Distribution Agreement

In presenting this thesis or dissertation as a partial fulfillment of the requirements for an advanced degree from Emory University, I hereby grant to Emory University and its agents the non-exclusive license to archive, make accessible, and display my thesis or dissertation in whole or in part in all forms of media, now or hereafter known, including display on the world wide web. I understand that I may select some access restrictions as part of the online submission of this thesis or dissertation. I retain all ownership rights to the copyright of the thesis or dissertation. I also retain the right to use in future works (such as articles or books) all or part of this thesis or dissertation.

Signature:

_____ _____

Shawnta L. Lloyd Date

Survival among Georgia Prison Releasees in Rural vs. Urban Residential Locations: A Retrospective, Observational Study

By

Shawnta L. Lloyd

Master of Public Health

Epidemiology

Anne C. Spaulding, MD MPH

Faculty Advisor

Survival among Georgia Prison Releasees in Rural vs. Urban Residential Locations: A Retrospective, Observational Study

By

Shawnta L. Lloyd

B.S., Hampton University, 2010

Faculty Advisor: Anne C. Spaulding, MD MPH

An abstract of

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University

in partial fulfillment of the requirements for the degree of
Master of Public Health
in Epidemiology

2013

Abstract

Survival among Georgia Prison Releasees in Rural vs. Urban Residential Locations: A Retrospective, Observational Study

By Shawnta L.Lloyd

OBJECTIVES: The residential location to which former prisoners will return may play an important role in the determination of post-release survival. The primary objective of this study was to assess the association of residential location with all-cause mortality, disease-specific natural deaths and cause-specific unnatural deaths among a cohort of prisoners released from Georgia prisons during 1991-2010 and 5 years post-release. The secondary objective was to assess the independent association of residential location with mortality types, adjusting for demographic and incarceration factors.

METHODS: Information obtained from the Georgia Department of Corrections for prisoners who were incarcerated in the state of Georgia on June 30, 1991 was linked to death information from the Georgia Death Registry and National Death Index. Using a retrospective cohort design, the 19.5-year survival and 5-year survival post-release were assessed using Cox proportional hazard models for eligible prisoners after the latest release.

RESULTS: There were 16,407 eligible releasees in this cohort, of whom 3,041 died from 1991-2010 and 1,366 died 5 years post-release. Among releasees from urban, metropolitan areas, there was an increased risk due to natural causes within 5 years after release from prison(adjusted hazard ratio, 1.80; 95% CI 1.04 to 3.12). Releasees from urban, metropolitan areas had an increased risk of mortality due to natural and unnatural causes of death during the 19.5 year study period as well as all-cause and unnatural deaths within 5 years post-release; however, this increased risk was not significant. Likewise, releasees from rural, non-metropolitan areas experienced an increased risk of mortality due to all-cause deaths during the 19.5 year study period, but these results were not significant.

CONCLUSION: Urban residential location was associated with increased mortality due to natural causes, 5 years post-release. There was not a significant difference in mortality based on the type of resident in which the releasees lived due to all causes of death, natural and unnatural deaths from 1991-2010 or all causes of death and unnatural deaths five years after release. Georgia prison releasees with chronic, infectious, and mental illness may need additional resources in urban, metropolitan areas to prevent premature death.

Survival among Georgia Prison Releasees in Rural vs. Urban Residential Locations: A Retrospective, Observational Study

By

Shawnta L. Lloyd

B.S., Hampton University, 2010

Faculty Advisor: Anne C. Spaulding, MD MPH

A thesis submitted to the Faculty of the

Rollins School of Public Health of Emory University

in partial fulfillment of the requirements for the degree of
Master of Public Health
in Epidemiology

2013

Acknowledgements

First, I would like to thank God and my family for their love, encouragement, and support throughout the past two years.

I would like to thank Dr. Anne Spaulding for giving me the opportunity to complete my thesis using one of her datasets and under her direction.

I would like to thank Lauren Messina for creating the dataset for my thesis and making numerous additions to it.

Finally, I would like to thank Dr. David Kleinbaum for meeting with me to discuss concepts regarding my thesis and survival analysis.

TABLE OF CONTENTS

CHAPTER I: BACKGROUND/LITERATURE REVIEW

INTRODUCTION

The large proportion of prisoners released from correctional facilities in the United States (US) face greater medical and social burdens, which may place these vulnerable persons at an increased risk of mortality than those in the general population. The geographic locations (rural or urban) to which former prisoners will return may also play an important role in the determination of the survival of former prisoners post-release. This chapter will introduce the state of incarceration in the United States as well as the public health implications among those incarcerated including racial, gender, social, and health disparities. We will then focus on 1) issues faced by prisoners post release; 2) post release mortality found in previous studies; 3) the health status of the general public who reside in rural or urban areas; and 4) the relevance of post release mortality and residence type in this study.

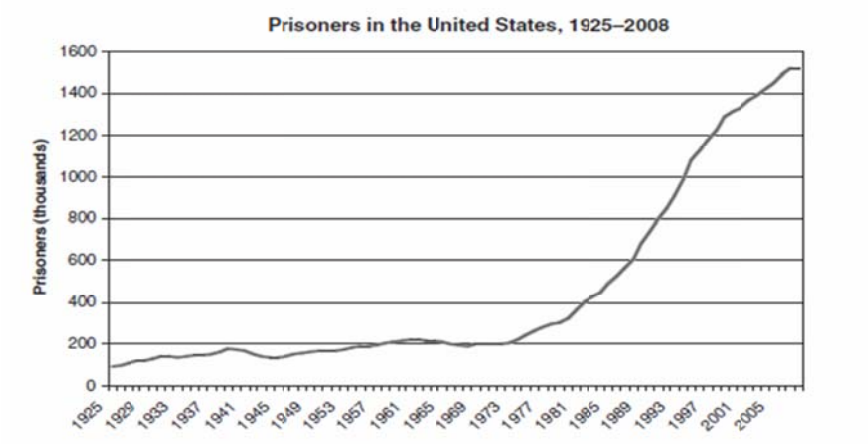
INCARCERATION IN THE UNITED STATES

In the US, incarceration refers to entering a prison facility or a jail facility. Prisons are long-term facilities managed by the state or federal government accommodating persons with sentences greater than one year (1). However, the definition of prisons may vary from state to state(2). These individuals are removed from their communities and families for an extended period of time to prevent additional offenses and punish the offender for their crime. On the other hand, detainees in jail are generally individuals who are awaiting trial, sentenced to up to 1 year, and/or are probation, parole, and bail bond violators or absconders(1). Jail systems vary, containing just a few cells in rural areas to the capacity to hold tens of thousands of beds in urban areas(3). Due to the close

proximity of jails to the surrounding communities and the rapid transition of inmates through the jail system, jails have a stronger interaction with local communities and a higher prevalence of recently active substance users, as compared to prisons. Additionally, jail systems are more porous than prison systems, incarcerating individuals with a length of stay as short as a few hours to as long as a year.

The U.S. leads the world in incarceration rates(4). The number of persons incarcerated in prisons from 1925 to 2008 in the United States is captured in the graph below in Figure 1. The prison population was stable during most of the twentieth century until the 1970s when political pressure for increased punishment for crime was amplified (5,6). Several scholars, including Dumont et al. noted that former President Nixon's "war on drugs" has been responsible for a large proportion of incarcerations during the last 40 years. Drug-related incarceration accounts for approximately two-thirds of the federal inmate population and one-half of the state inmate population(5). Approximately 1.6 million men and women are serving time in prisons in the U.S (7). Of these prisoners, more than 700,000 will be released back into the community annually(8). Since the early 1990's, the number of inmates in Georgia prisons have more than doubled with a population of 53,341 prisoners(9) and an average length of stay of 2.79 years(10). Approximately 21,000 prisoners are released each year(11).

Figure 1. Number of Prisoners incarcerated in the United States from 1925-2008



source: Dumont et al. (2012), Permission granted to republish or display content from Annual Reviews

WHO IS IN PRISON?

Unfortunately, the hyperincarceration beginning in the U.S during the 1970s had significant racial implications(5). Minorities are over-represented in the correctional population. The twenty-first century opened with a disproportionate amount of arrests and incarcerations among Blacks to a greater extent than that seen during the Jim Crow era(12). Both non-Hispanic Blacks and Latinos are represented disproportionately among those inmates held in custody in US prisons and jails (7). The incarcerated population consists of more than six times the number of Black men in comparison to White men, and the number of incarcerated Latino men is more than two times higher than White men. Black women represent approximately three times more of the incarcerated population than White women.

Furthermore, men are more likely to be incarcerated than women, with incarceration numbers that far surpass those of incarcerated women. In 2009, men had an imprisonment rate that was 14 times higher than that of females(8). However, the incarceration rates of women in prison have experienced a substantial increase in

comparison to those of men. In 2006, the number of incarcerated women increased by 4.5%, and the number of incarcerated men increased by 2.7% (13). Black and Latino men represent the greatest proportion of prisoners, followed by Black and Latino women in the US.

PRISONER HEALTH

A large proportion of arrests tend to take place in predominantly non-White, poor, medically underserved communities with significant consequences for health disparities among prisoners. Prisoners are faced with a large proportion of social and medical burdens relative to the general population(5). Inmates are more likely to carry a higher burden of co-existing medical conditions(14), and many are unaware of multiple conditions(15). Because most inmates suffer from co-morbidities, medical care and treatment can become quite complex. Undiagnosed and/or untreated substance abuse, mental illness, infectious diseases, and chronic diseases are common among the incarcerated population. Although prisoners may develop most of these conditions while in the community, health professionals in prisons may diagnose and treat various conditions while the prisoner is incarcerated. However, this access to health care and treatment may be interrupted after release from prison, as the prisoners return to various geographic regions. Many prisoners may not have access to medical care and treatment in the community.

Substance Abuse

Substance abuse and addiction play an important role in the growth of the U.S. prison population—between 1996 and 2006, the percentage of incarcerated substance

abusers grew by 43.2%(16). In the U.S, nearly two-thirds of the inmate population meets the medical criteria for alcohol or other drug use disorders. Prison and jail inmates are seven times more likely to suffer from a substance abuse disorders than their non-incarcerated counterparts. Substance abuse is not only a major factor in alcohol and drug violations, but also in violent crimes, property crimes, supervision violations, public order defenses, immigration offenses, and weapon offenses. In addition, substance abusers are also more likely to recidivate than those who are not substance abusers.

Mental Illness

Approximately a quarter of prison and jail inmates have a substance abuse disorder and a mental illness in the US(16). Prisons and jails have emerged as the largest institution for housing mentally ill individuals(5); it is estimated that 16-24% of inmates suffer from serious mental illness(17). Furthermore, health disparities exist among different ethnicities and social classes. Individuals from White, middle class communities are more likely to receive treatment for a mental illness rather than enter the criminal justice system(18). In contrast, individuals from poor communities or minority racial groups are less likely to be diagnosed with a mental illness and receive treatment, placing them at a higher risk of incarceration. Untreated mental illness can lead to recidivism as well as reduced adherence to necessary medications for other medical conditions. In addition to substance abuse, infectious disease and chronic disease exists among prisoners with mental illness at a higher rate than those in the non-incarcerated population.

Infectious Disease

In comparison to the general population, individuals in correctional facilities are more likely to be living with tuberculosis, sexually transmitted diseases, human immunodeficiency virus (HIV) and viral hepatitis(14). Women are more likely to be arrested for prostitution than men, placing them at a higher risk of transmission of infectious disease than incarcerated men(19). In the more recent years of this "epidemic of incarceration", the epidemic of the HIV has hit the correctional system especially hard(20). The HIV prevalence among U.S. prisoners is more than three times higher than that of the general population(21). According to the Centers for Disease Control, Blacks and Latinos account for 46% and 17% of people living with HIV, respectively. Minorities are over-represented in both the correctional population and the HIV positive population. Moreover, the emergence of a hepatitis C virus (HCV) epidemic in prisons has been observed. Among those in the general population, only 1-1.5% are infected with HCV(22). Conversely, 16%–41% of prison inmates have ever been infected with HCV, and 12%–35% of prison inmates are chronically infected. Infectious diseases not only negatively affect the health of individual prisoners, but the health of sexual and drug partners in prison and in the communities in which prisoners return as well.

Chronic Disease

Chronic diseases have received less attention than infectious diseases, such as HIV. However, the obesity epidemic in the U.S. and the aging incarcerated population may draw needed attention to chronic diseases(5). The United Nations Office on Drugs and Crime suggested that chronic diseases are usually diagnosed at a later stage in the

incarcerated population, placing these individuals at risk for more complex medical needs(23). Wilper et al. estimated that 38.5% of inmates in federal prisons and 42.8% of inmates in state prisons suffer from a chronic medical condition(24). In comparison to the non-incarcerated population, jail and prison inmates had increased odds of having hypertension, asthma, arthritis, cervical cancer, and chronic hepatitis (25). As mentioned earlier, prisoners tend to reside in poor, medically underserved communities; therefore long-term access to quality healthcare and medications are major factors that influence long-term health status before and after incarceration. Additionally, factors including, but not limited to housing conditions, access to healthy foods, health education, harmful environmental exposures in the community, and socioeconomic status may significantly affect the development of chronic disease in prisoners.

POST-RELEASE ISSUES

After being released from a correctional facility, individuals have to be re-integrated into the community. Former prisoners are faced with a large proportion of social and medical burdens relative to the general population(5), placing them at an increased risk of premature mortality. In a population with an exceedingly high number of substance abusers and individuals suffering from mental illness, relapse to addiction and untreated medical illness are both common upon release. In states with high rates of opiate abuse, such as Washington, drug overdose has been noted as a leading cause of death in the immediate post-release period(26). Mental conditions, if left untreated, can lead to a low adherence to medications, resulting in worsening medical conditions or death, and re-entry into a correctional facility(14).

Homelessness and poverty often burden releasees, as a large proportion of arrests

tend to take place in poor communities. It is possible for some inmates to lose Medicaid benefits during their sentence, resulting in an average interruption of 3 months in insurance coverage while the individual re-applies(27). Individuals convicted of drug-related charges are banned from receiving food stamps or federal assistance under the Welfare Reform Act and can be denied public housing under the Anti-Drug Abuse Act of 1988(28). Interruptions in health insurance coverage and the elimination of food and housing benefits can create further complications post-release.

Many prisons have release planning programs for prisoners. These programs focus on successful re-integration of former prisoners in the community at the moment of release, as well as in the weeks and months that follow(29). According to the National Institute of Corrections, prison-based release planning in Georgia begins during the intake process when the prisoner's needs are identified. Once needs are identified, such as lack of education or substance abuse, institutional programs may address them (30).

Within the first year of incarceration in a prison, a prisoner's tentative parole month is determined based on satisfactory adjustment in prison, parole eligibility, information packet, and case summaries. This process provides the inmate, prison staff, and parole field staff with a tentative release date to plan for institutional programming and parole, as Georgia courts frequently uses "split sentences," requiring a period of probation supervision after release from prison. Some prisoners may have the opportunity to be placed in a state-operated transition center 9-12 months before a scheduled release where services such as education, substance abuse counseling, and work opportunities are provided. However, only 10-15% of all releases have the

opportunity to participate in this program due to a small number of vacancies in the program in comparison to prisoners in need.

Upon release from a Georgia prison, former prisoners receive a change of civilian clothes, $25.00, and a bus ticket. If the inmate has been diagnosed with a mental illness, prisoners may be offered additional resources under the Transition Aftercare for Probationers and Parolees (TAPP) program, where prisoners are provided with a 30-day supply of medication and linked with community service providers to aid in treatment. The Georgia corrections system is engaged in ongoing planning and partnerships to improve inmate transition and re-entry.

POST-RELEASE MORTALITY

Many mortality studies of criminal justice involved populations have been published in countries other than the US (31-39); however, only a few studies address post-release mortality in the US (6, 26, 40, 41). Studies in the US have found an increased mortality rate among prisoners as they are re-integrated back into the community and struggle to find stability and basic needs. Prisoners released from Georgia prisons experienced an all-cause standardized mortality rate of 1.54 (95% CI 1.48-1.61) post-release (6). In Washington State, released prisoners experienced an adjusted relative risk of death 12.7 times higher [2589 per 100,000 person years (95% CI 1884-3558)] than other Washington State residents during the first two weeks after release; an overall mortality 3.5 times higher than other residents was observed(26). Even after several weeks post-release, mortality rates did not return to comparable rates among other residents. In contrast, extremely high mortality rates were not observed in the

period immediately after release for Georgia releases as seen in Washington state and New Mexico; the SMR for 0-<1, 1-<6, and 6-12 month periods were not significantly different from the overall post-release SMR(6).

Binswanger et al. suggested factors that may affect mortality rates between released prisoners and other residents of the same race, gender, and age, including educational attainment, income level, employment status, neighborhood of residence and health insurance(26). Many arrests tend to take place in poor communities; therefore, there are disparities among health and social resources available to prisoners before imprisonment and post-release. Causes of death that resulted in a large proportion of mortality in New Mexico, North Carolina, Georgia, and Washington State included cardiovascular disease(6, 26, 40), cancer(6, 26, 40), homicide(6, 26, 40), suicide(26), accidents(6, 26, 40), and infectious disease(6, 40).

Differences were detected among racial categories of Black and non-Black men, where non-Black men experienced an increased mortality rate after release from prison (6, 26, 40). In Georgia, the standardized mortality rates (SMR) after release from prison among Black and Non-Black men were 1.29 (95% CI: 1.22-1.36) and 2.07 (95% CI: 1.93-2.22), respectively (6). Similar standardized mortality rates were observed among men released from North Carolina prisons:Black males had a SMR of 1.03 (95% CI: 1.01-1.05), and White males had a SMR of 2.08 (95% CI: 2.04-2.13)(40). More Black males died from infectious disease and homicides than White males, but more White males died from alcohol and drug related complications. Both Black and White males had a considerable proportion of deaths caused by cardiovascular disease, cancer, and accidents.

Studies in Washington state(26) and New Mexico(41) found drug related complications as a leading cause of death among releasees. Deaths caused by drugs in Washington State peaked within two weeks after release, but drug-related deaths in New Mexico peaked at 18 months. However, a dramatic risk of early mortality due to drug related complications was observed in New Mexico during the first 2 weeks in comparison to the general population as in previous studies. In New Mexico, former prisoners who died within the first two months after release were more likely to have had a longer length of stay in prison as well as the presence of opiates and sedatives in their system after death. Although these studies did not assess the association between early death by accidental drug overdose and a decreased tolerance for drugs, it is possible for a longer length of stay in prison to lead to a decreased physiological tolerance to drugs. Therefore, drug overdose is more likely when the same dosage is taken after release as before incarceration(26). In New Mexico, Hispanics experienced an increased risk of accidental overdose deaths and represented 70% of the deceased prisoners, indicating that there may be factors within the Hispanic population that may cause an increased risk of drug-related mortality(41). Geographic location, including variations in states as well as rural and urban areas, can play an important role in the cause of death and factors associated with mortality among prisoners post-release.

HEALTH IN URBAN AND RURAL AREAS

The residence type of a prisoner may influence behaviors and predict access to health resources, which may lead to negative health outcomes. After completing a sentence in prison, a prisoner may return to the same area. The type of residence in which a prisoner lives may be a predictor of potential health concerns, including substance

abuse, mental illness, infectious disease, or chronic disease. Additionally, the medical and social resources available in the prisoner's area of residence may aid in the re-integration into the community upon release and reduce recidivism as well as mortality.

The health status of a resident from a rural area versus a resident from an urban area may greatly differ. One of the major priorities of rural health is access to primary and hospital care, as rural residents may live a considerable distance from the nearest medical office or hospital. However, medical conditions including diabetes, mental health disorders, oral health problems, and tobacco use are also top priorities in rural areas, according to a survey of rural health experts and practitioners(42). Rural areas also ranked poorly on population health indicators, such as health behaviors, mortality, morbidity, and child and maternal health(43). Residents of rural areas are more likely to smoke, exercise very little, have poor nutritional diets, and be obese in comparison to suburban residents. Many of these conditions and behaviors are associated with income, education, and physical environment, including exposure to harmful substances.

A greater number of higher paying jobs and educational institutions of prestige tend to exist in suburban and urban areas. Higher incomes and educational attainment may lead to a better understanding of health education as well as a safer and healthier living environment. Using the National Longitudinal Survey of American men aged 45-59 in 1966 who were interviewed through 1990, Hayward et al. found an association between male mortality and conditions during childhood, including socioeconomic status, family living arrangements, mother's work status, rural residence, and parent's nativity(44). These results indicate that conditions experienced during childhood may influence male mortality later in life. Factors such as environmental living conditions and

household composition may influence exposure to harmful substances and people as well as access to healthcare, medications, and proper nutrition. These findings further demonstrate that healthy living has to begin during childhood. Rural residents, therefore, are disadvantaged in many ways in comparison to their urban counterparts.

Probst et al. suggests that U.S. policies regarding the reduction of variations in education, poverty, and health insurance may aid in the elimination of health disparities in urban and rural populations(45). More than 50% of Blacks and Hispanics did not receive a high school diploma, marking socioeconomic disparities among these minority groups where poverty rates were highest(45). Although rural residents in each racial and ethnic group were more likely to live below the poverty line than urban residents, percentages of 26.3% and 21.5% were observed for rural Blacks and Hispanic residents, respectively, in comparison to 6.8% of rural White residents. Among rural Black and Hispanics residents, only 53.0% were insured by private medical insurance compared to 76.2% of rural Whites. Rural residents were also more likely to report their health as being poor or fair in comparison to urban residents. Rural Whites, rural Blacks, and urban Blacks were at a greater risk of death and premature mortality (before age 65) than urban Whites. Rural Blacks experienced a higher risk of death than urban Blacks. Not only do health and social disparities exist between rural and urban residents, but disparities also exist between different racial and ethnic groups in these geographic locations.

Mansfield et al. found that rural counties experienced the highest premature mortality rates of 890.8 per 10,000 population, but that the premature mortality rates for urban (867.5 per 10,000) and metropolitan (867.5 per 10,000) counties were similar(46). Among counties in the southeastern and southwestern U.S, there was a high

concentration of premature deaths and wide variation in rural counties. Black populations and female-headed households were the strongest predictors of premature mortality, followed by low education level, American Indian population, and unemployment.

Violence also plays a role in the mortality of those who live in urban and rural areas. It may be hypothesized that urban areas experience more deaths by firearms than rural areas. Branas et al. found that the rate of deaths by firearms were similar between 1989 and 1999 in rural and urban areas; however, rural areas had a higher rate of suicide by firearms in comparisons to urban areas, and urban areas had a higher rate of homicide by firearms in comparison to rural areas(47). The deaths produced similar results, but are caused by different motives. Nonetheless, firearm suicide is as big of a problem in rural areas as firearm homicide is in urban areas. It may be suggested that a lack of health education, culture, and access to quality healthcare in rural areas may lead to higher suicide rates than in urban areas.

As mentioned earlier, exposures in the physical environment may play a role in the health outcomes experienced by both rural and urban residents. Hendryx et al. found that pollution sources in the environment may be associated with certain types of mortality(48). Rural counties were more likely to be exposed to agriculture related pollution, as would be expected. Furthermore, water pollution was significantly associated with overall and cancer mortality. Rural air pollution and coal mining areas were associated with cancer mortality and respiratory mortality, respectively. Non-metropolitan areas adjacent to metropolitan areas experienced higher air and water pollution from industrial or commercial activity, coal mining, and other types of human development, such as transportation and residential sources. The living and structural

environment can negatively influence the health outcomes and mortality experienced by both rural and urban residents. These environments may also have a negative or positive influence on the health status of a prisoner pre-incarceration and post-release, as geographic location may determine the medical and social resources available to prisoners as well as hazardous exposures and behaviors.

RELEVANCE OF CURRENT STUDY

The residential location to which former prisoners will return to may play an important role in the determination of post-release survival. The primary objective of this study was to assess the association of residential location with all-cause mortality, disease-specific natural deaths and cause-specific unnatural deaths among prisoners released from Georgia prisons during 1991-2010 and 5 years post-release. The secondary objective was to assess the independent association of residential location with mortality types, adjusting for demographic and incarceration factors. We hypothesize that former prisoners from urban, metropolitan Georgia will have greater all-cause mortality and unnatural mortality from 1991-2010 and 5 years post-release than former prisoners from urban, non-metropolitan or rural, non-metropolitan Georgia. However, former prisoners from rural, non-metropolitan Georgia will have greater natural death mortality from 1991-2010 and 5 years post-release than former prisoners from urban, non-metropolitan or urban, metropolitan Georgia.

Prior studies have investigated the standardized mortality rates of ex-prisoners in comparison to the general population and among age and racial groups, as well as identified the causes of death for former prisoners. A study in the U.S has not assessed

the association of the geographic location (rural vs. urban) that prisoners may return to post-release and mortality type (all-cause, natural, and unnatural mortality), according to our knowledge. Binswanger et al. noted that neighborhood of residence may influence mortality after release from prison(26). Spaulding et al. accessed premature mortality as a crude proxy for the health of prisoners, but little information about the quality of life that former prisoners had was provided(6). Accessing the type of death and type of residence may, therefore, provide additional information about the health of inmates and resources available to prisoners post-release based on geographic location. This study may aid in the understanding of the distinct needs of prisoners post-release that reside in rural or urban areas in Georgia, as resources in rural and urban communities are considerably different.

Studies in New Mexico and North Carolina matched the mortality data for released prisoners who died in the state of New Mexico and North Carolina, respectively (40, 41). This study, however, will expand beyond the mortality of those who died in the state of Georgia and identify residents of the state of Georgia who died in other states in the U.S as completed in Washington State(26) and Georgia(6). Previous studies (26, 41) retrospectively analyzed data for shorter periods of time, excluding North Carolina studies(40), where mortality data was retrospectively linked to released prisoners from 1980 to 2005, and Georgia studies(6), where prisoners were retrospectively followed from 1991-2006. We will analyze data from 1991-2010 and have the ability to analyze the survival of prisoners for up to 19.5 years.

Furthermore, this study will examine post-release survival during the first five years after release from the latest prison incarceration. Spaulding et al. did not find a

significant difference in the mortality of Georgia prison releasees during the first year post-release; therefore, a longer period of time was assessed. Stewart et al. found that male and female Aboriginal and non-Aboriginal prisoners in Western Australia experienced the greatest decrease in survival between approximately 50-65 months after release. During the first five years after release, prisoners may continue to battle financial, social, medical, and emotional stressors.

CONCLUSION

A disproportionate number of minorities are represented in prisons in the U.S, which may explain some of the health disparities found in prisons, during and after release. These incarcerated men and women also tend to reside in poor, disadvantaged communities with little access to quality healthcare and social resources, such as employment and adequate nutrition to achieve and maintain a healthy lifestyle. Thus, it may be necessary for healthcare planning in prisons to place more emphasis on the entire life course of an individual (6).

Improved interventions before release into the community has the potential to reduce mortality and disparities in health outcomes found in these populations(26), especially in the immediate weeks following release. Interventions to reduce mortality after prison may include: 1) halfway houses; 2) work-release programs; 3) drug treatment programs; 4) linkage to preventative care and other medical services; and 5) intense case management. Mortality patterns differ by age(6, 26, 40); therefore, certain interventions may need to target specific age groups(26). Additionally, prisoners return to various geographic areas where necessary resources may or may not exist. Prisoners returning to

rural area, for example, may not have access or transportation to medical and social services; therefore, more resources may need to be established to assist former prisoners in rural areas. It is essential for prison officials and case managers to develop partnerships with agencies and organizations in both rural and urban areas to ease the transition for prisoners from prison to the community. These efforts can be substantially beneficial towards improved mortality among prisoners post-release.

CHAPTER II: MANUSCRIPT

INTRODUCTION

The US leads the world in incarceration rates(4). Approximately 1.6 million men and women are serving time in prisons in the U.S (7). Of these prisoners, more than 700,000 will be released back into the community annually(8). Since the early 1990's, the number of inmates in Georgia prisons have more than doubled with a population of 53,341 prisoners and an average length of stay of 2.79 years(9, 10). Approximately 21,000 prisoners are released each year in Georgia(11).

After being released from prison, individuals have to be re-integrated into the community. A large proportion of arrests tend to take place in predominantly non-White, poor, medically underserved communities with significant consequences for health disparities. These individuals are more likely to carry a higher burden of co-existing medical conditions(14); many are unaware of multiple conditions(15). Because most prisoners suffer from co-morbidities, medical care and treatment can become quite complex. Undiagnosed and/or untreated substance abuse, mental illness, infectious diseases, and chronic diseases are common among the incarcerated population. Furthermore, former inmates may lose access to healthcare and social resources after release if linkage to medical care, treatment, and social services in the community is not established and adhered to.

Former prisoners are faced with a large proportion of social and medical burdens relative to the general population(5), placing them at an increased risk of premature mortality. Many mortality studies of criminal justice involved populations have been published in countries other than the US (31-39, 49); however, only a few studies address

post-release mortality in the US(6, 26, 40, 41). Studies in the U.S have found an increased mortality rate among prisoners as they are re-integrated back into the community and struggle to find stability and basic needs. Prisoners released from Georgia prisons experienced an all-cause standardized mortality rate (SMR) of 1.54 (95% CI 1.48-1.61) post-release (6). Studies in Washington state(26) and New Mexico(41) found a dramatic risk of early mortality during the first 2 weeks in comparison to the general population. In contrast, SMRs in the period up to one year after release for Georgia releasees was not significantly different from the overall post-release SMR(6). Stewart et al. found that male and female Aboriginal and non-Aboriginal prisoners in Western Australia experienced the greatest decrease in survival between approximately 50-65 months after release(49). During the first five years after release, prisoners may continue to battle financial, social, medical, and emotional stressors.

Previous studies have investigated the standardized mortality rates of ex-prisoners in comparison to the general population and among age and racial groups as well as identified the causes of death for former prisoners. No studies in the US have assessed the association between mortality type (all-cause deaths, natural deaths, unnatural deaths) and residential location (urban or rural), according to our knowledge. The residential location of a prisoner may influence behaviors and predict access to health resources, which may lead to negative health outcomes.

This study may aid in the understanding of the distinct needs of prisoners post-release who reside in rural or urban areas in Georgia, as resources in rural and urban communities considerably differ. The primary objective of this study was to assess the association of residential location with all-cause mortality, disease-specific natural deaths

and cause-specific unnatural deaths among prisoners released from Georgia prisons during 1991-2010 and 5 years post-release. The secondary objective was to assess the independent association of residential location with mortality types, adjusting for demographic and incarceration factors. We hypothesize that former prisoners from urban, metropolitan Georgia will have greater all-cause mortality and unnatural mortality from 1991-2010 and 5 years post-release than former prisoners from urban, non-metropolitan or rural, non-metropolitan Georgia. However, former prisoners from rural, non-metropolitan Georgia will have greater natural death mortality from 1991-2010 and 5 years post-release than former prisoners from urban, non-metropolitan or urban, metropolitan Georgia.

METHODS

Study Population

Data containing demographic and incarceration information on all prisoners (n=23,510) in Georgia state prisons on June 30, 1991 was obtained from the Planning and Strategic Management section of the Georgia Department of Corrections (GDC). Eligible prisoners (n=16,407) of this study cohort were followed retrospectively from June 30, 1991 until December 31, 2010 for residence type (rural or urban) at the latest admission and mortality status after the latest release. Study subjects included prisoners of any age, gender, or race. Eligible subjects had to be linked to a Georgia residence at the latest admission and have a release date prior to the end of the study without recidivism. The study excluded all prisoners with a death recorded in prison or an incarcerated status at the end of the study.

Variables

The endpoints of interests included: 1) time to all-cause death, 2) time to natural death, and 3) time to unnatural death. Natural and unnatural deaths were categorized in distinct categories. Natural deaths included mortality due to infectious disease, mental health, and non-communicable illness. Unnatural deaths included mortality due to homicide and assault, suicide, transportation-related accidents, and injuries (excluding transportation related accidents). Cohort members with an unknown mortality status, based on GDC records (deaths in prison), were linked to mortality information from the Georgia Death Registry. The Georgia Death Registry maintains mortality information for persons whose death occurred in the state of Georgia. Prisoners with an unknown mortality status based on the GDC and Georgia Death Registry records were linked to mortality records from the National Death Index (NDI). True matches were accepted as those records which the Georgia Death Registry and NDI accepted as true matches. Prisoners were matched on name, Social Security number, age, home address, and/or known aliases. Prisoners without recorded deaths based on GDC, Georgia Death Registry, and NDI records were assumed to be alive. The cause of death was also obtained from the Georgia Death Registry and NDI. ICD codes were used to determine if a death was natural (death caused by disease or aging), unnatural (death caused by external factors), and categorize deaths into distinct categories (injury, transportation accidents, homicide/assault, suicide, infectious disease, mental health, non-communicable illness).

The 2003 rural-urban continuum codes developed by the U.S Department of Agriculture (USDA) were used to categorize urban and rural counties in Georgia.

According to the USDA, counties are classified in a nine-part codification: (1) counties in metro areas of 1 million population or more, (2) counties in metro areas of 250,000 to 1 million population, (3) counties in metro areas of fewer than 250,00 population, (4) urban population of 20,000 or more, adjacent to a metro area, (5) urban population of 20,000 or more, not adjacent to a metro area, (6) urban population of 2,500 to 19,999, adjacent to a metro area, (7) urban of 2,500 to 19,999, not adjacent to a metro area, (8) completely rural or less than 2,500 urban population, adjacent to a metro area, (9) completely rural or less than 2,500 urban population, not adjacent to a metro area. Subjects in this study were classified into three groups: Rural, non-metropolitan (8-9); Urban, non-metropolitan (4-7); Urban, metropolitan (1-3) (e.g. Atlanta, Augusta, Savannah, Columbus, Macon). Based on GDC records, all cohort members were linked to a residential location based on the county of residence at the latest admission. Cohort members whose county of residence was unknown were linked to a residential location based on the county of conviction at the latest admission.

Potential covariates included birth cohort, race, gender, educational attainment, substance abuse, mental illness, number of incarcerations, and crime type. Birth cohorts were divided into tertiles (1910-1948, 1949-1958, and 1959-1974) based on deceased releasees. Categorical variables included race (Black vs. non-Black), gender, educational attainment (no high school diploma vs. high school diploma), history of substance abuse, history of mental illness, and number of incarcerations (1 vs. $\geq$2). Binary variables, drug-related crime and violent crime, were defined for crime type based on the latest, most serious crime.

Statistical Methods

This study was approved by the Institutional Review Board at Emory University. All identifying information was removed from the data prior to analysis. Data were analyzed using SAS version 9.3 (SAS Institute, Cary, NC). Kaplan-Meier curves were used to determine the unadjusted overall time to all-cause, natural, and unnatural death from 1991-2010 and 5 years post-release. Univariate and multi-variable Cox proportional hazard models were created for each type of death (all-cause, natural, and unnatural) at the 5% significance level. Univariate Cox proportional hazard regression was used to assess the association between mortality type and residential location. Multi-variable Cox proportional hazard regression was performed to assess the association between mortality type and residential location, adjusting for covariates found to be confounding or biologically plausible. Individuals with missing or erroneous covariate values (n=21) were not included in the analysis, and unknown causes of death were not included in analyses for time to natural and unnatural mortality. The assumption of proportional hazards was checked for all final models.

RESULTS

Participants

The GDC provided data for 23,510 males and females who were imprisoned on June 30, 1991. Of the 23,510 prisoners, 7,103 (30.2%) were excluded from the study (Figure 1). Prisoners were excluded from the study if covariate values were erroneous or missing and if a release date was not present after their latest incarceration. Eligible prisoners had to be able to provide person time in the community after the latest release

date until death or the end of the study on December 31, 2010. A total of 16, 407 releasees were included in the study.

Most of the releasees (78.5%) were classified as a resident of an urban, metropolitan location (Table 1). Of the eligible former prisoners, males represented more than 90% of the prisoners released, and Blacks represented more than half of releases from rural and urban residential locations in this cohort. Younger persons represented a higher percentage of former prisoners than older former prisoners. Nearly half of former prisoners in this cohort had a history of substance abuse and mental illness. This cohort had an average follow-up time of 12.4 years.

Mortality in Releasees- 1991-2010

There were 3,041 deaths in releasees from this cohort, of which approximately 75% were due to natural causes (Table 2). Figures 2-4 display Kaplan Meier survival curves for all-cause, natural and unnatural deaths. In univariate analysis in which rural, non-metropolitan releasees were the reference group, releasees from rural areas had an increased risk of all-cause death in comparison to releasees from urban, non-metropolitan (unadjusted hazard ratio, 0.83; 95% CI, 0.65 to 1.06) and urban, metropolitan (unadjusted hazard ratio, 0.92; 95% CI, 0.73 to 1.15)locations (Table 3). Releasees from urban, non-metropolitan areas had an increased risk of death due to natural and unnatural causes in comparison to releasees from rural and urban non-metropolitan locations. However, these differences were not significant.

Adjustments for covariates did not substantially influence the estimates of residence type on mortality, which were likewise similar to univariate models. Releasees

from rural areas had an increased risk of all-cause death in comparison to releasees from urban, non-metropolitan (adjusted hazard ratio, 0.81; 95% CI, 0.64 to 1.04) and urban, metropolitan (adjusted hazard ratio, 0.95; 95% CI, 0.73 to 1.19) locations (Table 3). Birth cohort, educational status, number of incarcerations, history of substance abuse, a violent crime, and a drug-related crime were found to be significant in the adjusted model for all-cause death. Releasees from urban, non-metropolitan areas had an increased risk of death due to natural and unnatural causes in comparison to releasees from rural and urban non-metropolitan areas. The models for natural and unnatural deaths were adjusted for birth cohort, race, number of incarcerations, and history of mental illness due to their significance in the model. Additionally, the model for unnatural deaths was also adjusted for gender.

Mortality in Releasees- 5 years Post-release

Approximately 45% (1366 deaths) of all deaths took place within 5 years of release from prison (Table 4). Of the deaths that took place with 5 years post-release, 65% (879 deaths) were the result of natural causes in comparison to 35% (470 deaths) due to unnatural causes.). Figures 5-7 display Kaplan Meier survival curves for all-cause, natutal and unnatural deaths. In univariate analysis in which rural, non-metropolitan releasees were the reference group, releasees from urban, metropolitan areas had an increased risk of all-cause death (unadjusted hazard ratio, 1.49; 95% CI, 0.97 to 2.30), unnatural death (unadjusted hazard ratio, 1.55; 95% CI, 0.77 to 3.13), and natural death (unadjusted hazard ratio, 1.81; 95% CI, 1.04 to 3.12) within the first five years after release (Table 5). A significant difference in residential location was found only among natural deaths.

In multi-variable analysis, urban, metropolitan releasees (adjusted hazard ratio, 1.80; 95% CI, 1.04 to 3.12) were almost twice more likely to have to a death due to natural causes after 5 years post-release (Table 3 and Table 5). Even though residence type was found to be significant in the model, the covariates did not substantially influence the estimates of residence type on mortality. The model for natural death was adjusted for race, birth cohort, number of incarcerations and history of a mental illness due to significance. Age was protective for younger former prisoners; however, Blacks, individuals with multiple incarcerations, or individuals with a history of a mental illness had an increased risk of dying from a natural cause of death within 5 years after release from prison. Furthermore, urban, metropolitan releasees had an increased risk of all-cause death after adjusting for gender, birth cohort, race, educational status, number of incarcerations, history of substance abuse, a violent crime, and a drug-related crime; however, residence type was not significant (Table 3). Likewise, urban, metropolitan releasees had an increased risk of death due to unnatural causes after adjusting for gender, birth cohort, and number of incarcerations, but residence type was not found to be significant.

DISCUSSION

In this study of 16,407 releasees, there was a significant difference in mortality based on residential locations in which releasees from urban, metropolitan locations in Georgia were at an increased risk of mortality due to natural causes within 5 years post-release. The findings from this study indicate that there was not a significant difference in mortality based on residential locations in which releasees lived due to all-cause, natural and unnatural deaths from 1991-2010 as well as all causes of death and unnatural deaths

five years after release. Acquiring basic needs may be a higher priority for releasees than maintaining their health. On the other hand, obtaining access to medical services and treatment with little or no income and no health insurance may be difficult, limiting releasees to select human services facilities. Linkage to healthcare facilities in the community, especially those offering services and treatment for mental health and chronic illnesses, may need to be improved in Georgia prisons to decrease mortality among releasees. Additionally, the number of prisoners released into urban areas may be so large that health facilities do not have the capacity to care for such a high volume of low income or uninsured persons with co-existing conditions. The facilities may already be overwhelmed with homeless and low income populations that have not been incarcerated.

Rosen et al. found that White releasees from North Carolina (NC) prisons had an increased amount of death due to chronic diseases in comparison to Black releasees with an average follow-up time greater than 10 years(40). However, 55% of the cohort consisted of Black releasees from NC prisons, in comparison to approximately 65% of Black releasees that made up this study cohort. Black releasees in Georgia were more likely than non-Black releasees to experience death due to natural causes within 5 years after release, which consisted of a large proportion of deaths due to chronic disease, excluding HIV. Results were consistent with Binswanger et al., which found thatreleasees of an older age were found to be at an increased risk of mortality due to natural causes(26).Furthermore, releasees with a history of mental illness were more than twice as likely to experience an early death due to natural causes than releasees without a

history of a mental illness. Mental conditions, if left untreated, can also lead to a low adherence to medications, resulting in worsening medical conditions or death (14).

This study did not find significant differences in mortality due to residence location during the entire study period or within 5 years post-release for all causes of death and unnatural deaths. Many of the conditions and behaviors among the non-incarcerated population that cause differences in rural and urban health outcomes are associated with income, education, and physical environment, including exposure to harmful substances(43). Educational status was used as a proxy for income; however, more than 50% of former prisoners in each residential location did not complete high school. Without an adequate income to maintain quality basic needs, it is likely that low-income residents may experience similar health outcomes regardless of the residential location. The cost of housing and raising a family is likely increased in an urban area as well, diminishing the effect of resources that may be available in the area.

Limitations

This study is not without limitations. The former prisoners included in this study were imprisoned in the state of Georgia and represent the imprisoned population in the state of Georgia only. Former prisoners were linked to a residence category based on their latest admission to a Georgia prison facility. However, the amount of time the prisoner has lived at the location reported during their latest admission to prison is unknown. It is possible that a prisoner has been a resident of both a rural and an urban area during their lifetime, as individuals may relocate. Additionally, the assumption was made that most prisoners would return to the residence reported at the latest admission after release from prison.

Erroneous or missing data may also be present in the administrative data from death or prison records. Furthermore, missing data in the prison data may have led to misclassification. The IQ score of an inmate was used to determine the educational level of a prisoner if education status was missing from GDC records. Prisons with unknown counties of residence were linked to an urban or rural category based on county of conviction, and prisoners with a missing value for mental health status were assumed to have no mental health conditions.

Strengths

The residential location of a former prisoner has the potential to provide valuable information regarding the quality of life experienced while in the community. In addition to residential location, covariates, including history of substance abuse, history of mental illness, and violent crime or drug-related crime can provide additional information regarding health and behaviors that may lead to premature mortality after release from prison. The type of crime may even control for the amount of time spent in prison during the latest incarceration, if the prisoner's most serious crime was violent or drug related.

The large prison population also enhanced our ability to examine mortality in three residential locations. Approximately 70% of the prisoners met the criteria of the study, resulting in sufficient power to examine socio-demographic and incarceration related risk factors for death. The GDC provided demographic information on all prisoners for each prison admission in Georgia, which reduced the amount of missing data in the cohort. Mortality and demographic data was available for 19.5 years, providing adequate time to evaluate natural deaths, which may take longer to occur.

CONCLUSION

Mortality among prisoners may be affected by the residential location in which releases return. This study provides evidence that prisoners residing in urban locations may be at a greater risk of deaths due to natural causes within 5 years post-release. The risk of death may be further increased if the inmate is Black, has had multiple incarcerations, or has a mental illness. Infectious disease, chronic illness, and mental illness require continuous medical care and treatment, as many people will have these conditions for the rest of their lives. Therefore, additional health resources for prisoners in urban locations may be needed, especially immediately after release. This assessment is not to say that individuals in rural areas do not also need additional services. However,the results of this study indicate that urban areas may be in greater need of more services for releasees due to the large numbers of releasees that return to urban areas.

These findings may represent a primary step in assessing residential location and the physical and mental health needs of former prisoners in the state of Georgia. Future studies may need to include the amount of time spent in prison and the distinct needs of the female prison population. It may also be necessary to evaluate healthcare experiences before and after imprisonment to develop solutions of how to eliminate barriers that may prevent the former prisoners from maintaining their health. Improving the health status of former prisoners may also lead to improvements in health in the locations in which these releasees return, as releasees may return to poorer communities that may suffer from a lower health status than higher socioeconomic communities.

TABLES

Table 1. Characteristics of a Prisoner Cohort in Georgia, 1991-2010

Characteristics	Overall (n= 16,407)	Rural, Non-metropolitan (n=360)	Urban, Non-metropolitan (n= 3,169)	Urban, Metropolitan (n=12,878)	P-value[a]
Gender, n(%)					0.17
Male	15,296 (93.2)	330 (91.7)	2,937 (92.7)	12,029 (93.4)	
Race , n(%)					<0.001
Black	10,708 (65.3)	195 (54.2)	2,045 (64.5)	8,468 (65.8)	
Birth Cohort, n(%)					0.19
1910-1948	2,284 (13.9)	60 (16.7)	463 (14.6)	1,761 (13.7)	
1949-1958	4,857 (29.6)	113 (31.3)	944 (29.8)	3,800 (29.5)	
1959-1974	9,266 (56.5)	187 (51.9)	1,762 (55.6)	7,317 (56.8)	
Educational Status, n(%)					<0.001
< High School	9,603 (58.5)	223 (61.9)	2,069 (65.3)	7,311 (56.8)	
Number of Incarcerations, n(%)					0.04
≥2	10,424 (63.5)	213 (59.2)	2,061 (65.0)	8,150 (63.3)	
Substance Abuse, n(%)					0.05
Yes	9,517 (58.0)	205 (56.9)	1,899 (59.9)	7,413 (57.6)	
Mental Illness, n(%)					0.17
Yes	6602 (40.3)	138 (38.3)	1319 (41.6)	5145 (40.0)	
Violent Crime, n(%)					0.07
Yes	6,142 (37.4)	144 (40.0)	1,134 (35.8)	4,864 (37.8)	
Drug-Related Crime , n(%)					0.03
Yes	3,183 (19.4)	51 (14.2)	602 (19.0)	2,530 (19.7)	

a) The chi-square test was used to compare residence type at the 5% significance level.

Table 2. Types of Death in a Prisoner Cohort in Georgia, 1991-2010

Type of Death	Overall	Rural, Non-metropolitan	Urban, Non-metropolitan	Urban, Metropolitan	P-value[a]
All Deaths, n(%)[b]	3,041 (18.5)	75 (20.8)	543 (17.1)	2,423 (18.8)	0.05
Natural Deaths, n(%)[cd]	2,223 (74.4)	55 (76.4)	412 (77.2)	1,756 (73.7)	0.24
Infectious Disease	493 (16.5)	6 (8.3)	52 (9.7)	435 (18.3)	<0.001
Non-Communicable Illness	1674 (56.0)	45 (62.5)	349 (65.4)	1,280 (53.7)	<0.001
Mental Illness[e]	56 (1.9)	4 (5.6)	11 (2.1)	41 (1.7)	0.07
Unnatural Deaths, n(%)[cd]	765 (25.6)	17 (23.6)	122 (22.8)	626 (26.3)	0.24
Injury[e]	217 (7.26)	4 (5.6)	32 (6.0)	181 (7.6)	0.43
Transportation Accidents	179 (6.0)	7 (9.7)	32 (6.0)	140 (5.9)	0.40
Homicide/Assault[e]	268 (9.0)	1 (1.4)	42 (7.9)	225 (9.5)	0.02
Suicide	101 (3.4)	5 (6.9)	16 (3.0)	80 (3.4)	0.22

a) The chi-square test was used to compare residential location at the 5% significance level.

b) The percentages for all deaths are based on deaths that occurred in the total study population.

c) The percentages of natural and unnatural deaths are based on specific deaths that occurred in the deceased population.

d) Missingness: The causes of death for 53 persons were unknown. These deaths were not included in natural and unnatural deaths.

e) Fisher's Exact test was used to determine the p-value for types of death with values less than 5 at the 5% significance level.

Table 3. Hazard Ratios for All-Cause, Natural, and Unnatural Deaths from 1991-2010 and 5 years Post-release

	Hazard Ratio (95% CI)			
	1991-2010		5 years Post Release	
Residence Location	Without Adjustment	With Adjustment	Without Adjustment	With Adjustment
All Cause Deaths				
Rural, Non-Metropolitan	1.00	1.00	1.00	1.00
Urban, Non-Metropolitan	0.83 (0.65-1.06)	0.81 (0.64-1.04)	1.23 (0.79-1.93)	1.21 (0.77-1.89)
Urban, Metropolitan	0.92 (0.73-1.15)	0.95 (0.75-1.19)	1.49 (0.97-2.30)	1.52 (0.99-2.34)
Natural Deaths				
Rural, Non-Metropolitan	1.00	1.00	1.00	1.00
Urban, Non-Metropolitan	1.02 (0.77-1.35)	1.04 (0.79-1.38)	1.66 (0.94-2.93)	1.66 (0.94-2.92)
Urban, Metropolitan	1.10 (0.84-1.44)	1.13 (0.87-1.48)	1.81 (1.04-3.12)	1.80 (1.04-3.12)
Unnatural Deaths				
Rural, Non-Metropolitan	1.00	1.00	1.00	1.00
Urban, Non-Metropolitan	1.01 (0.61-1.69)	1.13 (0.68-1.87)	1.30 (0.63-2.70)	1.32 (0.64-2.74)
Urban, Metropolitan	1.26 (0.78-2.04)	1.33 (0.82-2.16)	1.56 (0.77-3.13)	1.49 (0.74-3.00)

Table 4. Types of Death in a Prisoner Cohort in Georgia, 5 years Post-release

Type of Death	Overall	Rural, Non-metropolitan	Urban, Non-metropolitan	Urban, Metropolitan	P-value[a]
All Deaths, n(%)[b]	1366 (44.9)	21 (28.0)	228 (42.0)	1117 (46.1)	0.60
Natural Deaths, n(%)[cd]	879 (65.2)	13 (61.9)	151 (67.1)	715 (64.8)	0.77
Infectious Disease[e]	280 (20.8)	3 (14.3)	25 (11.1)	252 (22.9)	<0.001
Non-Communicable Disease	579 (43.0)	10 (47.6)	122 (54.2)	447 (40.5)	<0.001
Mental Illness[f]	20 (1.5)	0 (0.0)	4 (1.8)	16 (1.5)	
Unnatural Deaths, n(%)[cd]	470 (34.8)	8 (38.1)	74 (32.9)	388 (35.2)	0.77
Injury[e]	108 (8.0)	1 (4.8)	15 (6.7)	92 (8.3)	0.73
Transportation Accidents[e]	114 (8.5)	2 (9.5)	22 (9.8)	90 (8.2)	0.64
Homicide/Assault[e]	186 (13.8)	1 (4.8)	29 (12.9)	156 (14.1)	0.49
Suicide[e]	62 (4.6)	4 (19.1)	8 (3.6)	50 (4.5)	0.02

a) The chi-square test was used to compare residential location at the 5% significance level.

b) The percentages for all deaths after 5 years post release are based on deaths that occurred in the total study population.

c) The percentages of natural and unnatural deaths are based on specific deaths that occurred in the deceased population after 5 years post release.

d) Missingness: The causes of death for 17 persons were unknown. These deaths were not included in natural and unnatural death

e) Fisher's Exact test was used to determine the p-value for types of death with values less than 5 at the 5% significance level.

f) Residential location was not compared for deaths due to mental illness because no person from a rural residence experienced a death due to mental illness.

Table 5. Adjusted Hazard Ratio for Natural Deaths, 5 years Post-Release

Variable	Adjusted Hazard Ratio (95% CI)
Residence Location	
Rural, Non-Metropolitan	1.00
Urban, Non-Metropolitan	1.66 (0.94-2.92)
Urban, Metropolitan	1.80 (1.04-3.12)
Race	
Black	1.33 (1.15-1.54)
Birth Cohort	
1910-1948	1.00
1949-1958	0.74 (0.63-0.87)
1959-1973	0.71 (0.60-0.84)
Number of Incarcerations	
≥2	1.38 (1.18-1.62)
History of Mental Illness	
Yes	2.34 (2.03-2.70)

FIGURES

Figure 1. Participant Exclusion and Inclusion

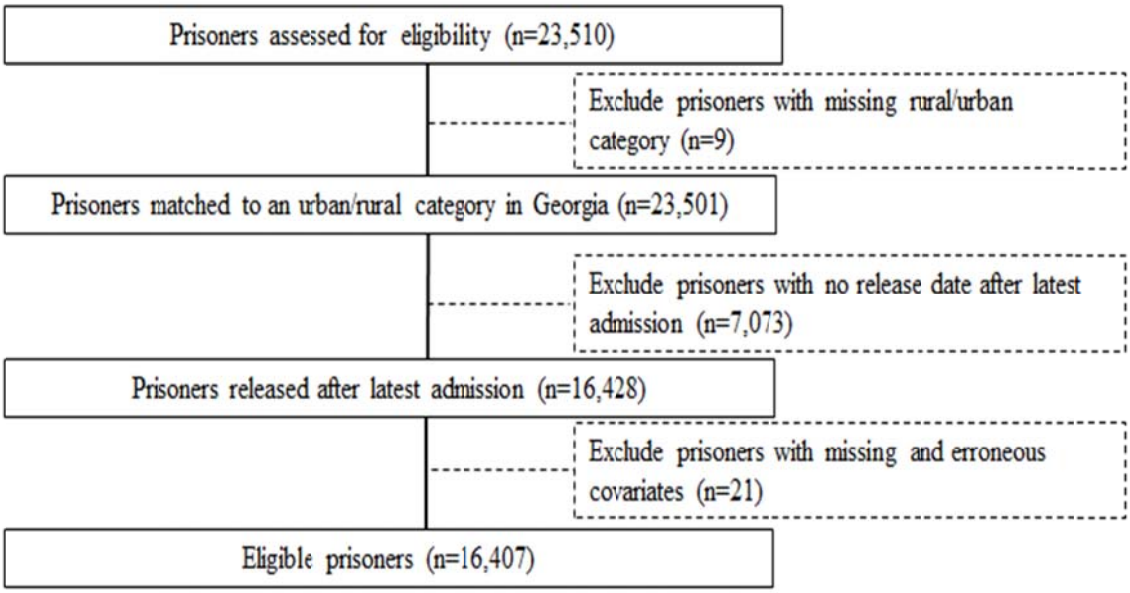


Figure 2. Kaplan Meier Curves for Survival due to All-Cause Death after Release from a Georgia Prison, 1991-2010

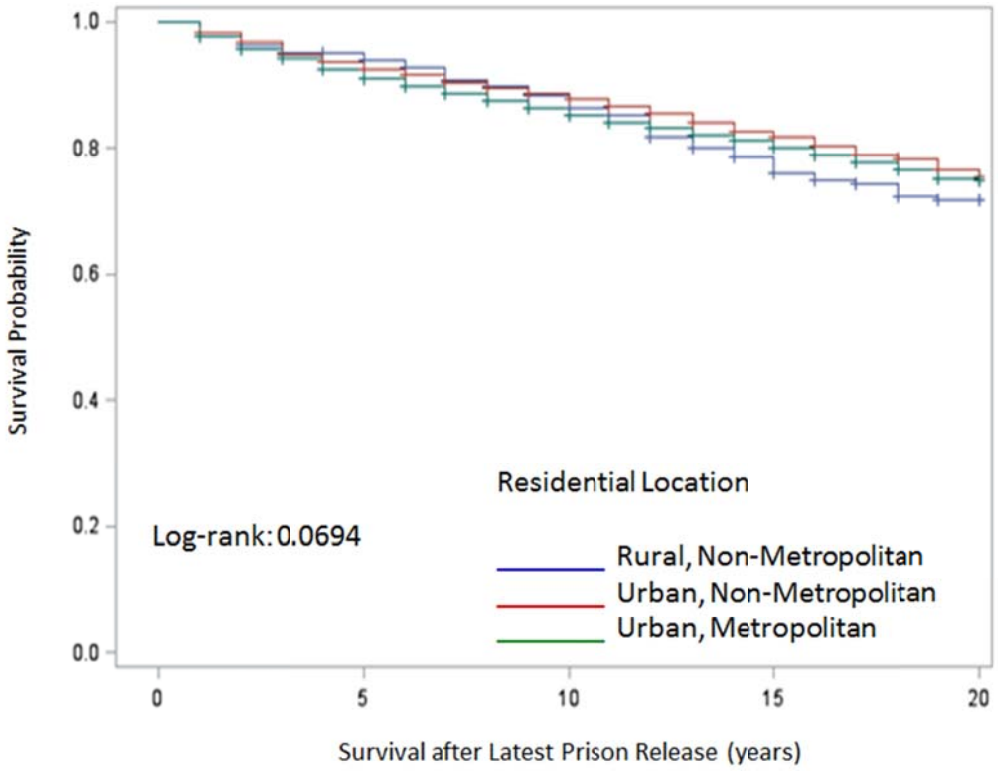


Figure 3. Kaplan Meier Curves for Survival due to Natural Deaths after Release from a Georgia Prison, 1991-2010

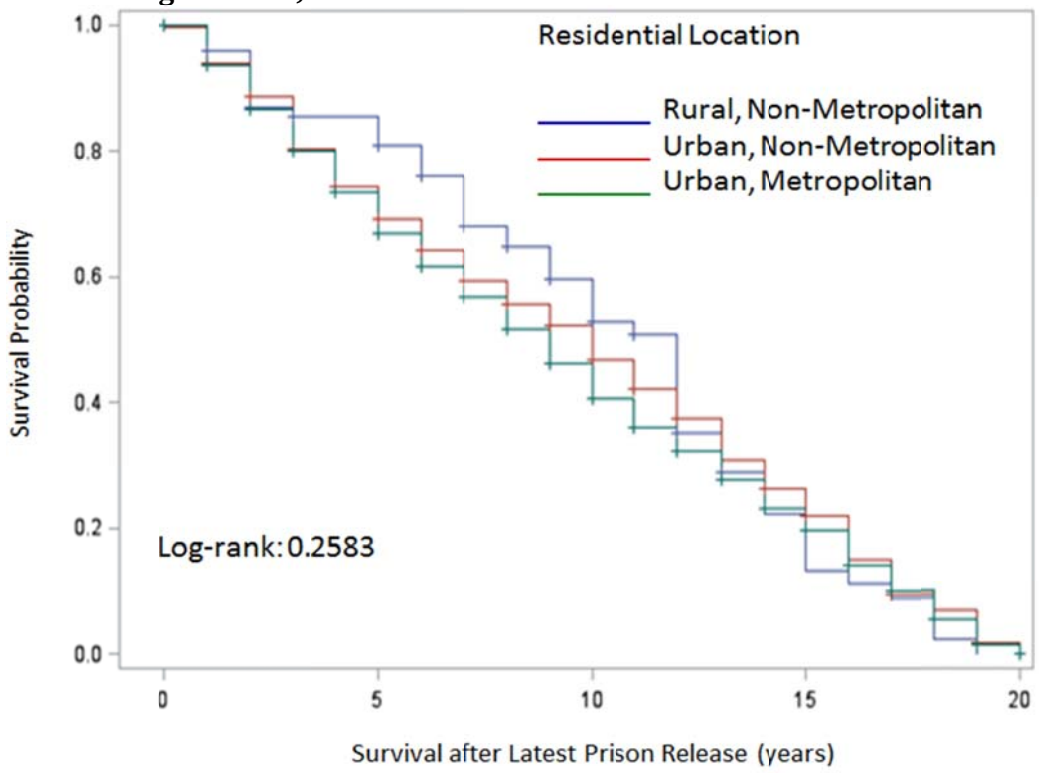


Figure 4. Kaplan Meier Curves for Survival due to Unnatural Deaths after Release from a Georgia Prison, 1991-2010

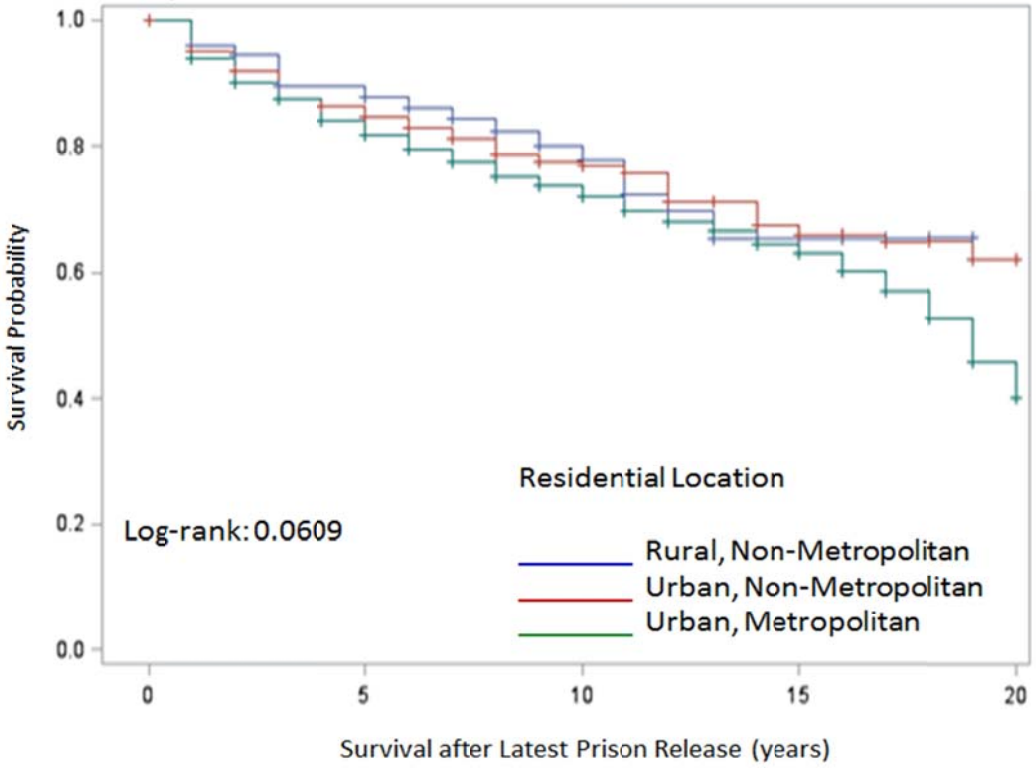


Figure 5. Kaplan Meier Curves for Survival due to All-Cause Death after Release from a Georgia Prison, 5 years Post-Release

Figure 6. Kaplan Meier Curves for Survival due to Natural Deaths after Release from a Georgia Prison, 5 years Post-Release

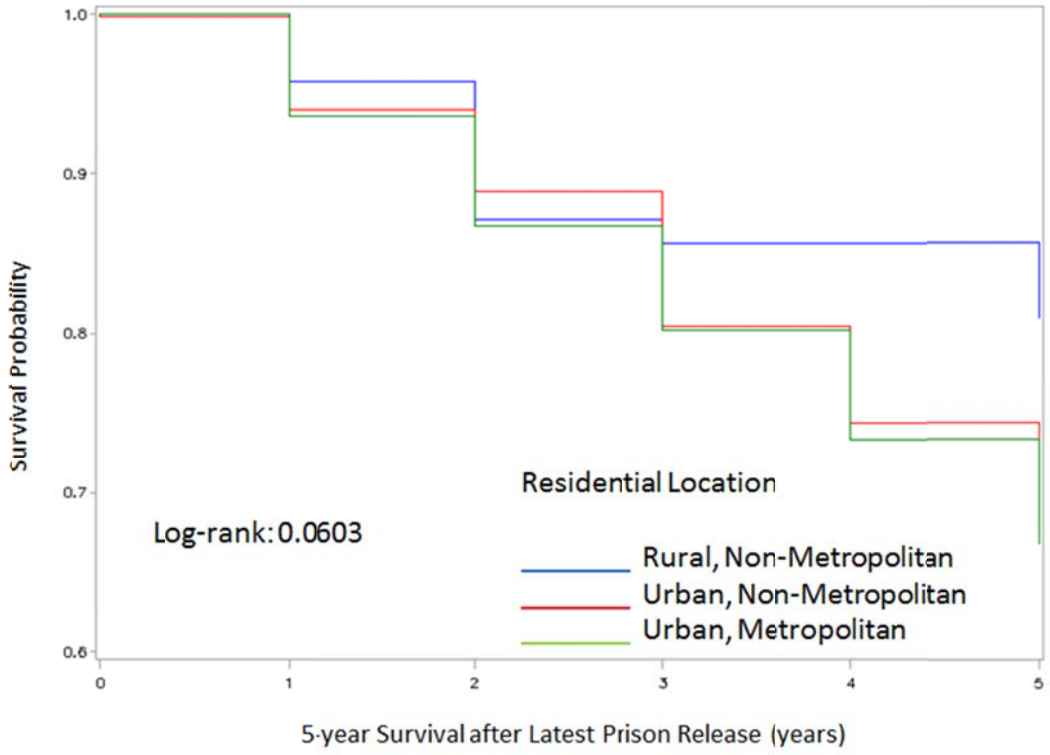
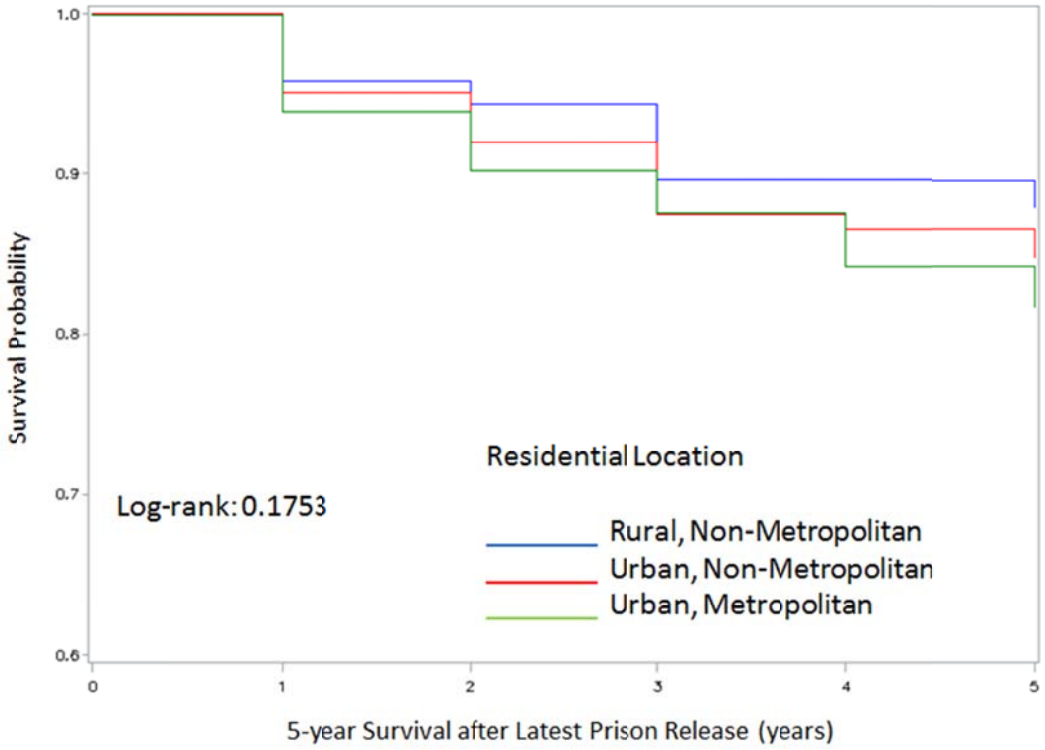


Figure 7. Kaplan Meier Curves for Survival due to Unnatural Deaths after Release from a Georgia Prison, 5 years Post-Release



CHAPTER III: SUMMARY, PUBLIC HEALTH IMPLICATIONS, AND POSSIBLE FUTURE DIRECTIONS

SUMMARY

In this study, the mortality of Georgia prison releasees was assessed from 1991 to 2010 and within five years post-release using residential location as the primary exposure. Mortality due to all-cause deaths, natural deaths, and unnatural deaths were considered both independently and adjusted for socio-demographic and incarceration factors. Almost half of the deaths in this cohort occurred within the first five years after release. In this study of 16,407 releasees, the residential location was significant in the survival of releases that experienced deaths due to natural causes within five years after release. There was not a significant difference in mortality based on the type of resident in which releasees lived due to all causes of death, natural and unnatural deaths from 1991-2010 as well as all causes of death and unnatural deaths five years after release.

PUBLIC HEALTH IMPLICATIONS

The findings from this study indicate that prisoners from an urban, metropolitan area in Georgia are at an increased risk of mortality due to natural causes within five years post-release. Former prisoners are faced with numerous social and medical burdens as re-integration into the community occurs. Acquiring basic needs may be a larger priority for releasees than maintaining their health. On the other hand, obtaining access to medical services and treatment with little or no income and no health insurance may be difficult, limiting releasees to select human services facilities. Linkage to healthcare facilities in the community, especially those offering services and treatment for mental health and chronic illnesses, may need to be improved in Georgia prisons to decrease mortality among releasees. Prior to incarceration, the majority of releasees in this cohort resided in an urban, metropolitan area in Georgia; therefore, a higher volume of releasees

will go through the re-integration process in urban areas than in rural areas. The number of prisoners released into urban areas may be so large that health facilities do not have the capacity to care for such a high volume of low-income or uninsured persons with co-existing conditions. Health facilities that provide services for individuals who may have little or no income may already be overwhelmed with homeless and low-income populations that have not been incarcerated. Infectious disease, chronic illness, and mental illness require continuous medical care and treatment, as many people will have these conditions for the rest of their lives. Therefore, additional health resources for prisoners in urban areas may be needed, especially immediate after release. This is not to say that individuals in rural areas do not need additional services, but the results of this study indicate that urban areas may be in greater need of more services for releasees due to the large population size.

In the past, infectious diseases have received more attention than chronic diseases; however, the US obesity epidemic as well as the aging incarcerated population may require US prisons systems to focus on chronic diseases(5). Releasees in this cohort had a substantial amount of deaths due to non-communicable illness, as the percentage of deaths doubled that of infectious disease. Prior to being imprisoned, prisoners tend to come from medically underserved populations, including poor and/or minority groups. Due to socio-demographic factors such as income or insurance status, it may be difficult to maintain long-term preventative care and adhere to medications; therefore, individuals may not seek care until they enter the late stages of disease. Individuals may also reside in environments in which harmful exposures or less access to nutritional foods is common.

In addition, Black releasees were more likely than non-Black releasees to experience death due to natural causes, which consisted of a substantial proportion of deaths caused by chronic disease. Rosen et al. found that white releasees from North Carolina (NC) prisons had an increased amount of death due to chronic diseases in comparison to Black releasees with an average follow-up time greater than 10 years(40). However, 55% of the cohort consisted of Black releasees from NC prisons, in comparison to approximately 65% of Black releasees which made up this study cohort. In the state of Georgia, Blacks releasees may be at risk of an early death due to natural causes, especially chronic disease.. Results were also consistent with Binswanger et al. Releasees of an older age were found to be at an increased risk of mortality due to natural causes(26).

Furthermore, releasees with a history of mental health were more than twice as likely to experience an early death due to natural causes than releasees without a history of a mental illness. Former prisoners may experience increased difficulty re-gaining stability, such as obtaining employment, housing, and other basic needs, which may involve additional challenges to a releasee with a mental illness. Mental conditions, if left untreated, can also lead to a low adherence to medications, resulting in worsening medical conditions or death (14).

This study did not find significant differences in mortality due to residence location during the entire study period or within five years post-release for all causes of death and unnatural deaths. Many of the conditions and behaviors among the general population that cause differences in rural and urban health outcomes are associated with income, education, and physical environment, including exposure to harmful

substances(43). Educational status was used as a proxy for income; however, more than 50% of former prisoners in each residential location did not complete high school. Without an adequate income to maintain quality basic needs, it is likely that low-income residents may experience similar health outcomes regardless of the residential location. The cost of housing and raising a family is likely increased in an urban area as well, diminishing the effect of resources that may be available in the area.

POSSIBLE FUTURE STUDIES

The goal of imprisonment is not only to punish a prisoner for a crime, but to rehabilitate the prisoner as well. Prisoners with a longer sentence may have the opportunity to be exposed to resources to which there was little access before imprisonment, including mental and physical health services. In some cases, prisoners may have the opportunity to participant in self-improvement activities such as substance abuse interventions or educational programs. Binswanger et al. found that an increased length of stay in a prison facility may decrease an all-cause risk of mortality, but it will not decrease the mortality for early death after release from prison (50). A longer length of stay in prison may aid in the complication of re-integration into the community after release, as the prisoner has been separated from social resources such as family and friends, housing, and employment for an extended amount of time. Furthermore, a prisoner would have to learn how to schedule and maintain medical appointments and adhere to medications outside of prison. With the separation from social support, the prisoner may or may not return to the same environment; therefore, risk factors for mortality may differ from those prior to imprisonment.

In future studies, it may be beneficial to evaluate the total time of imprisonment since the beginning of the study in 1991 until 2010. This study only evaluated if the person was imprisoned once or multiple times. Additionally, sensitivity analyses may be used to determine if the residence at latest prison admission or the residence at the admission of the prison sentence in 1991 would be a better predictor of mortality in the prisoner cohort. The type of death could also be specified to determine risk factors associated with causes of death that produce the highest mortality rates.

Moreover, female prisoners represented only a small percentage of prisoners in 1991. Since this time, the number of incarcerated females has increased at a rate higher than that of men, even though the number of incarcerated men is substantially higher than women. In 2006, the number of incarcerated women increased by 4.5%, and the number of incarcerated men increased by 2.7% (13). Imprisoned women also have increased medical, psychiatric, and drug dependence, in comparison to imprisoned men(25, 51, 52). Therefore, it may be necessary to evaluate risk factors based on residence type for women released from Georgia prisons separately.

REFERENCES

1. Freudenberg N. Jails, Prisons, and the Health of Urban Populations: A Review of the Impact of the Correctional System on Community Health. *J Urban Health* 2001;78(2):214-35.

2. Bureau of Justice Statistics. What is the difference between jails and prisons? (http://bjs.ojp.usdoj.gov/index.cfm?ty=qa&iid=322). (Accessed Sept. 14 2012).

3. Draine J, Ahuja D, Altice FL, et al. Strategies to enhance linkages between care for HIV/AIDS in jail and community settings. *AIDS Care* 2011;23(3):366-77.

4. International Centre for Prison Studies. World Prison Brief: Entire World- Prison Population Rates per 100,000 of the national population. King's College London, University of London. (http://prisonstudies.org/info/worldbrief/wpb_stats.php?area=all&category=wb_poprate). (Accessed Aug. 10 2012).

5. Dumont DM, Brockmann B, Dickman S, et al. Public Health and the Epidemic of Incarceration. *Annu Rev Public Health* 2012;33(1):325-39.

6. Spaulding AC, Seals RM, McCallum VA, et al. Prisoner survival inside and outside of the institution: implications for health-care planning. *Am J Epidemiol* 2011;173(5):479-87.

7. Glaze L. Correctional Population in the United States, 2010. *US Department of Justice, Bureau of Justice Statistics* 2011 NCJ 236319.

8. West H, Sabol W. Prisoners in 2009. Bureau of Justice Statistics, 2012 NCJ 231675.

9. Georgia Department of Corrections. FY 2011 Annual Report. Georgia, US: Department of Corrections, 2011:6.

10. Georgia Department of Corrections. Prisoner Length of Stay (CY) Report, New Court Commitments Only. Georgia, US, 2012:13.

11. Georgia Department of Corrections. Inmate Statistical Profile: Inmates Released During CY2011. Georgia Department of Corrections, 2012.

12. Golembeski C, Fullivore R. Criminal (in)justice in the city and its associated health consequences. *Am J Public Health* 2008;98:S185-90.

13. Sabol W. Prisoners in 2006. Bureau of Justice Statistics, 2007.

14. Rich JD, Wohl DA, Beckwith CG, et al. HIV-Related Research in Correctional Populations: Now is the Time. *Current HIV/AIDS Reports* 2011;8(4):288-96.

15. Weiss J, Osorio G, Ryan E, et al. Prevalence and patient awareness of medical comorbidites in an urban AIDS clinic. *AIDS Pat Care* 2010;24(1):39-48.

16. The National Center on Addiction and Substance Abuse at Columbia. Behind Bar II: Substance Abuse and America's Prison Population. Columbia University: New York, NY, 2010.

17. Lamb H, Weinberger L. The shift of psychiatric inpatient care from hospitals to jails and prisons. *J Am Acad Psychiatry Law* 2005;33:529-34.

18. Hatcher S, Toldson I, Godette D, et al. Mental health, substance abuse, and HIV disparities in correctional settings: practice and policy implications for African Americans. *J Health Care* 2009;20:6-16.

19. Weiser S, Neilands T, Comfort M, et al. Gender-specific correlates of incarceration among marginally housed individuals in San Fransico. *Am J Public Health* 2009;99:1459-63.

20. Spaulding A, Stephenson B, Macalino G, et al. Human Immunodeficiency Virus in Correctional Facilities: A Review. *Clin Infect Dis* 2002 35(3):305-12.

21. Maruschak L. HIV in Prisons, 2006. *US Department of Justice, Bureau of Justice Statisitcs* 2008:NCJ-222179.

22. Centers For Disease Control and Prevention. Correctional Facilities and Viral Hepatitis. 2011. (http://www.cdc.gov/hepatitis/Settings/corrections.htm). (Accessed Nov. 2 2012).

23. United Nations Office on Drugs and Crime. Handbook on Prisoners with Special Needs. New York: United Nations, 2009.

24. Wilper A, Woolhandler S, Boyd J, et al. The health and health care of US prisoners: results of a nationwide survey. *Am J Public Health* 2009;99(4):666-72.

25. Binswanger IA, Krueger PM, Steiner JF. Prevalence of chronic medical conditions among jail and prison inmates in the USA compared with the general population. *J Epidemiol Community Health* 2009;63(11):912-9.

26. Binswanger I, Stern M, Deyo R, et al. Release from prison--a high risk of death for former inmates. *N Engl J Med* 2007 Jan 11;356(2):157-65.

27. Wakeman S, McKinney M, Rich J. Filling the gap: the importance of Medicaid continuity for former inmates. *J Gen Intern Med* 2009;24(7):860-2.

28. Pogorzelski W, Wolff N, Pan K, et al. Behavioral health problems, ex-offender reentry policies, and the "Second Chance Act". *Am J Public Health* 2005;95(1718-1724).

29. Vigne N, Davies E, Palmer T, et al. Release Planning for Successful Reentry: A Guide for Corrections, Service Providers, and Community Groups. Washington, D.C.: Urban Institute, Justice Policy Center 2008:5.

30. Linke L, Ritchie P. Releasing Inmates From Prison National Insititution of Corrections, 2004:24-5.

31. Verger P, Rotily M, Prudhomme J, et al. High mortality rates among inmates during the year following their discharge from a French prison. *J Forensic Sci* 2003;48(3):614-6.

32. Harding-Pink D. Mortality following release from prison. *Med Sci Law* 1990;30(1):12-6.

33. Seymour A, Oliver JS, Black M. Drug-related deaths among recently released prisoners in the Strathclyde Region of Scotland. *J Forensic Sci* 2000;45(3):649-54.

34. Bird SM, Hutchinson SJ. Male drugs-related deaths in the fortnight after release from prison: Scotland, 1996-99. *Addiction (Abingdon, England)* 2003;98(2):185-90.

35. Farrell M, Marsden J. Acute risk of drug-related death among newly released prisoners in England and Wales. *Addiction (Abingdon, England)* 2008;103(2):251-5.

36. Seaman SR, Brettle RP, Gore SM. Mortality from overdose among injecting drug users recently released from prison: database linkage study. *BMJ (Clinical research ed)* 1998;316(7129):426-8.

37. Kariminia A, Butler TG, Corben SP, et al. Extreme cause-specific mortality in a cohort of adult prisoners--1988 to 2002: a data-linkage study. *Int J Epidemiol* 2007;36(2):310-6.

38. Hobbs M, Krazlan K, Rodout S, et al. Mortality and Morbidity in Prisoners after Release from Prison in Western Australia 1995-2003. *Research and Public Policy Series* Canberra: Australian Institute of Criminology, 2006.

39. Graham A. Post-prison Mortality: Unnatural death among people released from Victorian prisons between January 1990 and December 1999. *Aust N Z J Criminol* 2003;36(1).

40. Rosen D, Schoenbach V, Wohl D. All-Cause and Cause-Specific Mortality Among Men Released From State Prison, 1980-2005. *Am J Public Health* 2008;98(12):2278-84.

41. Krinksy C, Lathrop S, Brown P, et al. Drugs, Detention, and Death: A study of the Mortality of Recently Released Prisoners. *AM J Forensic Med Pathol* 2009;30(1):6-9.

42. Gamm L, Hutchinson L, Dabney B, et al. Rural Health People 2010: A Companion Document to Healthy People 2010. *College Station, Tex: Texas A and M University Health System Health Science Center, School of Rural Public Health, Southwest Rural Health Research Center* 2003;1.

43. Hartley D. Rural Health Disparities, Population Health and Rural Culture. *Am J Public Health* 2004;94(10):1675-8.

44. Hayward M, Gorman B. The Long Arm of Childhood: The Influence of Early-Life Social Conditions on Men's Mortality. *Demography* 2004;41(1):87-107.

45. Probst JC, Bellinger JD, Walsemann KM, et al. Higher risk of death in rural blacks and whites than urbanites is related to lower incomes, education, and health coverage. *Health affairs* 2011;30(10):1872-9.

46. Mansfield C, Wilson J, Kobrinski E, et al. Premature Mortality in United States: The Roles of Geographic Area, Socioeconomis Status, Household Type, and Availability of Medical Care. *Am J Public Health* 1999;89(6):893-8.

47. Branas C, Nance M, Elliot M, et al. Urban-Rural Shifts in Intentional Firearm Death: Different Causes, Same Results. *Am J Public Health* 2004;94(10):1750-5.

48. Hendryx M, Fedorko E, Halverson J. Pollution Sources and Mortality Rates across Rural-Urban Areas in the United States. West Virginia University, Morgantown, WV: West Virginia Rural Health Research Center, 2010.

49. Stewart L, Henderson C, Hobbs M, et al. Risk of death in prisoners after release from jail. *Aust N Z J Public Health* 2004;28(1):32-6.

50. Binswanger IA, Blatchford PJ, Lindsay RG, et al. Risk factors for all-cause, overdose and early deaths after release from prison in Washington state. *Drug Alcohol Depend* 2011;117(1):1-6.

51. Binswanger IA, Merrill JO, Krueger PM. Gender differences in chronic medical, psychiatric , and substance-dependence disorders among jail inmates. *Am J Public Health* 2010;100:476-82.

52. Fazel S, Bains P, Dolt H. Substance abuse and dependence in prisoners: a systematic review. *Addiction (Abingdon, England)* 2006;101:181-91.

APPENDIX

APPENDIX A

EMORY UNIVERSITY

Institutional Review Board

DATE: January 29, 2013

RE: **Determination:** No IRB Review Required
Title: All-Cause, Natural, and Unnatural Mortality Among Rural vs. Urban Men Released from Georgia Prisons
PI: Shawnta Lloyd

Dear Ms. Lloyd:

Thank you for requesting a determination from our office about the above-referenced project. Based on our review of the materials you provided, we have determined that it does not require IRB review because it does not meet the definition of "human subjects" as set forth in Emory policies and procedures or federal regulations. Specifically, in this project, you will not have interaction with subjects and all data will be gathered from a de-identified data set from a separate IRB approved protocol (IRB#47094).

Please note that this determination does not mean that you cannot publish the results. If you have questions about this issue, please contact me.

This determination could be affected by substantive changes in the study design, subject populations, or identifiability of data. If the project changes in any substantive way, please contact our office for clarification.

Thank you for consulting the IRB.

Sincerely,

Kevin Wack, BA
Analyst Assistant
Education and Quality Assurance
Emory University Institutional Review Board
1599 Clifton Rd, Atlanta, GA 30322

APPENDIX B

Table B1. Adjusted Hazard Ratio for All-Cause Death among Georgia Prison Releasees, 1991-2010

Variable	Adjusted Hazard Ratio (95% CI)
Residence Location	
Rural, Non-Metropolitan	1.00
Urban, Non-Metropolitan	0.81 (0.64-1.04)
Urban, Metropolitan	0.95 (0.75-1.19)
Birth Cohort	
1910-1948	1.00
1949-1958	0.44 (0.41-0.49)
1959-1973	0.23 (0.21-0.25)
Educational Status	
< High School	1.18 (1.09-1.27)
Number of Incarcerations	
≥2	1.61 (1.49-1.74)
History of Substance Abuse	
Yes	1.21 (1.12-1.30)
Violent Crime	
Yes	0.92 (0.85-0.99)
Drug-Related Crime	
Yes	0.85 (0.77-0.94)

Table B2. Adjusted Hazard Ratio for Natural Deaths among Georgia Prison Releasees, 1991-2010

Variable	Adjusted Hazard Ratio (95% CI)
Residence Location	
Rural, Non-Metropolitan	1.00
Urban, Non-Metropolitan	1.04 (0.79-1.38)
Urban, Metropolitan	1.13 (0.87-1.48)
Race	
Black	1.23 (1.13-1.34)
Birth Cohort	
1910-1948	1.00
1949-1958	0.75 (0.68-0.83)
1959-1973	0.70 (0.62-0.78)
Number of Incarcerations	
≥2	1.22 (1.12-1.34)
History of Mental Illness	
Yes	2.78 (2.49-3.10)

Table B3. Adjusted Hazard Ratio for Unnatural Deaths among Georgia Prison Releasees, 1991-2010

Variable	Adjusted Hazard Ratio (95% CI)
Residence Location	
Rural, Non-Metropolitan	1.00
Urban, Non-Metropolitan	1.13 (0.68-1.87)
Urban, Metropolitan	1.33 (0.82-2.16)
Gender	
Male	1.78 (1.25-2.53)
Race	
Black	0.86 (0.74-1.00)
Birth Cohort	
1910-1948	1.00
1949-1958	2.87 (2.21-3.72)
1959-1973	6.74 (5.27-8.63)
Number of Incarcerations	
≥2	1.25 (1.06-1.47)
History of Mental Illness	
Yes	1.68 (1.42-2.00)

Table B4. Adjusted Hazard Ratio for All-Cause Death among Georgia Prison Releasees, 5 years Post-Release

Variable	Adjusted Hazard Ratio (95% CI)
Residence Location	
Rural, Non-Metropolitan	1.00
Urban, Non-Metropolitan	1.21 (0.77-1.89)
Urban, Metropolitan	1.52 (0.99-2.34)
Gender	
Male	1.30 (1.01-1.66)
Race	
Black	1.13 (1.00-1.26)
Birth Cohort	
1910-1948	1.00
1949-1958	0.50 (0.44-0.58)
1959-1973	0.32 (0.28-0.37)
Educational Status	
< High School	1.21 (1.08-1.35)
Number of Incarcerations	
≥2	1.74 (1.53-1.97)
History of Substance Abuse	
Yes	1.29 (1.15-1.44)
Violent Crime	
Yes	0.87 (0.77-0.98)
Drug-Related Crime	
Yes	0.79 (0.68-0.92)

Table B5. Adjusted Hazard Ratio for Unnatural Deaths among Georgia Prison Releasees, 5 years Post-Release

Variable	Adjusted Hazard Ratio (95% CI)
Residence Location	
Rural, Non-Metropolitan	1.00
Urban, Non-Metropolitan	1.32 (0.64-2.74)
Urban, Metropolitan	1.49 (0.74-3.00)
Gender	
Male	2.16 (1.29-3.61)
Birth Cohort	
1910-1948	1.00
1949-1958	2.94 (2.09-4.13)
1959-1973	6.46 (4.69-8.90)
Number of Incarcerations	
≥2	1.52 (1.23-1.87)