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Toni Williams Date

A Spatial Analytic Approach to Examining the Trends and Patterns of Substance Abuse Related Suicides in Metropolitan Atlanta

BY

Toni Williams

Degree to be Awarded: M.P.H
Executive MPH

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## Abstract

A Spatial Analytic Approach to Examining the Trends and Patterns of Substance Abuse Related Suicides in Metropolitan Atlanta

BY

Toni Williams

**Background:** Suicides are a major public health issue that has gained national attention for prevention measures. Prominent contributing factors of suicides include substances such as alcohol, illicit drugs and prescription medications. By utilizing advanced informatics systems and analysis, surveillance efforts can be improved for enhanced suicide prevention.

**Purpose:** The purpose of this thesis is to examine the trends and patterns of substance abuse related suicides in metropolitan Atlanta. Geospatial analysis will visually enhance the data by providing maps that expose high-risk areas in metropolitan Atlanta. The results of this study will contribute to the body of knowledge of understanding substance abuse related suicides metropolitan Atlanta. The study will also evaluate the value of utilizing spatial analytics for advancing public health surveillance of suicides related to substance abuse.

**Methods:** Data were collected from the National Violent Death Reporting System (NVDRS), which is a state-based surveillance system that tracks violent deaths nationwide. The collected data provided statistics that reveal information pertaining to substance abuse related suicides in metropolitan Atlanta. A spatial analysis technique was used to evaluate the data. Based on the results, a GIS mapping technique was used to visually represent the prevalence of substance abuse suicides in metropolitan Atlanta.

**Results**: Metropolitan Atlanta had a total of four counties that met the criteria for this study: Cobb, DeKalb, Fulton and Gwinnett. Total sample of substance abuse related suicides among the four counties from 2004 to 2011 was 211. Demographics with highest rates of prevalence included Females (sex – 57.8%), White/non-Hispanic (race/ethnicity – 78.7%) and 40 – 64 years of age (61.1%). Leading cause of substance abuse suicides was a combination of controlled substances and prescription drugs. Resulting chloropleth maps provide advanced visualization of statistical information.

**Conclusions:** The combination of multiple informatics systems can provide advanced surveillance for public health initiatives. Spatial analytics and mapping techniques serve as a powerful visualization tool for revealing trends and patterns of substance abuse related suicides.

A Spatial Analytic Approach to Examining the Trends and Patterns of Substance Abuse Related Suicides in Metropolitan Atlanta

BY

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A Thesis submitted to the Faculty of the Rollins School of Public Health of Emory University in partial fulfillment of the requirements of the degree of Master of Public Health in the Executive MPH program 2015.

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Last but not least, I would like to dedicate this endeavor to my family and partner; I could not have completed this with out their unconditional love and support.

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## ***Chapter 1: Introduction***

### Introduction and Background

Substance abuse is an emerging issue in the United States. Substance abuse is described as "a set of related conditions associated with the consumption of mind- and behavior-altering substances that have negative behavioral and health outcomes" (HHS, 2014). According to the Healthy People 2020 initiatives, substance abuse has a major effect on many levels of society because it contributes to social, physical, mental and public health problems such as the following: teenage pregnancy, human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), other sexually transmitted diseases (STDs), domestic violence, child abuse, motor vehicle crashes, physical fights, crime, homicide and suicide (HHS, 2014). The United States government's Department of Health and Human Services (HHS) suggests that nearly 22 million Americans abused drugs or alcohol in 2005 alone (HHS, 2014). Furthermore, the Substance Abuse and Mental Health Services Administration (SAMHSA) reported in 2005 via the Drug Abuse Warning Network that, "over 132,500 visits to emergency rooms were for alcohol- or drug-related suicide attempts" (CSAT, 2008). As a result, reduction of drug-induced deaths, (SA-12), is one of the many national objectives related to substance abuse recognized by Healthy People 2020 (HHS, 2014).

Suicides related to substance abuse are a major health concern that consumes the lives of many individuals. In general, the Centers for Disease Control and Prevention (CDC) attributes suicide to consuming lives of over 33,000 Americans each year, making it the 11$^{th}$ leading cause of death (CDC, n.d.).

Furthermore, alcohol and drug abuse are the second most prominent contributors to suicide behavior (CDC, n.d). Substance abuse related suicides are needless and highly preventable. For instance, suggested preventable measures such as limiting access to contributing substances and more effective mental health treatment are actions that can reduce the number suicides caused by substance abuse (CDC, n.d.). Therefore, it has become a nationwide public health initiative to improve awareness, surveillance and support for affected individuals, families and communities.

Improving surveillance measures for suicides related to substance abuse is the primary goal of this study. The combination of a state-based active surveillance system accompanied by spatial analysis will be used to capture and visually represent trends of substance abuse related suicides. Furthermore, advanced visual representation of prevalence provided by the resulting maps are intended to raise awareness and to enhance prevention efforts that can dramatically impact policies, standards and, most importantly, health outcomes.

**Problem, Purpose and Research Questions**

Suicide prevention has been a national strategy in the United States for many years due to governmental concern with consistently high suicide rates (IOM et al., 2002). Various federal agencies, including the Center for Disease Control and Prevention (CDC), the National Institute of Drug Abuse (NIDA), the National Institute on Alcohol Abuse and Alcoholism (NIAAA), the National Institute of Mental Health (NIMH), Substance Abuse and Mental Health Services Administration (SAMHSA), the Institute of Medicine (IOM), the Committee on Pathophysiology and

Prevention of Adolescent and Adult Science, the U.S. Department of Health and Human Services (HHS), the Office of the Surgeon General and National Action Alliance for Suicide Prevention and the Veterans Administration (VA) have all contributed efforts to improve research-based knowledge and prevention strategies of suicides (IOM et al, 2002).

One of the specific reoccurring goals of national initiatives has been to improve suicide-related surveillance. The United States government's Department of Health and Human Services (HHS) describes public health surveillance as the continuous systematic process of data collection, analysis, interpretation and time efficient dissemination of data to reduce morbidity and mortality (HHS et al, 2012). Furthermore, the Institute of Medicine (IOM) suggests that, "surveillance is a cornerstone of public health, allowing realistic priority setting, the design of effective prevention initiatives, and the ability to evaluate such programs (as cited in IOM et al., 2002)." As mentioned in the Surgeon General's National Strategy for Suicide Prevention, although suicide-related surveillance has improved over the years, additional efforts need to be made to "inform and guide suicide prevention efforts nationwide" and the "collection and integration of surveillance data should be expanded and improved" (HHS et al, 2012).

The state of Georgia has similar initiatives for suicide prevention. According to the 2009 Georgia Data Summary, "suicide is the eleventh leading cause of death and leading cause of violence-related death in Georgia" (DCH, 2009). Furthermore, in 2006, it was reported that 11% of suicides in Georgia were due to poisoning; here "poisoning" refers to both alcohol and substance abuse (DCH, 2009). The Suicide

Prevention Advocacy Network USA (SPAN USA) developed the Georgia Suicide Prevention Plan to provide a framework "to guide individual people, agencies and organizations, in local communities as well as regional and state levels," to prevent suicide (Chambliss, 2001). One of the goals specifically addresses improving and expanding surveillance systems in order to collect information about the prevalence, to improve reporting of data and to enhance indicators that measure the success of community level-results and expanded surveillance systems (Chambliss, 2001).

As a result, the purpose of this thesis is to examine the trends and patterns of substance abuse related suicides in metropolitan Atlanta. The thesis will use de-identified data from the National Violent Death Reporting System (NVDRS), which is intended to capture the statistical data of suicides associated with substance abuse. Geospatial analysis will visually enhance the data by providing maps that expose high-risk areas in metropolitan Atlanta. The results of this study will contribute to the body of knowledge of understanding substance abuse related suicides metropolitan in Atlanta. The study will also evaluate the value of utilizing spatial analytics for advancing public health surveillance of suicides related to substance abuse; this is intended to serve as a model for other areas of Georgia and additional states for enhanced surveillance efforts.

The research questions this study intends to answer are as follows:

- How does the geospatial analysis of the National Violent Death Reporting System (NVDRS) and spatial analytic visualization tools enhance surveillance of suicides related to substance abuse in metropolitan Atlanta?

- What trends and patterns regarding substance abuse related suicides in metropolitan Atlanta are evident based on the resulting maps?
- How can the resulting maps be used for public health initiatives for reducing suicides associated with substance abuse?

**Theoretical Framework**

An objective of the 2012 National Strategy for Suicide Prevention for enhancing surveillance is to "improve the usefulness and quality of suicide-related data" (HHS, 2012). One of the suggested ways of improvement is to, "promote the increased utilization of the National Violent Death Reporting System (NVDRS)" (HHS, 2012). Currently, the Centers for Disease Control and Prevention (CDC), funds the Georgia Violent Death Reporting System (GVDRS) to participate in data collection for the NVDRS (DPH, n.d). The NVDRS and GVDRS are designed to collect information on violent deaths, which is defined by the Georgia Department of Public Health (DPH) as " homicides, suicides, accidental deaths from firearms, deaths related to terrorism, deaths from legal intervention, and those of undetermined intent" (DPH, n.d.). Therefore, a federal source of suicide-related data can be extracted from the NVDRS for the purpose of this study.

Mapping techniques and spatial analysis are used in various studies to enhance surveillance of public health issues by means of Geographic Information Systems (GIS). An additional layer of geographic visualizations for data can reveal patterns and trends of behavior "related to the spatial distributions of different populations and environments" (Gruenewald, 2013). Existing studies highlight a multitude of benefits of adding geospatial analyses, when these techniques are

properly utilized. Use of geospatial analyses can be an effective component in education, policy formation, and monitoring and evaluation, among other applications (Boulous, 2014). Therefore, a GIS can be used to enhance the quality of surveillance data provided by the NVDRS. As suggested to improve understanding of violent deaths, such as suicides, "the quality of surveillance data can be enhanced by developing new relationships with data providers that may offer complementary data, as well as increasing contact and training of data providers to accurately capture and document crucial information on violent death incidents" (Ramirez-Irizzary, 2012).

**Significance**

In effort to improve surveillance of substance abuse related suicides in this study, the methodology proposes groundwork for advancing informatics systems of public health initiatives. The utilization of visualization techniques, such as geospatial analytics, can demonstrate prevalence of suicides in specific communities and geographical areas over time. Also, according to the Institute of Medicine (IOM), "understanding which specific qualities of the areas and populations tend to influence the suicide rate is critical for designing programs to enhance protective factors and reduce risk factors" (IOM et al., 2002).

## ***Chapter 2: Review of Literature***

### Introduction

The literature review is used to explore publications that discuss current policies, strategies and initiatives to prevent substance abuse and its relation to suicides. Surveillance methods that are presently used in public health for similar efforts will be probed as well. Lastly, descriptions and the usages of the data sources and informatics systems utilized in this study will be further investigated. Various publications were gathered from repositories such as PubMed, federal websites, eJournals and other credible electronic libraries.

### Suicide Prevention Strategies and Initiatives

Suicide statistics produce alarming results, which makes prevention strategies and initiatives a national priority. The Department of Health and Human Services (HHS) reveals approximately 33,000 Americans died yearly due to suicide between 2001 and 2009 (HHS, 2012). The human and economic costs to society are another issue. One recognizable human issue refers not only to the victims who commit suicide, but the loved ones and individuals who will be affected by the incident. Also economically, according to a study about medical costs associated with interpersonal and self-directed violence, approximately $33 billion was attributed to the lifetime cost of self-inflicted injuries during the year of 2000 (Corso et al, 2007).

The federal response to the high rates of suicides has extended for several years. Below is a brief timeline of events that highlight federal prevention efforts of suicides:

- **1966**: Center for Suicide Prevention established at the National Institute of Mental Health (IOM, 2002)
- **Mid 1980s**: The Centers for Disease Control and Prevention develops task force to prevent high rates of suicides amongst youth (IOM, 2002)
- **1998**: The Suicide Prevention Action Network USA (SPAN USA) held the National Suicide Prevention Conference in Reno, Nevada (Chambliss, 2001)
- **1999**: The Surgeon General introduced his Call to Action to Prevent Suicide (Chambliss, 2001)
- **2010**: Healthy People 2010 presents goals to reduce the overall suicide rate and to reduce attempts amongst adolescents (HHS, 2010)

Recently, an update to the original Surgeon General's Call to Action to Prevent Suicide was created in 2012 in order to track the success of previous efforts, to reveal areas where more work is needed, to identify scientific research that can enhance and improve the care given to those who are affected by suicide, and to assess lessons learned to guide future endeavors (HHS, 2012).

Based on the national efforts of the Surgeon General's Call to Action and the National Suicide Prevention Conference in Reno, Nevada, the state of Georgia developed the Georgia Suicide Prevention Plan (Chambliss, 2001). SPAN USA developed the Georgia Suicide Prevention Plan based on the Surgeon General's national strategy in combination with the needs and interests specific to the state (Chambliss, 2001). The main themes of the plan are as follows (Chambliss, 2001):

- Draw attention to a wide range of actions so that specific activities can be developed to fit the resources and areas of interest of people in everyday community life as well as professionals, groups, and public agencies.
- Seek to integrate suicide prevention into existing health, mental health, substance abuse, education, and human services activities.
- Guide the development of activities that will be tailored to the cultural contexts in which they are offered.
- Seek to eliminate disparities that erode suicide prevention activities.
- Emphasize early interventions to promote protective factors and reduce risk factors for suicide.
- Seek to build statewide capacity to conduct integrated activities to reduce suicidal behavior and prevent suicide.

In essence, suicide prevention is a major public health concern that is being addressed nationwide. Federally driven preventative strategies have served as a catalyst and blueprint for states to develop initiatives based on their specific needs. The Georgia Suicide Prevention Plan serves as a state-based plan for battling suicide. The Georgia Suicide Prevention Plan takes in account perspectives from various sources, including "researchers and scientists, practitioners, leaders of private non-governmental organizations and groups, federal agencies, survivors and community leaders," in order to address the complete issue in regards to suicide in Georgia (Chambliss, 2011). Furthermore, the plan intends to promote awareness and participation from the various contributing sources, in order to design a plan

that will provide "commitment, accountability and measurable progress for suicide prevention" (Chambliss, 2001).

**Current Suicide Related Surveillance Methods**

There are various types of surveillance currently used to monitor suicides. Sources of data that contribute to the surveillance include death records, hospital records, population-based surveys, and health insurance claims. Advancements in technology enable most data to be extracted electronically.

As previously discussed, surveillance is an effective strategy to evaluate public health issues such as suicides and substance abuse. Data that are collected from surveillance systems provide a foundation for developing prevention measures. For instance, data and surveillance are valuable for identifying public health issues, determining at risk populations, support of prevention initiatives and evaluation of implemented strategies (Horan et al, 2003). It has been an overarching goal to improve surveillance of suicides. An example of a nationwide initiative is the fourth strategic direction of the Surgeon General's National Strategy, which focuses on improving research and evaluation activities related to suicide prevention surveillance (HHS, 2012).

There are several issues that need to be resolved with current surveillance of suicides. Most of the issues involve availability, timeliness and quality of the data collected. The Data and Surveillance Task Force (DTSF) of the National Action Alliance for Suicide Prevention conducted a study that assessed the presently utilized suicide-related surveillance systems and provided suggestions for improvement. The suggestions for improvement include (DTSF, 2014):

- Implementing standard language and definitions on self-harm and suicidal thoughts and behavior in coding manuals and national surveys, such as represented in the CDC's Self-Directed Violence Surveillance Uniform Definitions and Recommended Data Elements and the Department of Veterans Affairs' Self-Directed Violence Classification System.
- Add missing key variables or data elements (e.g. socio-demographics, mechanism of injury) to existing nonfatal data systems to enhance their usefulness for suicide-related surveillance.
- Expand geographic scope of surveillance at the regional, state, county level or among subpopulations to reveal underrepresented or unrepresented groups.
- Endorse the use of external cause coding (a data element needed to identify suicide attempts) on medical records as a requirement for reimbursement by insurance carriers.
- Support inclusion of suicide-related items in data systems that capture real-time information on hospital emergency department visits to improve the monitoring of trends in suicidal behavior.
- Encourage all states to include nonfatal suicidal behavior (i.e. suicide attempts) by youth aged 12-17 years as a health condition to be reported to the state health department.

Overall, while there are many types of suicide-related surveillance, challenges still exist that need to be resolved. Systematic challenges regarding interoperability, data quality and data exchange, present issues for unifying multiple surveillance systems. The research conducted by DTSF provides useful strategies to

resolve the systematic issues for all categories of surveillance that are utilized by federal, state and local entities. DTSF believes that, "successful implementation of these recommendations will significantly enhance the development of a national coordinated program of fatal and nonfatal suicide surveillance" (DTSF, 2014). Furthermore, a program of fatal and nonfatal suicide surveillance promotes evidence-based public health initiatives to reduce suicides and suicidal behaviors (DTSF, 2014).

**NVDRS Contribution to Substance Abuse Related Suicide Surveillance**

The National Violent Death Reporting System (NVDRS) is a state-based surveillance system developed by the Centers for Disease Control and Prevention (CDC). The CDC describes the NVDRS as a system "that links data from law enforcement, coroners and medical examiners, vital statistics, and crime laboratories to assist each participating state in designing and implementing tailored prevention and intervention efforts" (CDC, 2014). As of 2014, thirty-two states contribute and access data from the central database provided by the NVDRS (CDC, 2014). The thirty-two participating states are: Alaska, Arizona, Colorado, Connecticut, Georgia, Hawaii, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, Utah, Vermont, Virginia, Washington, and Wisconsin (CDC, 2014). Various research assessable spatial levels of data can be extracted from the NVDRS, including county and zip code levels.

The National Center for Injury Prevention and Control released a briefing that revealed statistics of suicides due to substance abuse based on data from the NVDRS. The data was collected from 16 participating states between 2005 and 2007. The NVDRS defines suicides as, "a death resulting from the use of force against oneself when the evidence indicates that the death was intentional" (CDC, n.d.)." Furthermore, according to the NVDRS, deaths caused by unintentional poisonings or acute substance abuse are not included in the briefing because they are not classified as suicides (CDC, n.d.). The types of substances involved in the study were from death certificates that attributed poisonings by alcohol and various forms of drugs, including prescription, illicit and over-the-counter, as the cause of death (CDC, n.d). The major findings from the study conducted by the NVDRS include the following (CDC, n.d.):

- A leading cause of suicides is poisoning, with drugs and alcohol contributing to 75% of the deaths.
- The second leading cause of substance abuse related suicides were attributed to over-the-counter drugs.
- Alcohol combined with prescription drugs (31%) and prescription drugs combined with over-the-counter drugs (30%) were found to be leading causes of those who consumed more than one type of drug.

The NVDRS has proven to be a beneficial surveillance system for accessing substance abuse related suicides. Due to lack of participation during this study, the results do not reflect all of the 50 states in the U.S. However, as encouraged by the Surgeon General to increase the usage of the NVDRS to improve suicide prevention

and the current involvement of 32 states contributing data to the NVDRS, this national database will continue to evolve as a leading tool for advanced public health surveillance. Furthermore, dissemination of the results revealed in this study will raise awareness and serve as a model for progressive suicide prevention efforts as well.

**Conclusion**

This chapter reviews various initiatives and efforts to prevent suicides. Based on the surveillance systems that are currently utilized, it is evident that there is a need for advancements in order to effectively capture prevalence of suicides. The NVDRS has proven to be an effective national surveillance method for capturing data about violent deaths. Given the usefulness of the NVDRS database, evidence-based research can be conducted to link suicide occurrences to risk factors such as substance abuse.

## ***Chapter 3: Methodology***

### Introduction

This chapter intends to describe the methodology used for assessing trends and patterns of substance abuse related suicides in Metropolitan Atlanta, GA. The source of data referenced is provided by the National Violent Death Reporting System (NVDRS).

### Population and Sample

The population and sample utilized for this study were extracted from the NVDRS with specifications to include suicides that occurred in the state of Georgia between the years of 2004 through 2011. The data collected was received de-identified and had no links to the subjects whose information were contained in the data set. According to the National Center of Injury Prevention and Control (NCIPC), suicides are deaths that are caused by intentional force towards oneself (CDC, 2010). The population included men and women with diverse ethnicities and various ages. The counties in Metropolitan Atlanta that met the criteria for reporting data were Cobb, DeKalb, Fulton and Gwinnett. Substance abuse related suicides were defined by ICD-10 codes that revealed deaths related to substance abuse that were primarily caused by intentional self-harm. ICD-10 codes that were classified as undetermined intent and other ill-defined and unspecified cause of mortality that proved to be related to substance abuse deaths were also included to maximize the sample size.

**Research Design and Procedures**

This study is designed as descriptive research to identify trends and patterns of substance abuse related suicides in metropolitan Atlanta. As previously mentioned, the counties of metropolitan Atlanta that met the criteria for reporting were Cobb, DeKalb, Fulton and Gwinnett; each county had a population of more than 100,000 people and more than 20 deaths related to this research topic. After the sample size was identified, each county was isolated to determine the prevalence of substance abuse related suicides specific to those areas. Substance abuse related deaths were defined by ICD-10 codes categorized as the following:

- Intentional Self-Harm
- Event of Undetermined Intent
- Ill Defined and Unknown Cause of Mortality

Events of undetermined intent and ill defined and unknown cause of mortality were used to increase the sample sizes in the counties. Furthermore, those two categories were filtered to only include deaths that involved substances that were the same as those associated with intentional self-harm. The substances that were used in suicides were described as the following:

- Mixed Drugs and Alcohol
- Mixed Drugs – Controlled Substances, Prescription and Over the Counter (OTC)
- Mixed Drugs – Controlled Substances, Prescription (no OTC)
- Mixed Drugs – Street Recreational and Prescription
- Mixed Drugs – OTC Only

- Single Drug – OTC Only
- Single Drug – Prescription (non-controlled)
- Single Drug – Controlled Substance
- Single Drug – Alcohol Only
- Unknown Drugs

After completion of filtering the substance abuse related suicides by county and drug description, demographic information was assessed. The demographic variables included sex, ethnicity/race and age. The calculated totals of the demographic variables from each county contributed to the final analysis of substance abuse related suicides in metropolitan Atlanta.

Lastly, spatial analysis was conducted based on each county's demographic information. Percentages were calculated specific to the substance abuse suicide rates associated with each county. Spatial analysis was used to visually represent the percentages of substance abuse related suicides of the counties on various maps.

**Instruments**

The data used for this study was provided by the National Violent Death Reporting System (NVDRS). SAS University Edition was the initial software used for data exploration for this paper; copyright accredited to the SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC, USA. Microsoft Excel, version 14.3.2—copyright 2010, was used to further explore the data and to construct spreadsheets for GIS mapping. GIS mapping was conducted by means of ArcGIS software, version

10.3.1 (ESRI, Redlands, California), and the use of open source data from the Atlanta Regional Commission.

**Limitations and Delimitations**

The major limitation of this project was that the lowest possible level of data representation was at the county level, based on the NVDRS guidelines for reporting the findings. This aggregation masks suicide trends at an intra-county scale. Additionally, only four counties met the minimum suicide numbers to report data, even after combining intentional self-harm with events of undetermined intent and ill defined and unknown cause of mortality. While preserving the de-identification of the cases is understandable and necessary, it also presented a challenge to conduct some advanced spatial analytics, such as some clustering techniques that require point data and spatial autocorrelation. Due to the circumstances, a delimitation involved adjusting the scope to represent the data in a meaningful manner to reflect trends and patterns of substance abuse at the county level; therefore, this study only visualizes average percentage of demographics in this dataset, using chloropleth maps.

## ***Chapter 4: Results***

### Introduction

This chapter discusses the results from the research conducted about substance abuse related suicides in metropolitan Atlanta. The four counties analyzed were Cobb, DeKalb, Fulton, and Gwinnett.

### Findings

The initial phase of this project included an exploration of the data provided by NVDRS. The total number of substance abuse related suicides based on counties and the percentage of suicides based on county population is represented below (Table 1):

| County | Total Number of Drug Related Suicides | County Population (% Suicides) |
|---|---|---|
| **Cobb** | 27 | 0.004 |
| **DeKalb** | 37 | 0.005 |
| **Fulton** | 84 | 0.008 |
| **Gwinnett** | 63 | 0.007 |

**Total (n): 211**

***Table 1: n and percentage of drug related suicides in each county (Intentional Self-Harm + Undetermined Intent + Ill Defined and Unknown; 2004 - 2011)***

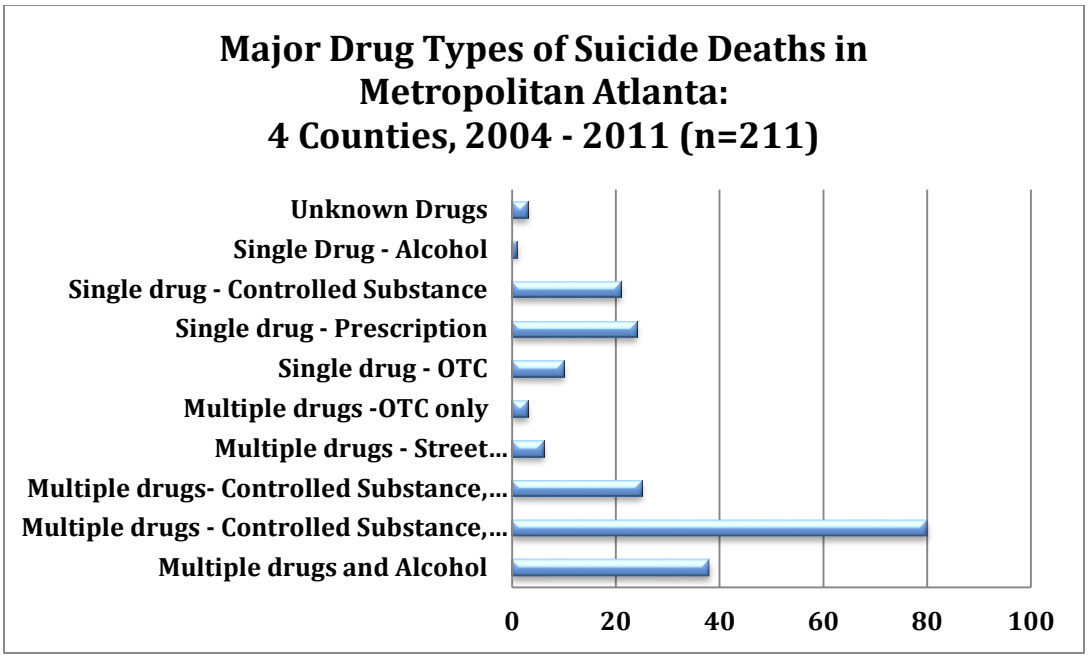
Based on these findings, it is evident that Fulton County has the highest percentage of drug related suicides amongst the researched counties during the years of 2004 - 2011.

Incorporating an analysis of demographics provided the following results (Table 2):

| Characteristic | No. | % of Total Suicides Due to Poisoning by Drugs/Alcohol |
|---|---|---|
| **Sex** | | |
| Male | 89 | 42.2 |
| Female | 122 | 57.8 |
| **Race/Ethnicity** | | |
| Hispanic | 5 | 2.4 |
| White, non-Hispanic | 166 | 78.7 |
| Black, non-Hispanic | 28 | 13.3 |
| American Indian/Alaska Native, non-Hispanic | 0 | 0 |
| Asian/Pacific Islander, non-Hispanic | 3 | 1.4 |
| Unknown/Other | 9 | 4.3 |
| **Age Group (years)** | | |
| ≤17 | 3 | 1.4 |
| 18-39 | 71 | 33.6 |
| 40-64 | 129 | 61.1 |
| ≥65 | 8 | 3.8 |
| Unknown | 0 | 0 |

***Table 2: Number and percent of suicides due to drug and/or alcohol ingestion, by decedent sex, and age group (4 counties – Metropolitan Atlanta, 2004 – 2011)***

The results of Table 2 reveal that females have the highest prevalence in regards to sex. White, non-Hispanic individuals reflect the majority accounted for in the race/ethnicity category. Also, the age group of 40 – 65 has the highest amount of substance abuse related suicides of the four counties. Another analysis that was conducted was based on the type of drugs that contributed to suicides (Table 3).




Based on the results, it was found that the most evident cause of substance abuse related suicides was due to a combination of drugs, which included controlled substances and prescription medications. One of the most popular combinations of drugs included an opiate, such as hydrocodone, morphine and oxycodone, and an antidepressant, such as bupropion, venlafaxine, and paroxetine. Over the counter drugs that were widely used include acetaminophen and diphenhydramine. Alcohol was also a common substance; for this study, ethanol was the only form of alcohol that was included.

Spatial analysis was a key component to this study. Visualizations provided by GIS mapping revealed additional statistical information about substance abuse related suicides. Please note that the legends of the maps are varied due to the number of cases and percentages of prevalence specific to each county. For instance, Gwinnett county has a total of 63 cases and Cobb county has a total of 27 cases, therefore the variance of the average percentages of the demographics are

county specific. Natural breaks were used to determine the scale of the legends. Also, average percentages were used in order to comply with identity protection standards. Therefore, for purposes of this study, the maps should be analyzed individually, and not for comparing and contrasting multiple maps.

See Figures 1 – 2 for visualizations related to the sex demographics, Figures 3 – 7 for the race/ethnicity demographics and Figures 8 – 11 for age demographics.

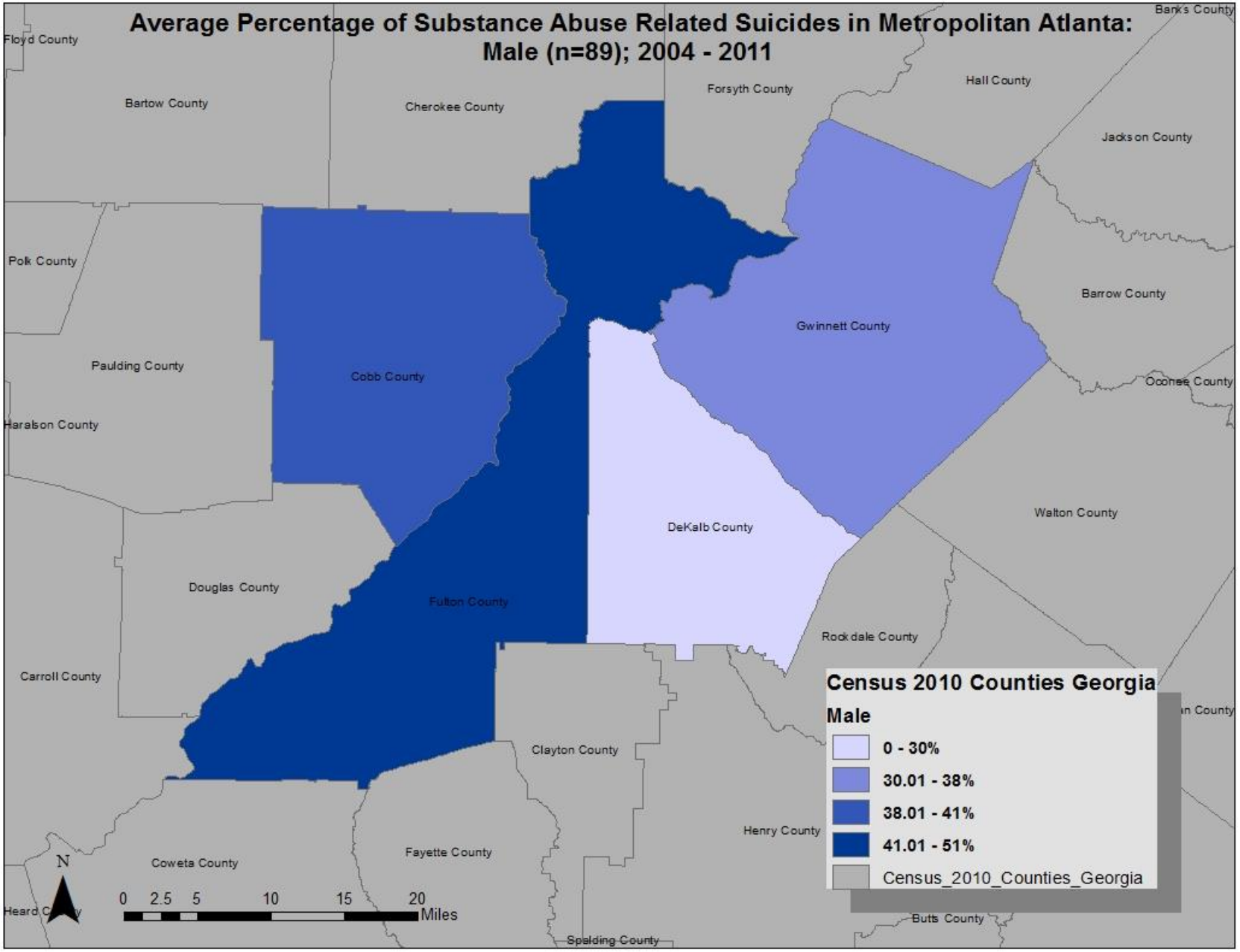



***Figure 1: Average Percentage of Substance Abuse Related Suicides in Metropolitan Atlanta: Male (n=89); 2004-2011***

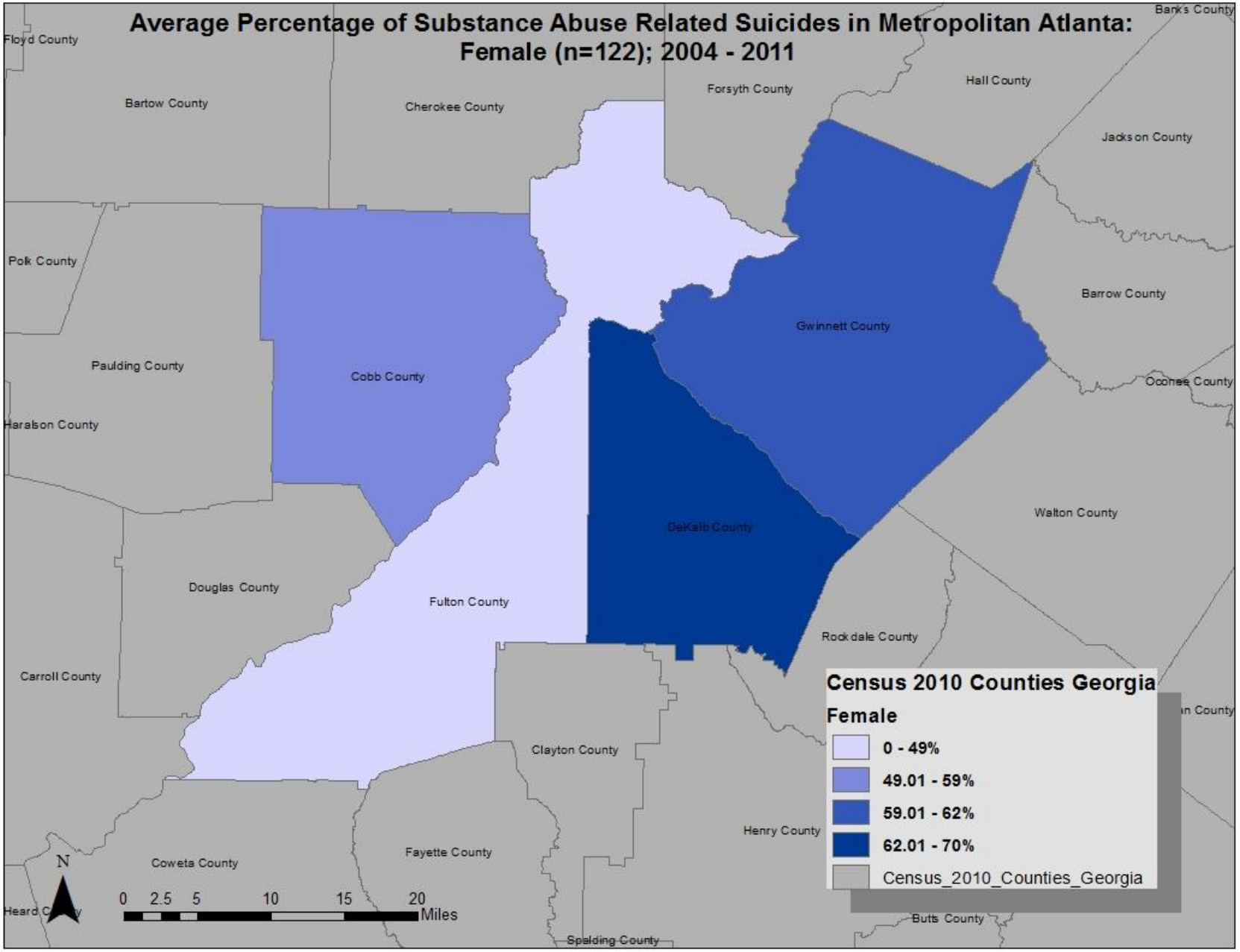



***Figure 2: Average Percentage of Substance Abuse Related Suicides in Metropolitan Atlanta: Female (n=122); 2004-2011***

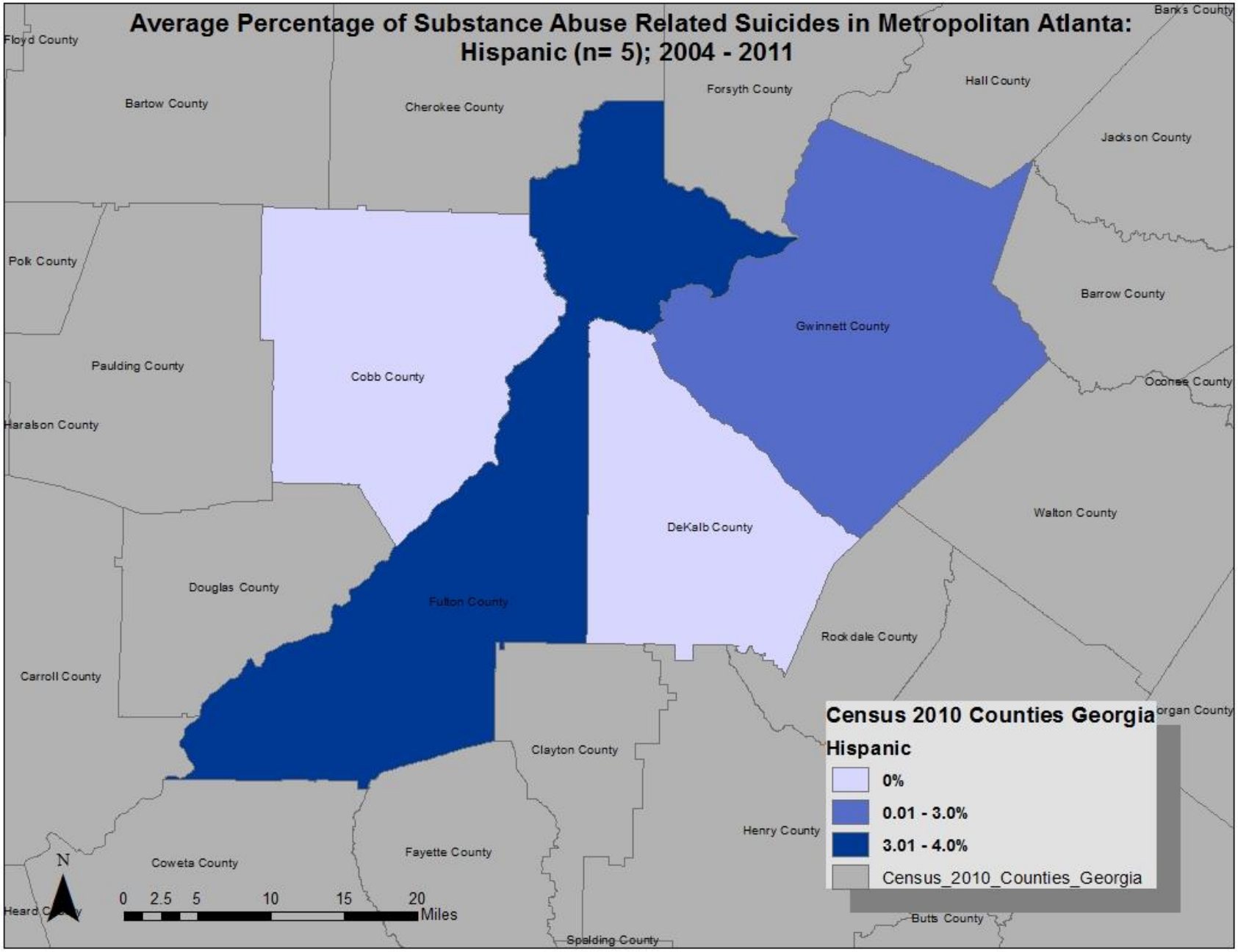



***Figure 3: Average Percentage of Substance Abuse Related Suicides in Metropolitan Atlanta: Hispanic (n=5); 2004-2011***

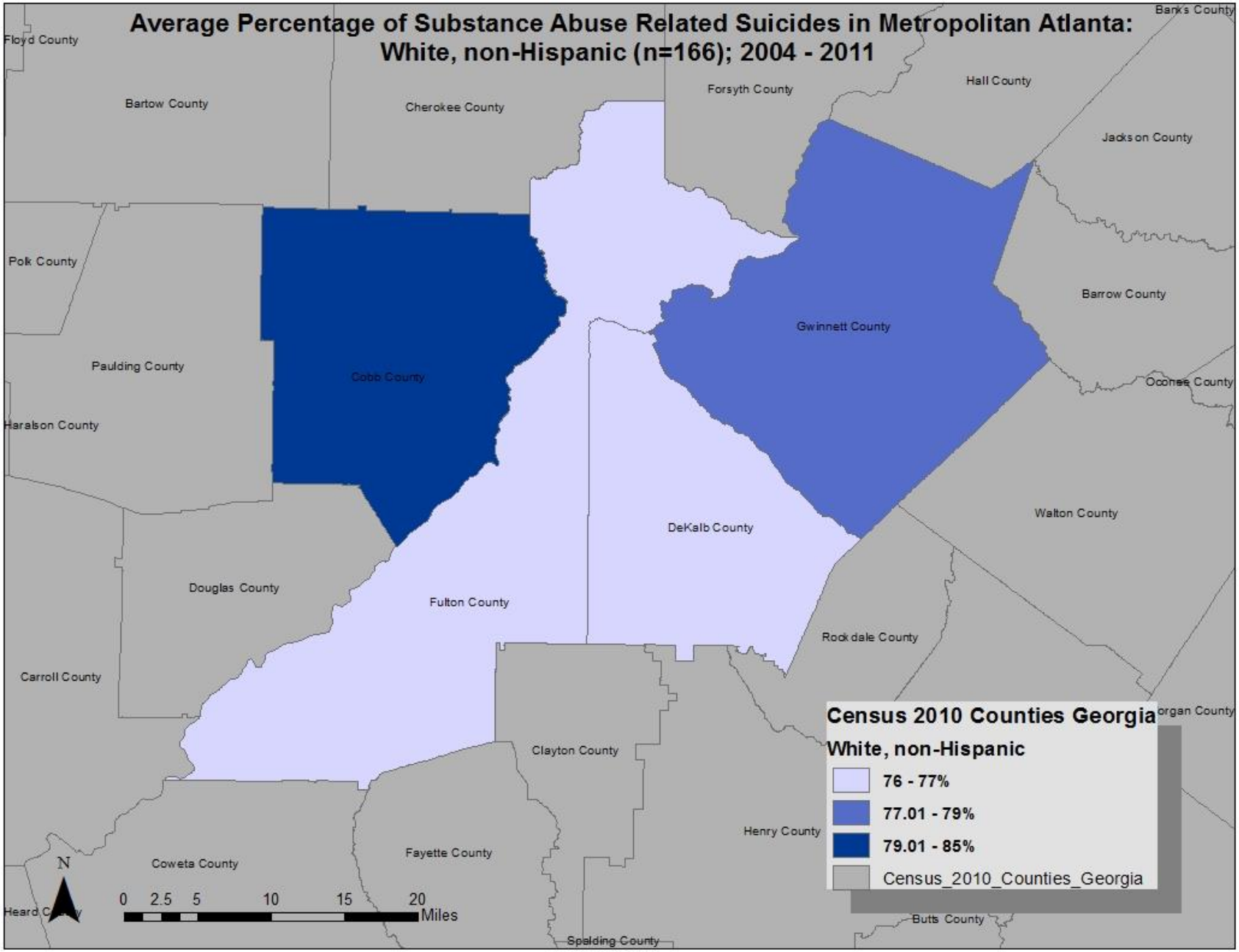



***Figure 4: Average Percentage of Substance Abuse Related Suicides in Metropolitan Atlanta: White, non-Hispanic (n=166); 2004-2011***

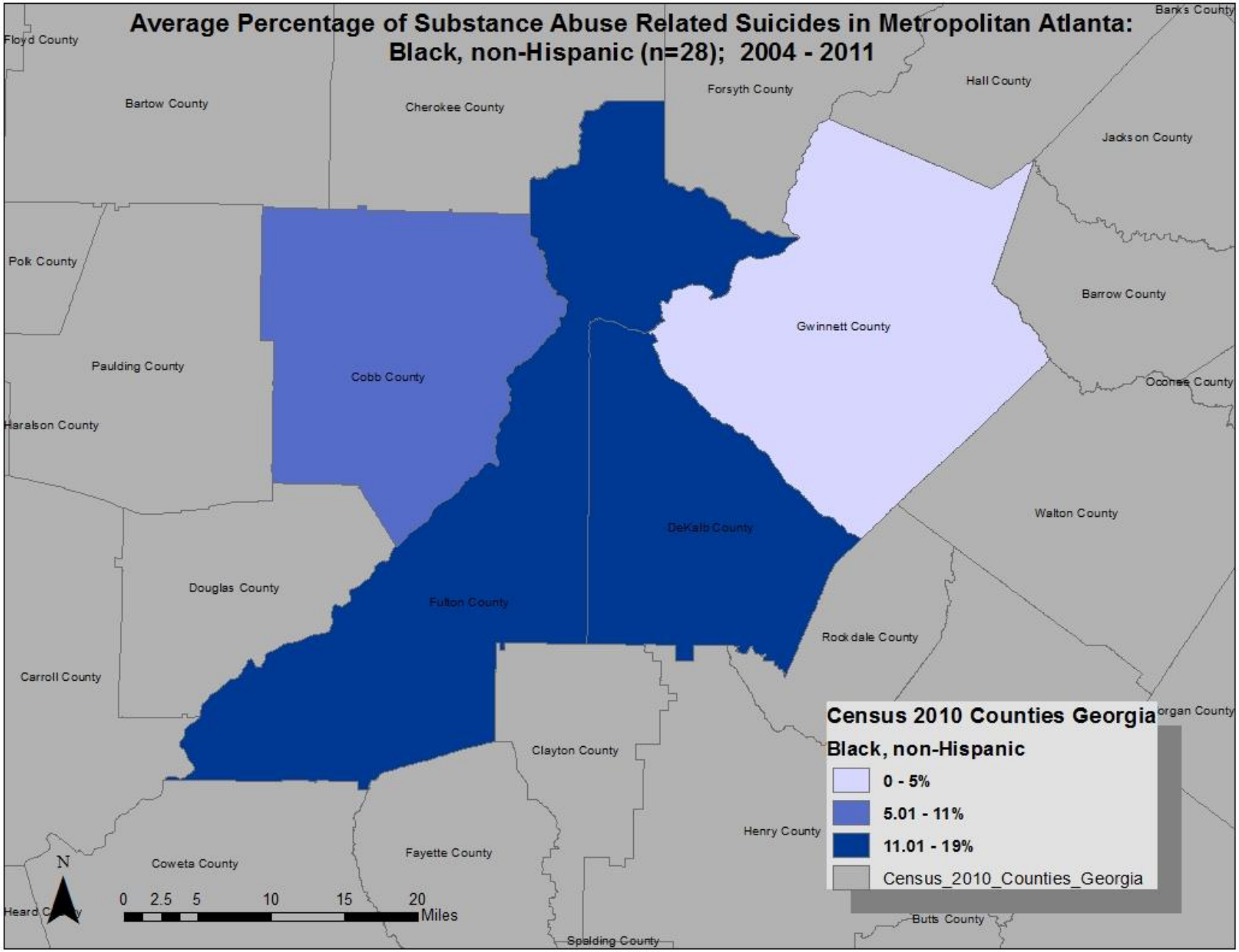



***Figure 5: Average Percentage of Substance Abuse Related Suicides in Metropolitan Atlanta: Black, non-Hispanic (n=28); 2004-2011***

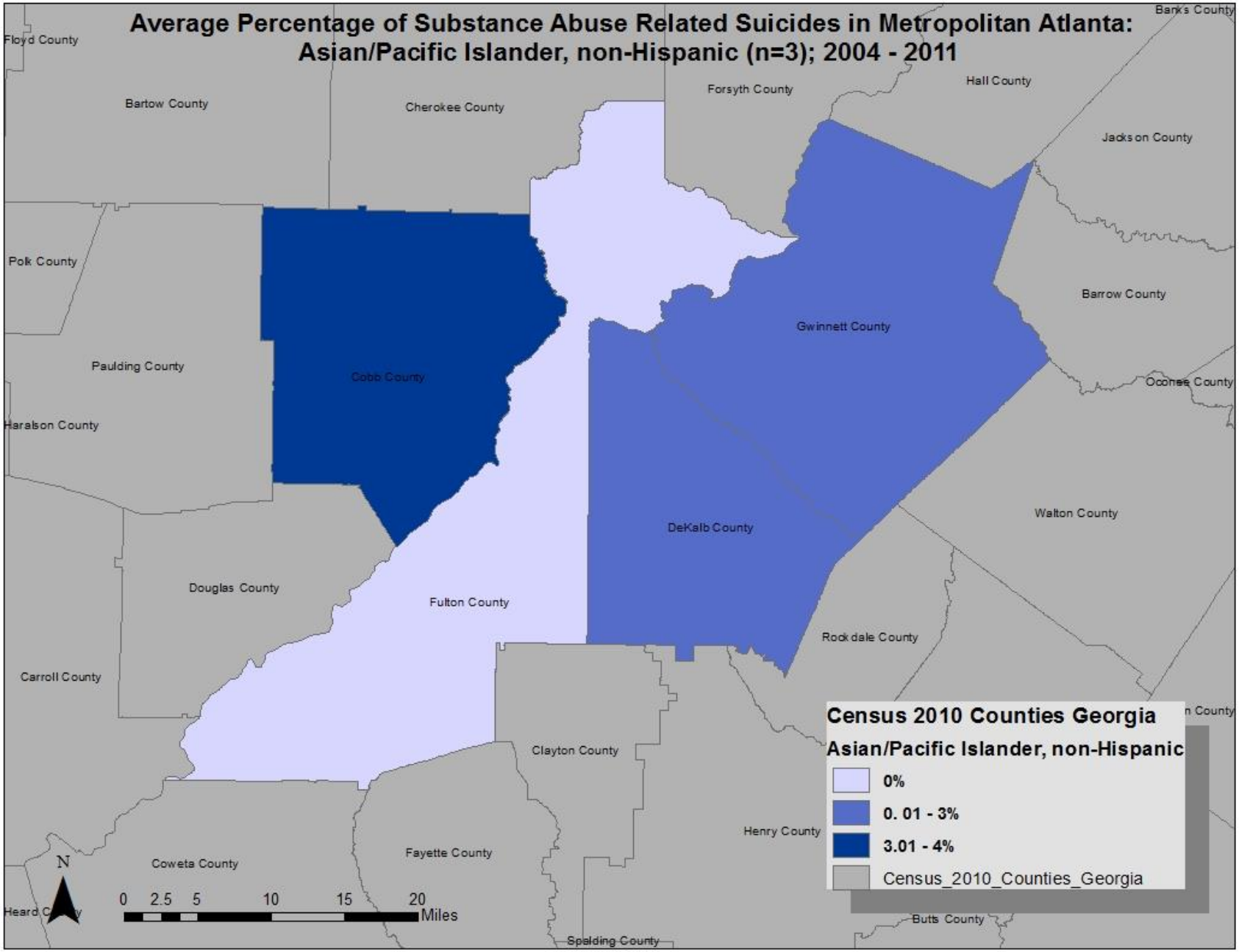



***Figure 6: Average Percentage of Substance Abuse Related Suicides in Metropolitan Atlanta: Asian/Pacific Islander (n=3); 2004-2011***

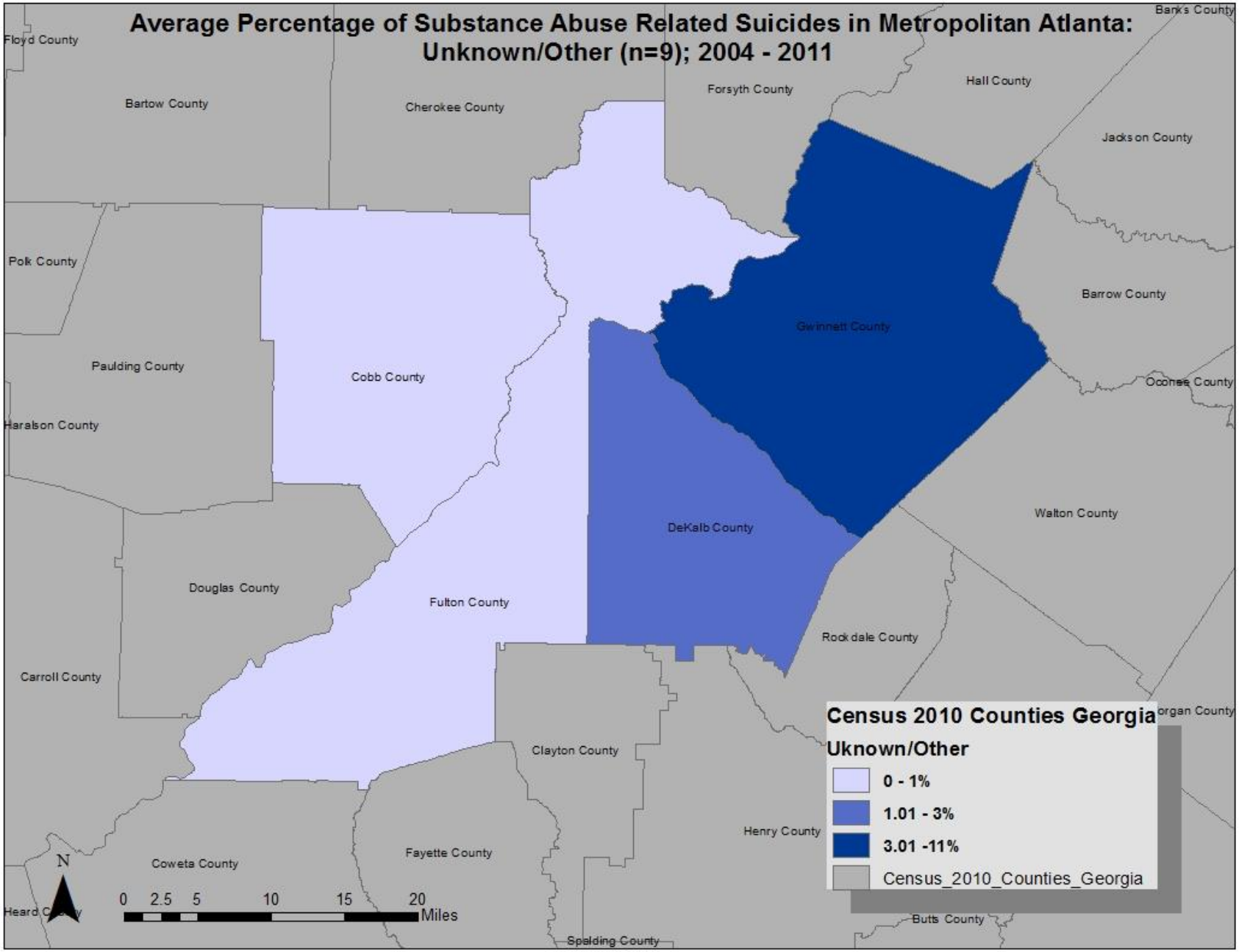



***Figure 7: Average Percentage of Substance Abuse Related Suicides in Metropolitan Atlanta: Unknown/Other (n=9); 2004-2011***

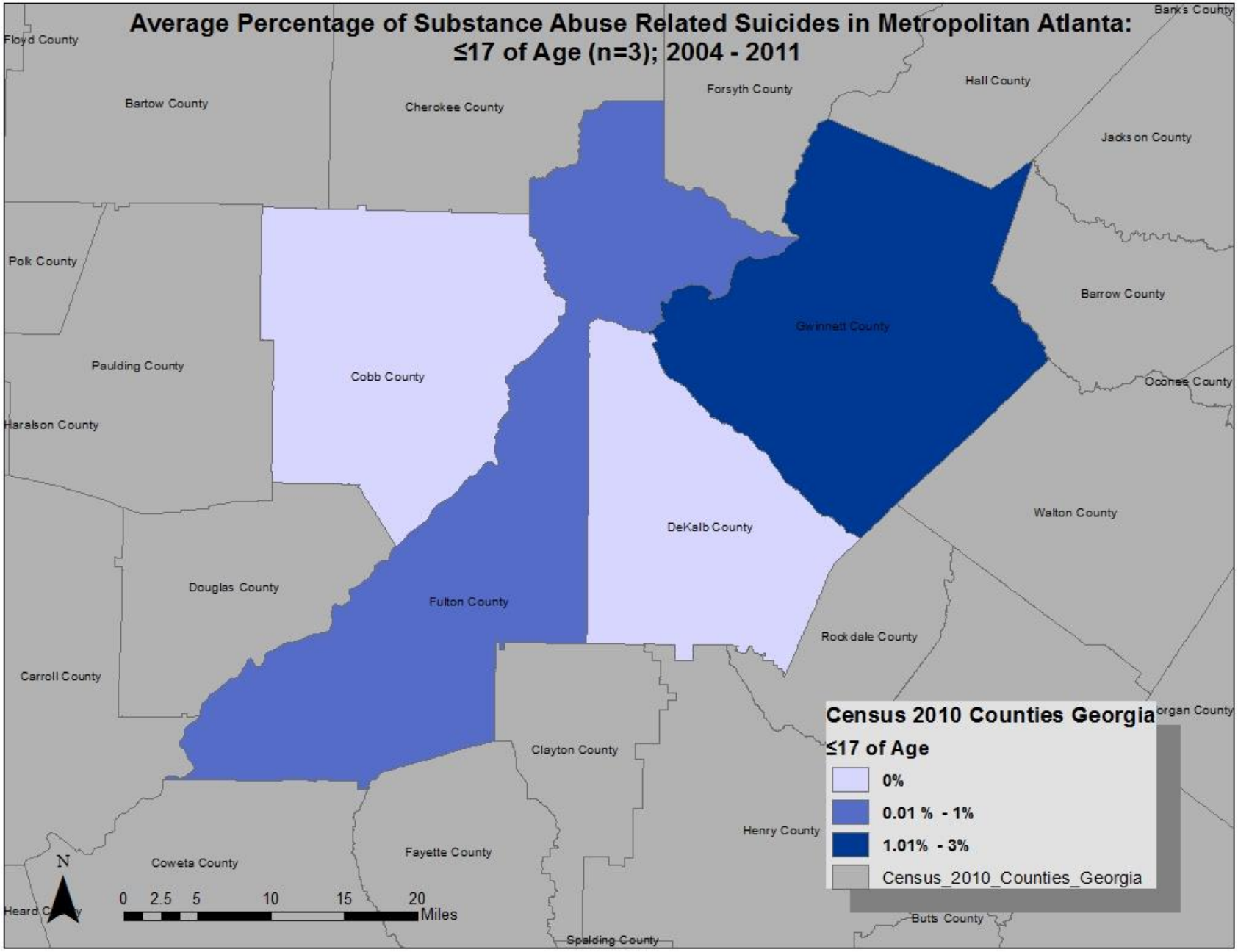



***Figure 8: Average Percentage of Substance Abuse Related Suicides in Metropolitan Atlanta: ≤17 of Age (n=3); 2004-2011***

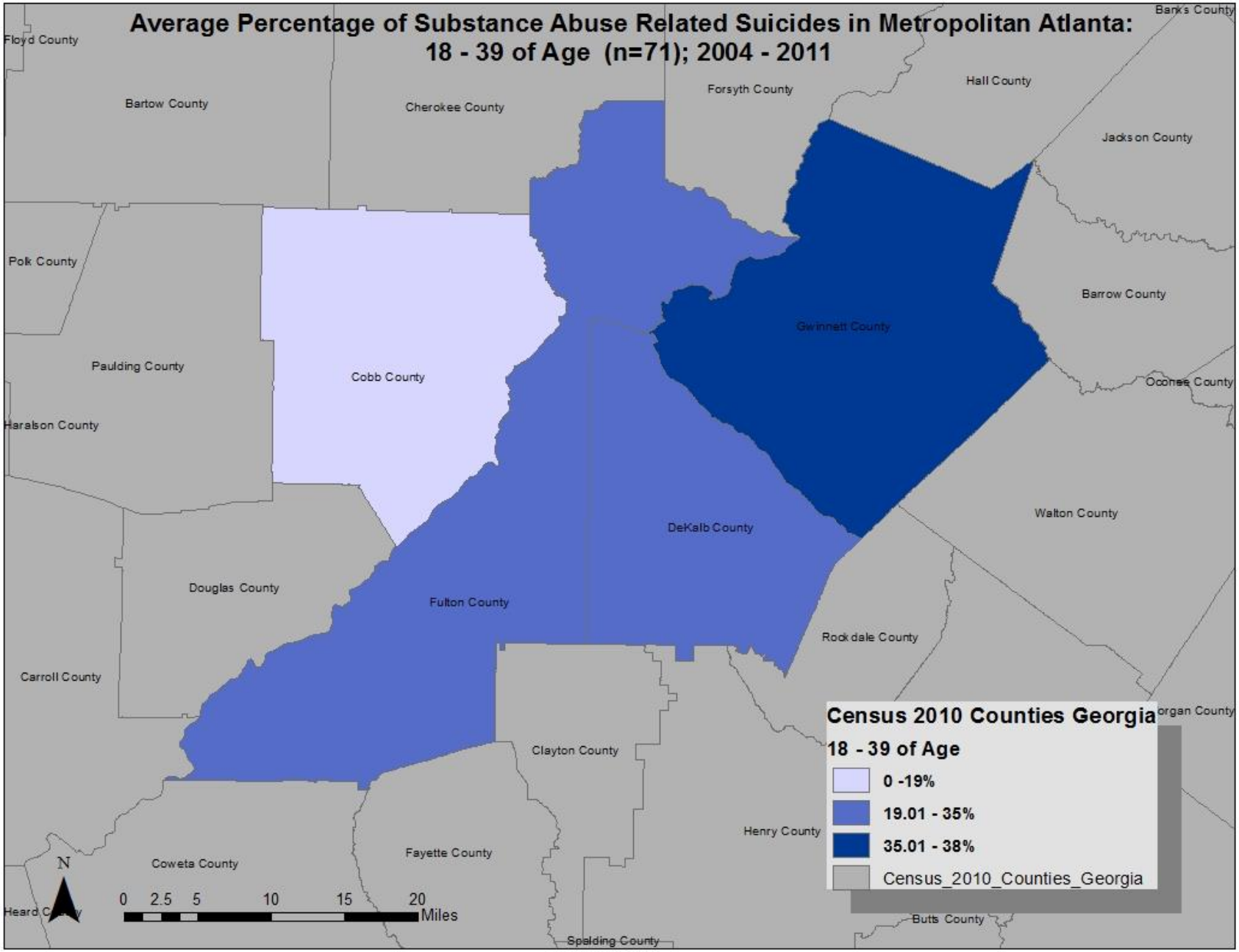



***Figure 9: Average Percentage of Substance Abuse Related Suicides in Metropolitan Atlanta: 18-39 of Age (n=71); 2004-2011***

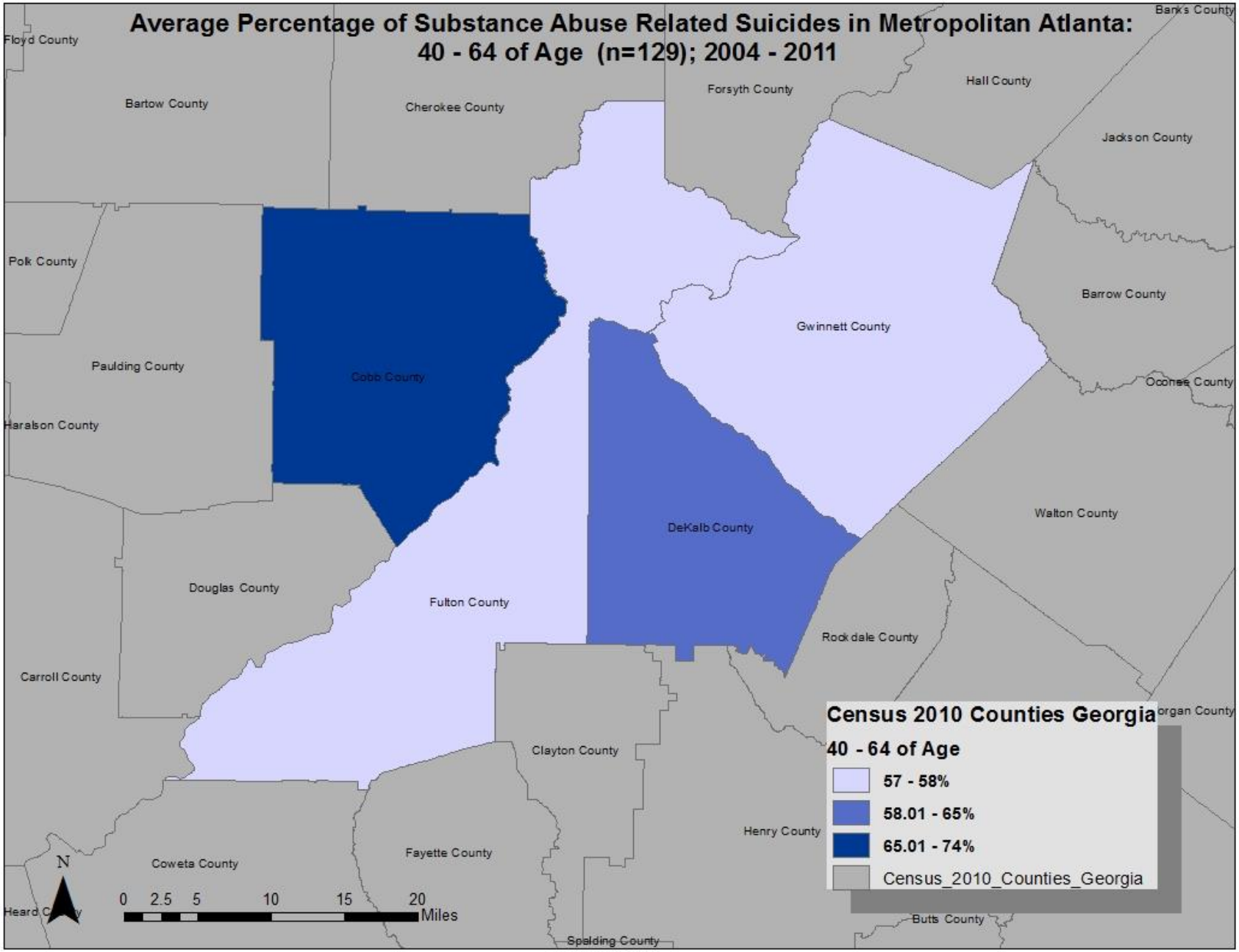



***Figure 10: Average Percentage of Substance Abuse Related Suicides in Metropolitan Atlanta: 40-64 of Age (n=129); 2004-2011***

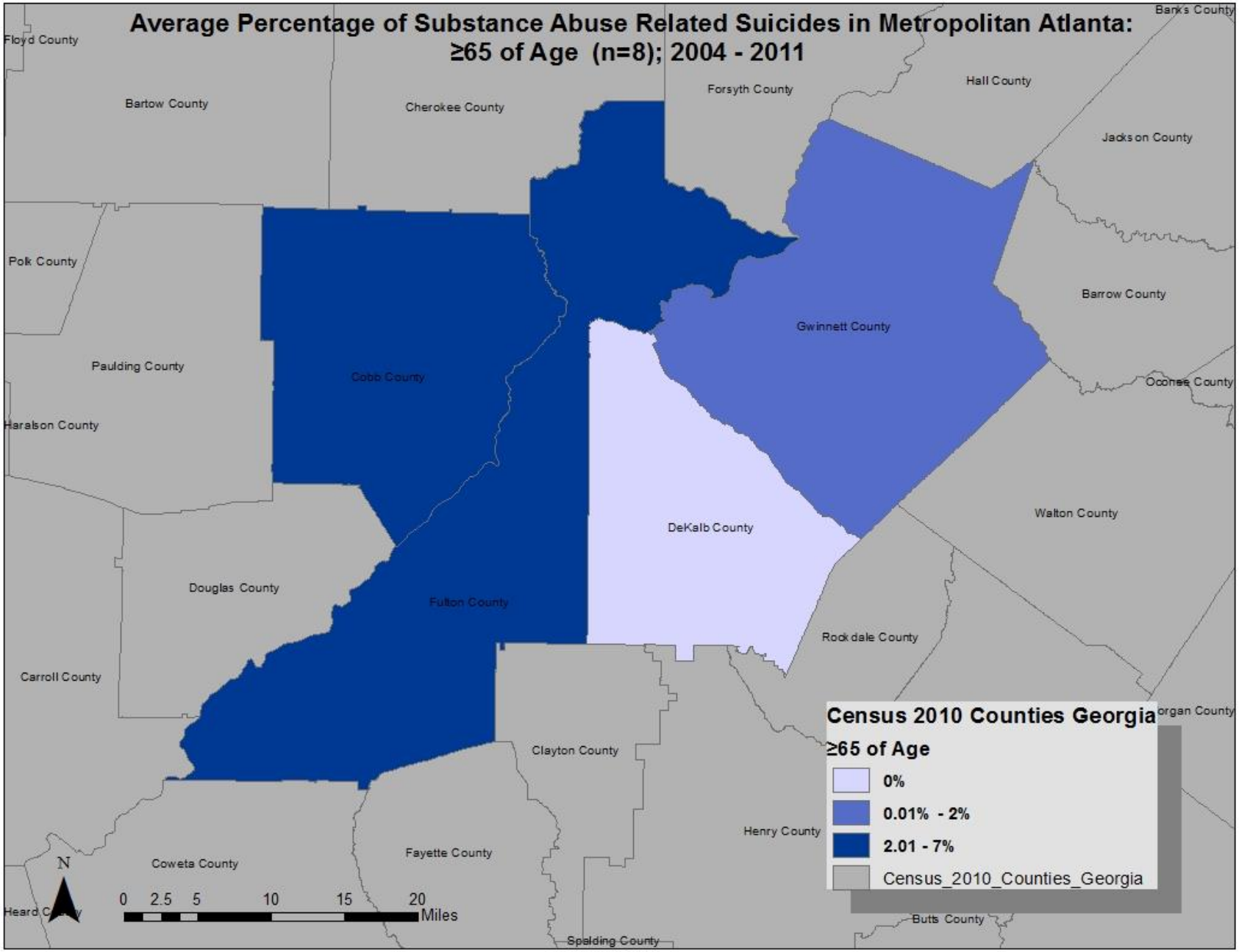



***Figure 11: Average Percentage of Substance Abuse Related Suicides in Metropolitan Atlanta: ≥65 of Age (n=8); 2004-2011***

**Summary**

Due to the analysis of the results, statistical values reveal trends and patterns of substance abuse related suicides that are beneficial for various methods of representation. The calculations represented on the tables and charts clearly show the demographic information and leading drug types used in substance abuse related suicides. An additional layer of spatial analysis revealed average percentages of substance abuse related suicides by means of chloropleth maps. The maps reveal trends and patterns by using gradient shading to visualize low to high areas of prevalence.

## ***Chapter 5: Conclusions, Implications, and Recommendations***

### Introduction

This chapter reviews and summarizes key factors of this study. Furthermore, this chapter intends to discuss how this study contributes to the body of knowledge for understanding substance abuse related suicides in metropolitan Atlanta.

### Summary of Study

This study involved analysis of the National Violent Death Reporting System (NVDRS) data system in regards to substance abuse related deaths in metropolitan Atlanta. Due to restrictions presented by the CDC, four counties met the criteria for reporting data, which included Cobb, DeKalb, Fulton and Gwinnett. Based on calculations of statistical data, tables and charts were developed that revealed prevalence and descriptive analysis of substance abuse related suicides evident in the four counties. Demographic values, such as sex, ethnicity/race, and age were key factors that categorized the data. The following results were revealed:

- The total number of substance abuse related suicides in the four counties was 211.
- Females had the highest prevalence of substance abuse related suicides in the four counties from 2004 – 2011.
- White, non-Hispanic individuals had the highest prevalence of substance abuse related suicides in the four counties from 2004 – 2011.
- The age range for the majority of the substance abuse related suicides was 40 – 64 years old.

- The leading cause of substance abuse related deaths involved usage of multiple drugs, which included a mix of controlled substances and prescription drugs.

Due to limitations of reporting data, advanced techniques of spatial analysis were not conducted. Instead, average percentage rates that were county specific revealed prevalence of substance abuse related deaths via chloropleth maps. These maps enhanced visualization of data because they provide actual boundaries of the counties and gradient style depictions of researched demographics, thus providing an additional useful layer of data exploration.

**Conclusion**

In essence, surveillance efforts for public health initiatives can be advanced by the use of multiple informatics systems. National efforts have been identified with desires to improve data reporting of substance abuse and suicides. In this study, a state-based reporting system, NVDRS, and an additional GIS layer of analysis provided useful results for analysis of trends and patterns of drug-induced suicides. Based on initial analysis of the data from the NVDRS system, a solid description of the demographics was extracted. The statistical data provided a foundation for spatial analysis to occur. The resulting chloropleth maps provided a clear depiction of the location of researched counties and revealed high-risk areas of substance abuse related suicides in those areas. Even though the sample size was small, the results can contribute to assist public health officials determine beneficial intervention strategies for that area; furthermore, can promote the importance of

advanced surveillance strategies to be implemented through out the state of Georgia and beyond.

**Implications and Recommendations**

Public health officials have identified the need for advancements of substance abuse and suicide surveillance for years with various initiatives. Therefore, utilizing existing surveillance systems and adding an additional layer of analysis, such as spatial analysis, can enhance reporting of trends and patterns of public health issues, such as drug-induced suicides. The advancements of reporting can lead to implementation of standards that promote interoperability amongst different informatics systems.

For the NVDRS department and other public health departments that have access to advanced levels of data analysis, it is suggested to continuously develop research programs that encourage spatial analysis and GIS mapping as a pertinent tool for advancements of surveillance and reporting of data. For instance, access to zip code level data encourages studies that can use advanced spatial analysis methods, such as clustering methods or point analysis, to reveal mappings of high-risk areas of substance abuse related suicides. Even though those confidential reports cannot be revealed to the public, decision-making authorities can use the results to implement efficient and effective public health strategies; furthermore, it will promote actions that will make a positive impact on reducing deaths that are preventable.

Appendix A – Case Definitions

| Term | Definition | Source |
|---|---|---|
| **Age** | Definitions:<br>Age: Age of victim<br>AgeUnit: Type of unit (e.g., years, hours) used to report age<br><br>Response Options:<br>Age<br>• Numeric<br>• 999 Unknown<br><br>Age Unit: 1 Years<br>• 2 Months 3 Weeks<br>• 4 Days<br>• 5 Hours<br>• 6 Minutes 9 Unknown | NVDRS Coding Manual (10.28.14), pg. 33 |
| **Birthplace** | Definition:<br>Birth state, territory, or country<br><br>Response Options:<br>Georgia=11 | NVDRS Coding Manual (10.28.14), pg. 40 |
| **Blood Alcohol Legal Limit** | ≥0.08 g/DL | MMWR Surveillance of Violent Deaths – National Violent Death Reporting System – 2009/2010 (Dr. Grant source) |
| **Confirmed Violent Death** | The underlying cause of death has been officially coded using ICD-10. The ICD-10 code assigned to the death matches the case definition above. Alternatively, the death or has been identified/confirmed as such by abstractors from other data sources (e.g., law enforcement and CME). | NVDRS Coding Manual (10.28.14), pg. 8 |
| **Controlled Substances** | A controlled substance is generally a drug or chemical whose manufacture, possession, or use is regulated by a government, such as illicitly used drugs or prescription medications that are | Wikipedia https://en.wikipedia.org/wiki/Controlled_substance |

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| | designated a Controlled Drug. | |
| **Death Manner Variables** | Definitions:<br>• DeathManner DC: Manner of death on death certificate<br>• DeathManner LE: Manner of death recorded in law enforcement report<br>• DeathMannerCME: Manner of death recorded in CME report<br>• DeathMannerAbstractor: Manner of death based on abstractor review of all available data<br>Response Options:<br>DeathMannerDC<br>DeathMannerLE<br>DeathMannerCME<br>1 Natural<br>2 Accident<br>3 Suicide<br>4 Homicide<br>5 Pending investigation<br>6 Could not be determined<br>7 Legal intervention<br>9 Record not available or blank<br>DeathMannerAbstractor<br>1 Suicide or intentional self-harm<br>2 Homicide<br>3 Unintentional firearm - self-inflicted<br>4 Unintentional firearm - inflicted by other person<br>5 Unintentional firearm - unknown who inflicted<br>6 Legal intervention (by police or other authority)<br>7 Terrorism homicide<br>8 Terrorism suicide<br>9 Undetermined intent<br>10 Other unintentional death (outside NVDRS case definition) | NVDRS Coding Manual (10.28.14), pg. 45 |
| **Document Type** | Definition:<br>Type of document being requested, logged in, or tracked. Death certificate, | NVDRS Coding Manual (10.28.14), pg. 27 |

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| | medical examiner/coroner and police report are required documents.<br><br>Response Options:<br>1 Death certificate<br>2 Medical examiner report<br>3 Coroner report<br>4 Police report<br>5 SHR<br>6 NIBRS<br>7 Crime lab report<br>8 Toxicology report<br>9 Hospital discharge record<br>10 ED record<br>11 Gun trace<br>12 EMS report<br>13 CFRT report<br>14 Newspaper article<br>88 Other | |
| **Drug Types attributed to Substance Abuse** | Alcohol, Street Recreational, Over the Counter (OTC), Prescription Drugs, Other Specified Substance, Unknown Drug | Suicides Due to Alcohol and/or Drug Overdose (NVDRS, p. 4) |
| **Hispanic/Latino/Spanish** | Definition:<br>Ethnicity is a concept used to differentiate population groups on the basis of shared cultural characteristics or geographic origins. In NVDRS, victims with Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin should be considered Hispanic or Latino, regardless of race.<br><br>Response Options:<br>0 Not Hispanic or Latino<br>1 Hispanic or Latino<br>9 Unknown | NVDRS Coding Manual (10.28.14), pg. 36 |
| **Homeless** | Definition:<br>Indicator of victims' homeless status. Homeless is defined as having no fixed address AND living in a [illegible] shelter, on the street, in a car, or in makeshift quarters in an outdoor setting. | NVDRS Coding Manual (10.28.14), pg. 43 |

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| | Response Options:<br>0 No<br>1 Yes<br>9 Unknown | |
| **Incident Type** | Overall description of whether the incident involved a single or multiple victims and the manner of all the victim's deaths.<br><br>Response Options:<br>1 Single suicide<br>2 Death of undetermined intent<br>3 Single homicide<br>4 Multiple homicides<br>5 Homicide(s) followed by suicide(s)<br>6 Unintentional firearm death(s)<br>7 Multiple suicides<br>8 Other<br>9 Not an NVDRS case | NVDRS Coding Manual (10.28.14), pg. 22 |
| **Metropolitan Atlanta** | Metropolitan Atlanta of Georgia includes the following (29) counties: Barrow, Bartow, Butts, Carroll, Cherokee, Cobb, Clayton, Coweta, Dawson, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnette, Haralson, Heard, Henry, Jasper, Lamar, Meriwether, Morgan, Newton, Paulding, Pikens, Pike, Rockdale, Spalding, and Walton | County Metropolitan Statistical Area (MSA) Atlanta-Sandy Springs-Roswell |
| **Military** | Definition:<br>Has the person ever served in the U.S. Armed Forces?<br><br>Response Options:<br>0 No<br>1 Yes<br>9 Unknown | NVDRS Coding Manual (10.28.14), pg. 37 |
| **Over the Counter Drugs** | Over-the-counter (OTC) drugs are medicines sold directly to a consumer without a prescription, from a healthcare professional, as compared to prescription drugs, which may be sold only to | Wikipedia https://en.wikipedia.org/wiki/Over-the-counter_drug |

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| | consumers possessing a valid prescription. | |
| **Person Type** | Definition:<br>This variable indicates whether the person was a victim of violence or both a victim and suspect (e.g., the person killed someone else and then died by suicide).<br><br>Response Options:<br>1 Victim<br>3 Both victim and suspect | NVDRS Coding Manual (10.28.14), pg. 30 |
| **Preliminary Violent Death** | The underlying cause of death has not yet been officially coded using the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10); and Review of the uncoded death certificate or official law enforcement (LE) or coroner/ medical examiner (CME) records indicate that the death is likely to be ultimately coded as one of the ICD codes included in the case definition above. | NVDRS Coding Manual (10.28.14), pg. 8 |
| **Prescription Drugs** | A drug that can be obtained only by means of a physician's prescription | Webster's Dictionary Online http://www.merriam-webster.com/dictionary/prescription drug |
| **Residence Variables** | Definitions:<br>Residential address information is collected at a number of levels (see below) to help support the identification of the agency responsible for potential public health interventions, to undertake geocoding, to better target interventions and to calculate population-based injury rates.<br><br>• **Country**: Residential country of victim<br>• **ResidenceState:** Residential U.S. state or territory of victim | NVDRS Coding Manual (10.28.14), pg. 38 |

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| | • **ResidenceCounty**: Residential county (or county equivalents) address of victim,<br>• **ResidenceCity**: Residential city address of the victim ("place" code)<br>• **ResidenceZip**: Residential zip code<br>• **ResidenceCensusTract**: U.S. Census tract of victim's residence<br>• **ResidenceCensusBlock**: U.S. Census block group of victim's residence<br><br>Response Options:<br>Country:<br>• Start typing country name to activate auto-complete<br>ResidenceState:<br>• Start typing the state name or INCITS 38-2009 (formerly FIPS code) †<br>• 88 Notapplicable<br>• 99 Unknown<br>ResidenceCounty:<br>• Start typing the county name or INCITS 31-2009 (formerly FIPS code) ††<br>• 888 Not applicable<br>• 999 Unknown<br>ResidenceCity:<br>• Start typing the city name or FIPS 55-3 or Census Code†††<br>• 88888 Not applicable<br>• 99999 Unknown<br>ResidenceZip:<br>• Enter 5-digit zip code<br>• 88888 Not applicable<br>• 99999 Unknown<br>ResidenceCensusTract:<br>• Enter 4-digit census tract and when applicable two-digits on right side of the decimal point†††† | |

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| | • 9999.99 Unknown<br>ResidenceCensusBlock:<br>Enter the one-digit block group number†††† | |
| **Sex** | Definition:<br>The victim's biological sex at the time of the incident<br><br>Response Options:<br>1 Male<br>2 Female<br>9 Unknown | NVDRS Coding Manual (10.28.14), pg. 32 |
| **Sexual Orientation** | Definition:<br>This variable is used to report sexual orientation which includes heterosexual, gay, lesbian, or bisexual.<br><br>Response Options:<br>0 Heterosexual<br>1 Gay<br>2 Lesbian<br>3 Bisexual<br>9 Unknown | NVDRS Coding Manual (10.28.14), pg. 37 |
| **Site ID** | Indicates which state has abstracted the incident. This may not be the state of injury or the state of residence of any victim in the incident, as discussed in the Definitions section. The Site ID number is the Federal Information Processing Standards (FIPS) code assigned to the state or U.S. territory. | NVDRS Coding Manual (10.28.14), pg. 21 |
| **State Occurrent Violent Death** | The initial injury must have occurred within the state or on those portions of the American Indian reservations within the state. | NVDRS Coding Manual (10.28.14), pg. 7 |
| **State Resident Violent Death** | The decedent was an official resident of the state (or territory) including those portions of an American Indian reservation within the state at the time of injury, according to the death certificate. | NVDRS Coding Manual (10.28.14), pg. 7 |

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| **Street Recreational Drugs** | The use of a drug (legal, controlled, or illegal) with the primary intention to alter the state of consciousness (through alteration of the central nervous system) in order to create positive emotions and feelings | Wikipedia https://en.wikipedia.org/wiki/Recreational_drug_use |
| **Suicide** | A suicide is a death resulting from the intentional use of force against oneself. A preponderance of evidence should indicate that the use of force was intentional. | NVDRS Coding Manual (10.28.14), pg. 8<br><br>More specifics in literature |
| **Undetermined Manner of Death** | Undetermined death is a death resulting from the use of force or power against oneself or another person for which the evidence indicating one manner of death is no more compelling than the evidence indicating another manner of death. Unlike homicide and suicide deaths which can be detected using the ICD-10 codes and reviewing the manner of death on the preliminary death certificate, law enforcement report, or coroner/medical examiner report, the identification of undetermined deaths involves looking at the ICD-10 codes and reviewing both underlying cause of death and the manner of death on the preliminary death certificate, law enforcement report, or coroner/medical examiner report. | NVDRS Coding Manual (10.28.14), pg. 10 |
| **Victims Race Variables** | • **White**: Person with origins among any of the original peoples of Europe, North Africa, or the Middle East<br><br>• **Black or African American**: Person with origins among any of the black racial groups of Africa Asian: Person with origins among any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent | NVDRS Coding Manual (10.28.14), pg. 35 |

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| | • **Native Hawaiian or other Pacific Islander**: Person with origins among any of the original peoples of the Pacific Islands (includes Native Hawaiians)<br><br>• **American Indian or Alaska Native**: Person with origins among any of the original peoples of North America and who maintains cultural identification through tribal affiliation or community recognition (includes Alaska Natives)<br><br>• **Other**: If a data provider uses different or additional categories to describe a person's race, it will be necessary to work with that data provider to develop the best match between their system and the standard Federal racial and ethnic categories used in NVDRS. If an appropriate match cannot be determined for any person, code "Other" for race.<br><br>• **Unspecified**: If a person's ethnicity is provided in place of their race, e.g., race is given as "Hispanic", and no other valid race value is given, mark their race as "unspecified | |
| **Violent Death (operational)** | Death certificates that are coded with an underlying cause of death as one of the ICD-10 codes listed on Table 1 should be included. A death that is not given an appropriate ICD-10 code may be included, if the death certificate, law enforcement report, or coroner/medical examiner report characterizes the death as a suicide, homicide, legal intervention death, or death of undetermined intent, | NVDRS Coding Manual (10.28.14), pg. 7 |

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| | and the death meets the conceptual definition given above.<br><br>A death of a fetus prior to birth that is caused by violence is not included in the case definition, and such deaths should never be included in NVDRS. However, states who want to collect such deaths may enter these as a separate incident (in instances where there are multiple victims) and follow the guidance as described in the Definitions section above. | |
| **Violent Deaths (conceptual)** | A violent death is a death that results from the intentional use of physical force or power, threatened or actual, against oneself, another person, or a group or community. The person using the force or power need only have intended to use force or power; they need not have intended to produce the consequence that actually occurred. "Physical force" should be interpreted broadly to include the use of poisons or drugs. The word "power" includes acts of neglect or omission by one person who has control over another. | NVDRS Coding Manual (10.28.14), pg. 7 |
| **Year in Which Incident Occurred** | Year in which the incident occurred (YYYY) | NVDRS Coding Manual (10.28.14), pg. 21 |

Appendix B – ICD-10 Codes and Definitions

| ICD-10 Code | Definition |
|---|---|
| **X60** | **Intentional self-poisoning by and exposure to nonopioid analgesics, antipyretics and antirheumatics**<br>*Including:*<br>4-aminophenol derivatives<br>nonsteroidal anti-inflammatory drugs [NSAID]<br>pyrazolone derivatives<br>salicylates |
| **X61** | **Intentional self-poisoning by and exposure to antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, not elsewhere classified**<br>*Incuding:*<br>antidepressants<br>barbiturates<br>hydantoin derivatives<br>iminostilbenes<br>methaqualone compounds<br>neuroleptics<br>psychostimulants<br>succinimides and oxazolidinediones<br>tranquillizers |
| **X62** | **Intentional self-poisoning by and exposure to narcotics and psychodysleptics [hallucinogens], not elsewhere classified**<br>*Including:*<br>cannabis (derivatives)<br>cocaine<br>codeine<br>heroin<br>lysergide [LSD]<br>mescaline<br>methadone<br>morphine<br>opium (alkaloids) |
| **X63** | **Intentional self-poisoning by and exposure to other drugs acting on the autonomic nervous system**<br>*Including:*<br>parasympatholytics [anticholinergics and antimuscarinics] and spasmolytics |

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| | parasympathomimetics [cholinergics]<br>sympatholytics [antiadrenergics]<br>sympathomimetics [adrenergics] |
| **X64** | **Intentional self-poisoning by and exposure to other and unspecified drugs, medicaments and biological substances**<br>*Including:*<br>agents primarily acting on smooth and skeletal muscles and the respiratory system<br>anaesthetics (general)(local)<br>drugs affecting the:<br>. cardiovascular system<br>. gastrointestinal system<br>hormones and synthetic substitutes<br>systemic and haematological agents<br>systemic antibiotics and other anti-infectives<br>therapeutic gases<br>topical preparations<br>vaccines<br>water-balance agents and drugs affecting mineral and uric acid metabolism |
| **X65** | **Intentional self-poisoning by and exposure to alcohol**<br>***Incl.:***<br>alcohol:<br>. NOS<br>. butyl [1-butanol]<br>. **ethyl [ethanol]* (drinking alcohol)**<br>. isopropyl [2-propanol]<br>. methyl [methanol]<br>. propyl [1-propanol]<br>. fusel oil<br><br>** for purposes of this study, only ethanol (drinking alcohol) was considered as a substance for abuse* |
| **X84** | **Intentional self-harm by unspecified means** |
| **Y10** | **Poisoning by and exposure to nonopioid analgesics, antipyretics and antirheumatics, undetermined intent**<br>*Including:*<br>4-aminophenol derivatives<br>nonsteroidal anti-inflammatory drugs [NSAID]<br>pyrazolone derivatives<br>salicylates |

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| **Y11** | **Poisoning by and exposure to antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, not elsewhere classified, undetermined intent**<br>*Including:*<br>antidepressants<br>barbiturates<br>hydantoin derivatives<br>iminostilbenes<br>methaqualone compounds<br>neuroleptics<br>psychostimulants<br>succinimides and oxazolidinediones<br>tranquillizers |
| **Y12** | **Poisoning by and exposure to narcotics and psychodysleptics [hallucinogens], not elsewhere classified, undetermined intent**<br>*Including:*<br>cannabis (derivatives)<br>cocaine<br>codeine<br>heroin<br>lysergide [LSD]<br>mescaline<br>methadone<br>morphine<br>opium (alkaloids) |

| | |
|---|---|
| **Y14** | **Poisoning by and exposure to other and unspecified drugs, medicaments and biological substances, undetermined intent**<br>*Including:*<br>agents primarily acting on smooth and skeletal muscles and the respiratory system<br>anaesthetics (general)(local)<br>drugs affecting the:<br>. cardiovascular system<br>. gastrointestinal system<br>hormones and synthetic substitutes<br>systemic and haematological agents<br>systemic antibiotics and other anti-infectives<br>therapeutic gases<br>topical preparations<br>vaccines<br>water-balance agents and drugs affecting mineral and uric acid metabolism |
| **Y15** | **Poisoning by and exposure to alcohol, undetermined intent**<br>*Including:*<br>alcohol:<br>. NOS<br>. butyl [1-butanol]<br>. **ethyl [ethanol]* (drinking alcohol)**<br>. isopropyl [2-propanol]<br>. methyl [methanol]<br>. propyl [1-propanol]<br>. fusel oil<br><br>**for purposes of this study, only ethanol (drinking alcohol) was considered as a substance for abuse* |
| **R99** | **Other ill-defined and unspecified causes of mortality**<br>*Including:*<br>Death NOS<br>Unknown cause of mortality |

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