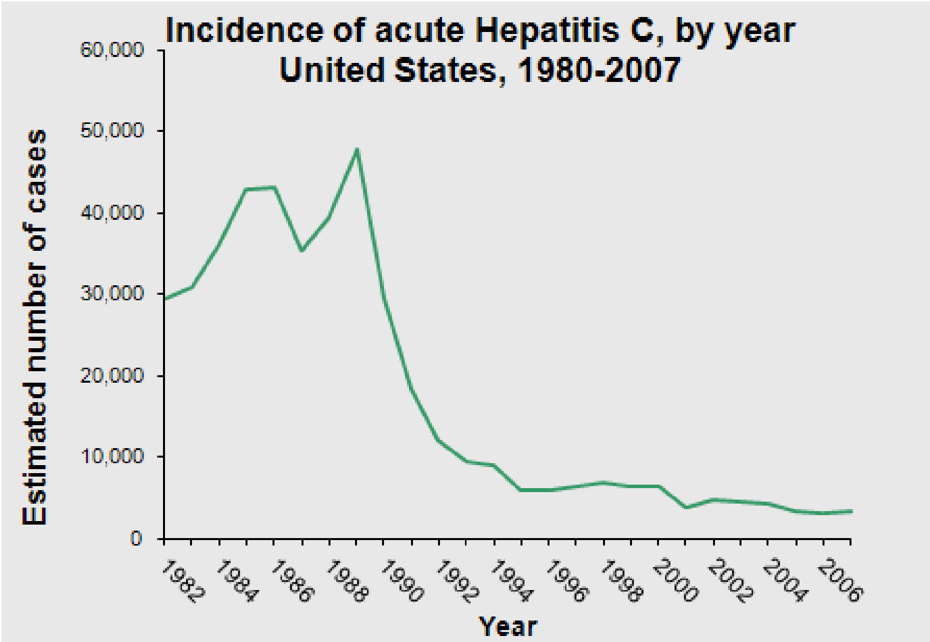
Incidence of acute Hepatitis C in the State of Georgia 1995-2007. (CDC/MMWR 2007).
N/A signifies data not available for any particular year as indicated on table ().
Cases are reported as (number of cases/100000 persons).

Table 1.3 Disease Burden from Viral Hepatitis C in the United States

Hepatitis C	2007	2006	2005	2004	2003	2002
No. of Acute Clinical Cases Reported [a]	849	802	694	758	891	1,223
Estimated No. of Acute Clinical Cases [b]	2,800	3,200	3,400	4,200	4,500	4,800
Estimated No. of New Infections [b] (current)	17,000	19,000	21,000	26,000	28,000	29,000
Percent Ever Infected [c]	1.3% - 1.9%					
Number of Persons Living with Chronic Infection [d]	2.7–3.9 million persons					
Annual Number of Chronic Liver Disease Deaths associated with Viral Hepatitis [e]	12,000					

Centers for Disease Control and Prevention. (2007). *Disease Burden from Viral Hepatitis A,B,and C in the United STates.* Retrieved February 2010, from Centers for Disease Control and Prevention: http://www.cdc.gov/hepatitis/HCV/StatisticsHCV.htm

Figure 1.1



Centers for Disease Control and Prevention. (2007). *Disease Burden from Viral Hepatitis A,B,and C in the United STates.* Retrieved February 2010, from Centers for Disease Control and Prevention: http://www.cdc.gov/hepatitis/HCV/StatisticsHCV.htm

Table 1.4 Incidence of Hepatitis C, United States

Year	Estimated Acute Cases	Estimated Total New Infections
1982	29,500	180,000
1983	30,800	188,000
1984	36,000	219,000
1985	42,700	261,000
1986	43,000	262,000
1987	35,400	216,000
1988	39,400	240,000
1989	47,800	291,000
1990	29,400	179,000
1991	18,400	112,000
1992	12,000	73,000

1993	9,400	57,000
1994	8,900	54,000
1995	5,900	36,000
1996	5,900	36,000
1997	6,300	38,000
1998	6,800	41,000
1999	6,400	39,000
2000	6,300	38,000
2001	3,900	24,000
2002	4,800	29,000
2003	4,500	28,000
2004	4,200	26,000
2005	3,400	21,000
2006	3,200	19,000
2007	2,800	17,000

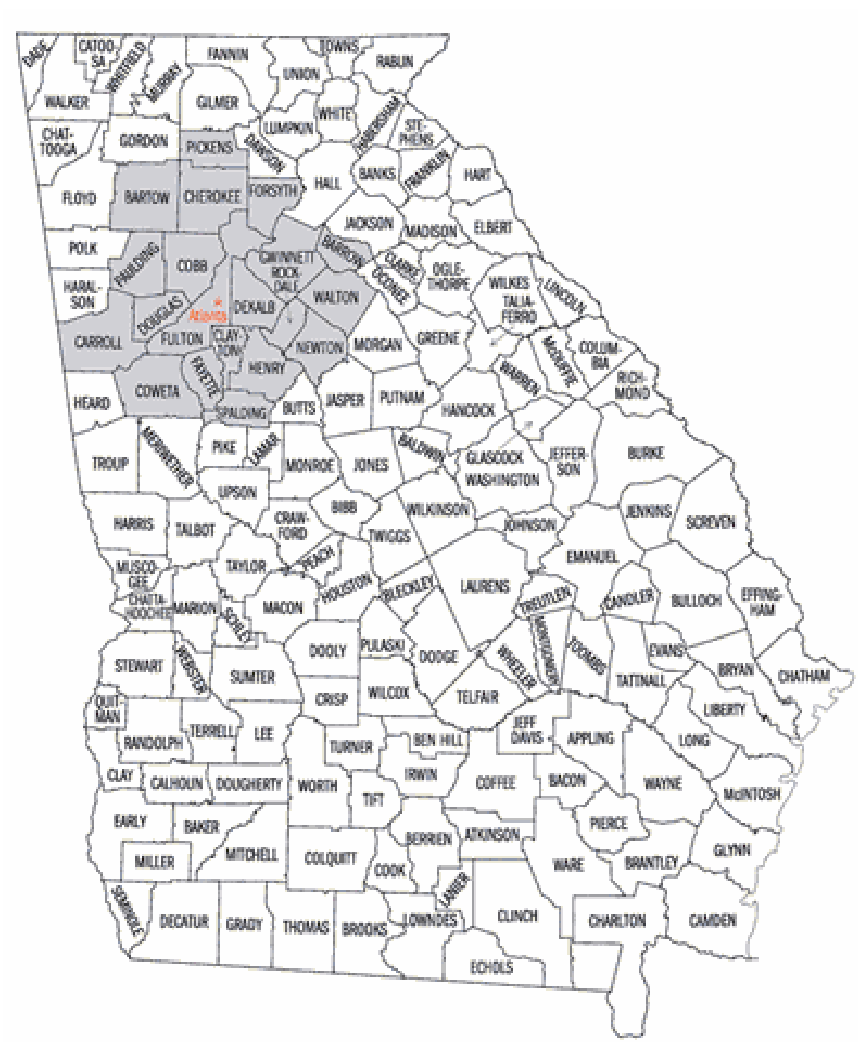
Centers for Disease Control and Prevention. (2007). *Disease Burden from Viral Hepatitis A,B,and C in the United STates.* Retrieved February 2010, from Centers for Disease Control and Prevention: http://www.cdc.gov/hepatitis/HCV/StatisticsHCV.htm

Table 1.5

TABLE 1. Percentage of acute hepatitis cases that included risk factor data, by state/area --- United States, 2007			
85%--100%	**61%--84%**	**11%--60%**	**0--10%***
Colorado	Alabama	Idaho	Alaska
Connecticut	Arizona	Kansas	California
Florida	Arkansas	Kentucky	Delaware
Hawaii	Indiana	Louisiana	Georgia
Iowa	Maryland	Texas	Illinois
Maine	Massachusetts	Virginia	Mississippi
Nevada	Michigan	Wyoming	Montana
North Carolina	Minnesota		New Hampshire
North Dakota	Missouri		New Jersey
Oklahoma	Nebraska		New York City
Rhode Island	New Mexico		Oregon
South Carolina	New York		
Washington	Ohio		
West Virginia	Pennsylvania		
	South Dakota		
	Tennessee		
	Utah		
	Vermont		
	Wisconsin		
* No risk factor data were available for states in this category.			

Centers for Disease Control and Prevention. (2007). *Disease Burden from Viral Hepatitis A,B,and C in the United STates.* Retrieved February 2010, from Centers for Disease Control and Prevention: http://www.cdc.gov/hepatitis/HCV/StatisticsHCV.htm

Figure 1.2 Georgia EIP Regional Map



Grey = Metropolitan Statistical Area (MSA) for Atlanta
White = Georgia Outside of Atlanta (including rural Georgia)

CDC, Georgia Department of Community Health – Emerging Infectious Disease Program

Appendix 2

Table 2.1 Basic Descriptive Characteristics of Hepatitis C Subjects in the State of Georgia (2009)

Variable	N	Percent (%)
Gender		
Male	525	61.4
Female	330	38.6
Ethnicity		
White-Non Hispanic	407	55.4
Black-Non Hispanic	304	41.4
Other	24	3.3
Geographic Zone		
MSA	368	44.1
GOA	467	55.9
Disease Status		
Acute Hepatitis C	31	3.6
Chronic Hepatitis C	713	83.4
Hepatitis C (Infected)	111	13.0

* Valid percent values are indicated for each value recorded for variables in the previous two tables.

Table 2.2 Age Characteristics and Age Distribution Characteristics for Hepatitis C Subjects in the State of Georgia (2009)

Variables	N	Mean ± SD	Minimum	Maximum
Age	855	47.4 ± 13.4	0	88
Age Distributions		N	Percent (%)	
0 – 9		5	0.6	
10 – 19		14	1.6	
20 – 29		110	12.9	
30 – 39		68	8.0	
40 – 49		200	23.4	
50 – 59		346	40.5	
60 +		112	13.1	

Figure 2.1

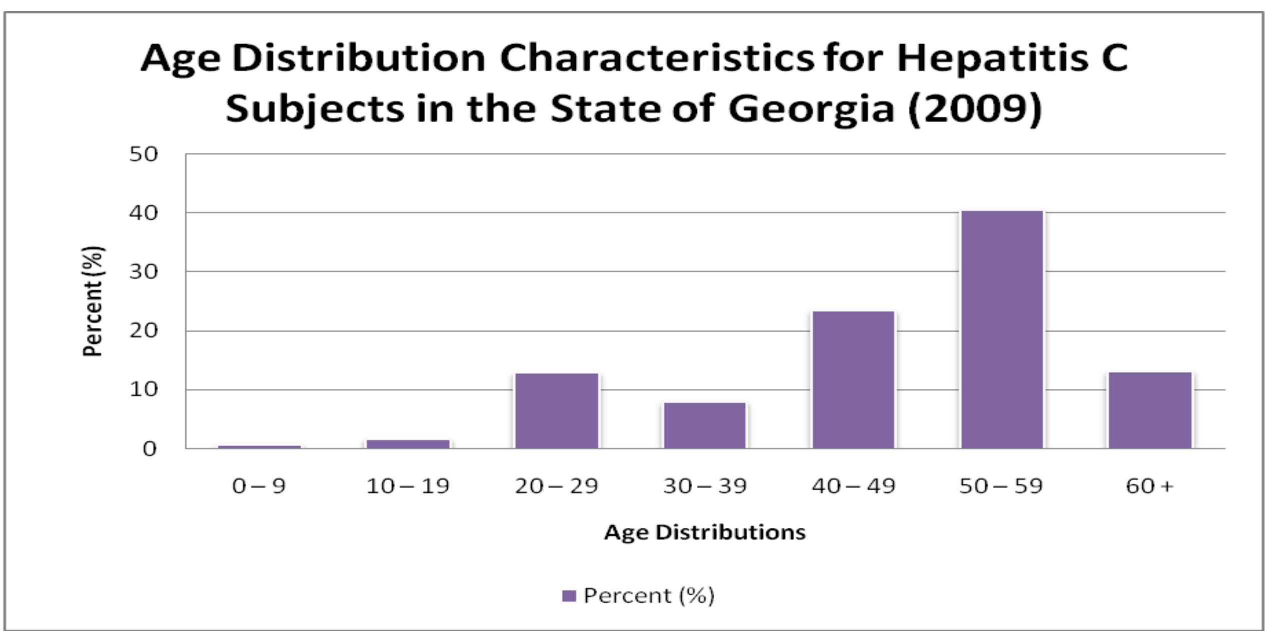


Table 2.3 Geographic Distribution of Basic Descriptive Characteristics of Hepatitis C Subjects in the State of Georgia (2009)

Geographic Region	Variables (%)					
	Gender			Ethnicity (Non-Hispanic)		
	Male	Female	p-Value	White	Black	p-Value†
MSA	63.6	36.4	.15	39.5	60.5	< .001
GOA	58.7	41.3		69.5	30.5	

Geographic Region	Variables (%)			
	Disease Status			
	Acute	Chronic	Infected	p-Value†
MSA	4.3	88.0	7.6	0.001
GOA	3.2	80.3	16.5	

† two – Assymp-sig.

Table 2.4 Geographic Distribution of Hepatitis C Risk Factor Data for the State of Georgia (2009)

Geographic Region	Variables (%)					
	Injection Drug Use			Blood Transfusion Prior to 1992		
	Yes	No	p-Value‡	Yes	No	p-Value‡
MSA	25.0	75.0	0.15	9.4	90.6	0.15
GOA	10.7	89.3		22.2	77.8	

Geographic Region	Variables (%)	
	Long Term Hemodialysis*	Accidental Needle Stick*

	Yes	No	p-Value‡	Yes	No	p-Value‡
MSA	8.8	91.2	0.11	9.1	90.9	0.69
GOA	0	100		12.5	87.5	

Geographic Region	Variables (%)					
	Tattoo†			**Sexual Contact***		
	Yes	No	p-Value‡	Yes	No	p-Value‡
MSA	18.8	81.2	1.00	15.6	84.4	0.30
GOA	15.4	84.6		0	100	

Geographic Region	Variables (%)		
	Incarceration*		
	Yes	No	p-Value‡
MSA	5.9	94.1	1.00
GOA	7.7	92.3	

* Two cells (50%) have expected counts less than five. Fischer's exact test was utilized for these indicated variables

† One cell (25%) has expected count less than five. Fischer's exact test was utilized for these indicated variables

‡ two – Assymp-sig.

Table 2.5 Geographic Distribution Age Distribution for Hepatitis C Subjects in the State of Georgia (2009)

Variables	Geographic Zone Percent (%)		p-value‡
	MSA	**GOA**	
Age Distribution (years) *			0.23
0 - 9	0.3	0.9	
10 – 19	1.6	1.7	
20 – 29	10.6	14.8	
30 – 39	6.0	8.6	
40 – 49	26.4	21.6	
50 – 59	41.6	40.3	
60 +	13.6	12.2	

* Two cells (14.3%) have expected counts less than five. Fischer's exact test was utilized for these indicated variables

Table 2.6 Ethnic Distribution of Hepatitis C Risk Factor Data for the State of Georgia (2009)

Ethnicity (Non-Hispanic)	Variables (%)					
	Injection Drug Use†			Blood Transfusion Prior to 1992		
	Yes	No	p-Value‡	Yes	No	p-Value‡
White	25.0	75.0	0.33	19.4	80.6	0.87
Black	12.5	87.5		17.9	82.1	

Ethnicity (Non-Hispanic)	Variables (%)					
	Long Term Hemodialysis*			Accidental Needle Stick*		
	Yes	No	p-Value‡	Yes	No	p-Value‡
White	0	100	0.08	13.3	86.7	0.69
Black	10.7	89.3		8.7	91.3	

Ethnicity (Non-Hispanic)	Variables (%)					
	Tattoo†			Sexual Contact*		
	Yes	No	p-Value‡	Yes	No	p-Value‡
White	13.3	86.7	0.19	12.0	88.0	0.63
Black	29.2	70.8		5.6	94.4	

Ethnicity (Non-Hispanic)	Variables (%)		
	Incarceration*		
	Yes	No	p-Value
White	16.1	83.9	0.72
Black	11.5	88.5	

* Two cells (50%) have expected counts less than five. Fischer's exact test was utilized for these indicated variables
† One cell (25%) has expected count less than five. Fischer's exact test was utilized for these indicated variables
‡ two – Assymp-sig

Table 2.7 Ethnic Distribution of the Age Distribution for Hepatitis C Subjects in the State of Georgia (2009)

Variables	Ethnicity (Non-Hispanic) (%)		p-value
	Whites	Blacks	
Age Distribution (years) *			< 0.001
0 - 9	0.5	0.3	
10 – 19	2.0	0.7	
20 – 29	13.5	4.6	
30 – 39	10.6	4.6	
40 – 49	26.5	22.7	
50 – 59	36.9	48.0	
60 +	10.1	19.1	

* three cells (21.4%) have expected counts less than five. Fischer's exact test was utilized for these indicated variables

Table 2.8 Descriptive Characteristics of Hepatitis C Risk Factors for Hepatitis C Subjects in the State of Georgia (2009)

Variable	N	Percent (%)
Injection Drug Use		
Yes	13	19.1
No	55	80.9
Blood Transfusion Prior to 1992		
Yes	12	16.7
No	60	83.3
Long Term Hemodialysis		
Yes	3	4.1
No	71	95.9

Accidental Needle Stick		
Yes	6	9.8
No	55	90.2
Tattoo		
Yes	12	19.4
No	50	80.6
Sexual Contact		
Yes	5	10.6
No	42	89.4
Incarceration		
Yes	8	12.5
No	56	87.5

* Valid percent values are indicated for each value recorded for variables in the previous two tables.

Table 2.9 Relative Risk of living in GOA regions in the State of Georgia tested against Descriptive and Risk Factor Variables (2009): Univariate Analysis

Variable†	Geographic Region		
	MSA	**GOA**	**p-Value**
Gender			
OR*	1.00	0.81	
95%CI	Reference	0.61 – 1.08	0.15
Race			
OR*	1.00	3.48	
95%CI	Reference	2.54 – 4.77	< 0.001
Injection Drug Use			
OR*	1.00	2.78	
95%CI	Reference	0.68 – 11.44	0.16

Blood Transfusion Prior to 1992			
OR*	1.00	0.36	
95%CI	Reference	0.09 – 1.50	0.16
Long Term Hemodialysis			
OR*	1.00	$1.56x10^{8}$	
95%CI	Reference	.000 -	0.998
Accidental Needal Stick			
OR*	1.00	0.70	
95%CI	Reference	0.13 – 3.81	0.68
Tattoo			
OR*	1.00	1.27	
95%CI	Reference	0.32 – 5.08	0.74
Sexual Contact			
OR*	1.00	$2.99x10^{8}$	
95%CI	Reference	.000 -	>0.998
Incarceration			
OR*	1.00	0.75	
95%CI	Reference	.098 – 5.71	0.78

* OR = Odds Ratio from univariate logistic regression analysis; CI = 95% confidence interval, p-value 2-sided
† Geographic distinction (MSA and GOA) is being tested against demographic and risk factor variables containing the specified reference as: gender (females), ethnicity (Black non-Hispanic), non- injection drug users, those who have not had blood transfusions prior to 1992, not on hemodialysis, not victims of needle stick injury, no tattoos, no sexual contacts HCV infected, not incarcerated.
‡ Low odds ratios and p-values that display no association for the risk factor data is reflective upon a large number of missing data. Table 2.8 shows the percentage of each total number **(N)** of cases represented by their respective risk factor.

Table 2.10 Relative Risk of living in GOA regions in the State of Georgia adjusting against Descriptive and Risk Factor Variables (2009): Multivariate Analysis

Variable[†]	Geographic Region		
	MSA	GOA	p-Value
Gender			
OR*	1.00	2.98	
95%CI	Reference	0.27 – 33.5	0.38
Race			
OR*	1.00	2.20	
95%CI	Reference	0.19 – 25.6	< 0.001
Injection Drug Use[‡]			
OR*	1.00	< 0.001	
95%CI	Reference	.000 -	0.999
Blood Transfusion Prior to 1992			
OR*	1.00	1.92	
95%CI	Reference	0.05 – 39.1	0.84
Long Term Hemodialysis[‡]			
OR*	1.00	< 0.001	
95%CI	Reference	.000 -	>0.998
Accidental Needal Stick			
OR*	1.00	1.51	
95%CI	Reference	0.05 – 44.1	0.81

Tattoo[‡]			
OR*	1.00	< 0.001	
95%CI	Reference	.000-	0.999
Sexual Contact[‡]			
OR*	1.00	< 0.001	
95%CI	Reference	.000 -	1.00
Incarceration[‡]			
OR*	1.00	2.585	
95%CI	Reference	.000 -	1.00

* OR = Odds Ratio from univariate logistic regression analysis; CI = 95% confidence interval, p-value 2-sided

[†]Geographic distinction (MSA and GOA) is being tested against demographic and risk factor variables containing the specified reference as: gender (females), ethnicity (Black non-Hispanic), non- injection drug users, those who have not had blood transfusions prior to 1992, not on hemodialysis, not victims of needle stick injury, no tattoos, no sexual contacts HCV infected, not incarcerated.

‡ Low odds ratios and p-values that display no association for the risk factor data is reflective upon a large number of missing data. Table 2.8 shows the percentage of each total number **(N)** of cases represented by their respective risk factor.