

SPATIAL ANALYSIS OF HIV/AIDS SURVIVAL IN  
DALLAS AND HARRIS COUNTIES, TEXAS

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More Texans are living with HIV infection than ever before. In fact, there has been a 6% increase annually, since 2002. This trend is not a result of increased HIV/AIDS incidence, but rather improving life expectancy of those living with HIV. Due to significant advances in HIV/AIDS testing, prevention, and treatment, individuals with HIV are living longer than ever before. However, throughout the state, the life expectancy of a person infected with HIV/AIDS varies spatially.

This study investigates and attempts to explain the spatial distribution of HIV/AIDS survival rates by examining neighborhood socioeconomic characteristics. The results suggest that, contrary to expectation, the lowest survival rates occur, not in extreme poverty areas, but rather in moderate SES areas. Too rich to qualify for free treatments, but not rich enough to afford purchasing such treatments, the middle income living with HIV infection are caught between the cracks. The results provide important input for targeting public health interventions to improve HIV/AIDS survival.

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## CHAPTER 1

### INTRODUCTION

More Americans are living with HIV/AIDS than ever before. In Texas, one in 387 people are living with HIV/AIDS as of 2008. Due to significant advances in HIV/AIDS testing, prevention, and antiretroviral treatment individuals with HIV can live longer and fuller lives with the disease. However, not all Texans live as long with the virus; some die quickly. Health status varies significantly between places. In certain communities, people may have a much shorter life expectancy with the disease. HIV/AIDS survival can be computed from survival months through a Kaplan Meier analysis. Survival months with HIV/AIDS can be measured in the time in months from the diagnosis of HIV to the diagnosis of AIDS. The time in months from the diagnosis of AIDS to the date of death is also used to measure survival with the virus.

Socioeconomic status, or SES, seems to be the most important determinant of HIV survival for urban dwellers. This study investigates the spatial variation of HIV/AIDS survival rates, explains this geographic distribution using neighborhood characteristics including income, poverty, education, and unemployment. Medical geography is concerned with this survival distribution because it has an important impact on future health planning. Knowing the locations and characteristics of populations vulnerable to shortened HIV/AIDS survival is crucial for future HIV/AIDS treatment and prevention in Texas. An increased understanding of the spatial distribution of survival over time may help to improve service to those at risk for shortened HIV/AIDS survival.

The U.S. Centers for Disease Control and Prevention reports that over one million people are living with HIV in the United States. About 21 percent of those individuals are unaware of their HIV infection (Centers for Disease Control (CDC), 2010). Nearly, 65,000 Texans are living

with HIV infection and an estimated 4,200 Texans receive an HIV diagnosis yearly. In addition, about 1,300 Texans die of HIV each year (CDC, 2010). Geographically, these HIV infections are not evenly distributed throughout Texas; the highest proportion of HIV cases in the state is among urban African Americans. African Americans comprise approximately 11 percent of the Texas population, but they represent 38 percent of the HIV infection statewide (Texas Department of State Health Services (TSHS), 2009). In fact, the rates of black Texans infected with HIV are four times higher than the rates for white and Hispanic Texans (TSHS, 2009). This coincides with the CDC's findings that African Americans face the most severe burden of HIV/AIDS in the nation. Hispanics, however, are also experiencing an increase in HIV infection rates (CDC, 2010).

In the population infected with HIV/AIDS, some individuals have a greater length of survival with the disease. Accessibility to appropriate healthcare may be a determinant of survival length and quality of life for people infected with HIV/ AIDS. Low socioeconomic status may be one of the greatest barriers to receiving the medical care that may allow for individuals with the virus to live a longer life. People of low socioeconomic status reside in close proximity to other disadvantaged individuals. This clustering effect of poverty and individuals at a greater risk for disease emphasizes the idea of place vulnerability. Place vulnerability theory argues that adverse life circumstances do not affect all places uniformly and certain factors make some places more vulnerable to diseases and death. Thus, the distribution and the characteristics of these areas could help to explain the geography of HIV/AIDS survival rates in urban Texas (Oppong and Harold, 2009). Specific environmental or social factors within a community may be related to shorter survival with the disease in socioeconomically disadvantaged neighborhoods.

## CHAPTER 2

### LITERATURE REVIEW

There are a greater number of whites living in poverty than blacks in Texas. However, poverty's impact on African Americans in Texas is amplified because they are the group most likely to reside in larger urban communities with concentrated poverty (Saenz, 2005). Residential segregation and low neighborhood income, coupled with high inner city unemployment rates, act as a barrier to isolate urban blacks further (Saenz, 2005). This produces disproportional adverse health effects for these groups. Poverty, a major risk factor for poor health outcomes, is much more prevalent in inner-city neighborhoods than suburban communities. Americans living in high density urban neighborhoods are more likely to experience higher mortality rates and have poorer health status than their suburban counterparts (van Dis, 2006). This may explain why economically disadvantaged individuals possibly suffer disproportionately from shortened survival from HIV/AIDS. It also may potentially explain why minorities, who are more likely to dwell in the inner-city, seem to be inflicted with the virus at higher rates and experience shortened survival.

Prior to 1996, about half of the people infected with HIV would develop AIDS within 10 years of infection (Center of Disease Control and Prevention (CDC), 2006). Factors, including the health status and health-related behaviors of individuals, accounted for variations in life expectancy. After the introduction of antiretroviral therapies in 1996, these variations in life expectancy have dramatically increased. Disparities in the social environment, the built physical environment, and barriers to HIV related healthcare may explain the differences in the progression time between HIV infection and the development of AIDS in individuals and their communities (CDC, 2006). U.S. national HIV surveillance data was utilized to statistically



compare the average life expectancy after HIV diagnosis in 1996 to 2005. The research indicated survival increased from 10.5 to 22.5 years from 1996 to 2005. According to the findings, females on average survived more years than males, however survival lengths for females from 1996-2005 experienced less improvement than in the male population. HIV/AIDS survival for African American males was shortest, followed by Hispanic males, and then white males (Harrison, Song, and Zhang, 2010). Socioeconomic factors, cultural norms, and differences in treatment and testing, are likely to account for disparities in HIV survival between groups.

#### Late Testing

HIV is the virus that causes AIDS. Typically, between five to ten years after HIV infection, individuals may begin to show symptoms in their progression to developing AIDS. Until the symptoms of AIDS appear, many people do not realize they have been infected with HIV (Texas Department of State Health Services (TSHS), 2009). Subjects that present with an AIDS defining illness coincident with a positive result in an HIV test progress from HIV infection to the AIDS virus without receiving medical treatment (Poznansky, 1995). Many Texans seek testing after they begin to experience symptoms; this late testing is an integral component of survival. As of 2009, in Texas, one third of those infected with HIV were diagnosed with AIDS within one year of their HIV diagnosis (TSHS, 2009).

Early testing is vital for those infected with HIV because it causes many infected individuals to make behavior changes and take safety precautions to prevent the spread of other communicable diseases that can reduce survival with the virus. It is also crucial to prolonging the life expectancy in individuals infected with the disease because they can begin to take the life

extending antiretroviral therapy treatments (TSHS, 2009). Although, due to affordability only 57 percent of the patients aware of their infection are estimated to be in care nationwide (Walensky, 2006). In the state of Texas, over three fourths of people living with HIV are men. In addition, men, especially Hispanic men, are the groups most likely to be late testers. Therefore, groups vulnerable to acquiring HIV and other transmissible diseases are, in these cases, also more likely to be late testers, and less likely to be aware of their HIV status (TSHS, 2009). Individuals in certain low socioeconomic neighborhoods then continue their risky behaviors and may inadvertently transmit diseases to other at risk community members.

#### The Human Social Environment Impacting HIV/AIDS Survival

In the United States, individuals living in urban areas are more vulnerable to contracting HIV/AIDS. Overwhelmingly, in 2006, large metropolitan areas contained 82% of AIDS cases reported, and 11% of cases were reported from medium-size metropolitan areas (CDC, 2006). In the urban realm, HIV infection is largely determined by social conditions for a variety reasons. There is a growing social and spatial concentration of poverty that creates of obstacles for inner city dwellers. Social, economic, and political structures continually change over time and differ from place to place. The social structure of urban inner city communities was radically altered in past decades. It has been marked by the mass exodus of jobs, working families, and the deterioration of housing, schools, businesses, and other community centers. Additionally, governments' industrial and urban policies serve to only exacerbate this deterioration (Wilson, 1989). Essentially, in the United States, the urban inner-city is thought to be undergoing a collapse or social decay. Poverty, lack of education, and unemployment have been used as measures for this trend (Wallace, 1997).

Urban poverty, in America, has a distinct geographical pattern. Individuals with low socioeconomic status cluster in areas of urban decay (Galea, 2005). They are also more likely to share a household with other individuals with a low socioeconomic status (SES) and live in a high poverty community (Fiscella, 2004). These areas are often characterized by higher percentages of minorities, especially African Americans. The highest cumulative number of reported AIDS cases was found in African Americans living in large metropolitan cities in the South and Northeast (CDC, 2006). African American men have the highest rates of infection. Approximately one in 16 black males will be diagnosed with HIV, and one in 30 black females will contract the virus during the span of their lives. Hispanics in urban areas had the second highest rates in the southern region of the country (CDC, 2006). Groups vulnerable to HIV/AIDS may also be more vulnerable to shortened survival due to the likelihood of contracting communicable opportunistic diseases from the risky behaviors they might be engaging in or the interaction with people who are.

In socioeconomically disadvantaged areas, single parent households are common, and a disproportional number of children in urban areas live below the poverty line (Galea, 2005). One in four children in the United States grow up in poverty, and a large segment of them dwell in declining urban ghettos (Wallace, 1997). As of 2000, in the 15 largest cities in America, including Dallas and Houston, African American children were overrepresented among the percentage of poor in these cities (Saenz, 2005). These young urban individuals have a high vulnerability to poverty, and their informal social ties are a crucial part of their daily lives. Often positive role models are scarce in these communities. Therefore, the social learning theory emphasizes that adolescents often will seek acceptance and model themselves after their peers. In urban neighborhoods, social learning can set both social norms and norms for social network

behaviors (Galea, 2005). Elijah Anderson (1991), found certain patterns and characteristics that help to define the behaviors and sexual conduct among poor black inner-city adolescents.

Frequently, adolescent African American males were strongly committed to their peer groups which emphasized boasting about sexual exploits as prime symbol of manhood. It is common for men in these communities to engage in unprotected sexual practices often and to have multiple sexual partners. Young women in these communities are often uneducated about safe sex practices and the prospect of babies also provide young socioeconomically disadvantaged girls with the opportunity for governmental support and slightly more independence in their community (Anderson, 1991). As a result, there is an increased opportunity for sexually transmitted diseases and pregnancy. This lack of protection and safe sex practices have made young black adults more vulnerable to sexually transmitted diseases and at a higher risk for contracting strains of HIV/AIDS and related opportunistic diseases, including tuberculosis, that would greatly shorten their survival if already infected with HIV/AIDS.

Injection drug users provide a yet another prime example of the influence of peers and the social network trend. Residents of low socioeconomic urban neighborhoods are at an increased risk for drug use because they are more likely to be exposed to factors that have been linked to drug use, such as; material hardships, stress, depression, and toxic environmental exposure (Geronimus, 2000). In addition, individuals with low SES may lack emotional support, which has been shown to correspond with increased rates substance abuse (Latkin, 1995). Therefore, the urban poor may be vulnerable to injection drug use because their social networks have a higher likelihood to be engaging in the activity.

Injection drug users may share needles, which increases their risk for diseases such as HIV/AIDS and hepatitis. If already infected with HIV/AIDS, an individual sharing needles has a

higher likelihood of contracting different strains of HIV or other opportunistic diseases, which can shorten survival with the virus. Annually, in Texas, injection drug users account 13% of all new HIV cases, and therefore, probably also comprise a significant proportion of those suffering from shortened HIV/AIDS survival (TSHS, 2009).

It is important to note, that not all residents in these vulnerable communities engage in unsafe health practices, but even if they are not engaging in risky behaviors they are interacting in the same environment as individuals who are. These people are also living in close proximity in densely populated areas, so the odds of encountering people involved in risky behaviors is much higher in these communities. If a resident in one of these decaying neighborhoods has HIV/AIDS, they may have a lower life expectancy from the disease because of the people they may come into contact with daily.

#### The Built Environment Impacting HIV/AIDS Survival

The physical characteristics of a neighborhood, particularly population density, may have an impact on survival of HIV infected people in a community. In urban inner-city neighborhoods there is a greater population density, and the spatial proximity of one's neighbors is much less than in suburban or rural areas. Socioeconomically disadvantaged areas are often overcrowded and characterized by sub standardized housing with poor ventilation. Groups in these areas are at a higher risk of transmission of biological organisms due to the fact that concentrated urban populations share common resources and individuals can easily affect the health of others. So it is easy to understand why the spread of contagious organisms would occur more rapidly in urban poor areas (Galea, 2005). Essentially, low socioeconomic neighborhoods may contain high concentrations of transmissible diseases and basically serve as a breeding ground for infections

like multiple-drug-resistant tuberculosis (Wallace, 1997). This is important to understanding HIV/AIDS survival rates because individuals living in these vulnerable environments will have increased exposure to opportunistic diseases. Opportunistic diseases such as tuberculosis, meningitis, bacterial pneumonia, encephalitis, and specific cancers can shorten HIV/AIDS patients' lives considerably (UNAIDS, 1998). Successful intervention against opportunistic diseases must incorporate both the effective use of medications and the necessary facilities to diagnose, monitor, and care for the patients. Appropriate drug storage, handling procedures, and administrative services also play an integral role in helping lengthen survival for individuals with HIV/AIDS (UNAIDS, 1998).

The actual physical deterioration of the built environment may also indicate a higher risk for shorter survival with HIV/AIDS. In a study conducted in 107 U.S. cities, Cohen found a relationship between boarded-up housing and rates of gonorrhea and other sexually transmitted diseases. Areas with abandoned and boarded up houses were linked to increased premature mortality from all causes. The presence of boarded-up housing, as a measure for physical deterioration, was thought to be related to mortality risk due to the negative influences on social relationships and lack of opportunities for beneficial health choices. It is, therefore, conceivable that neighborhood physical decay and low SES populations may have an increased risk of a shorter survival with a sexually transmitted disease like HIV (Cohen, 2003).

Drucker (1994) conducted a study from 1970 to 1990 that focused on the resurgence of tuberculosis in New York City in relation to the AIDS epidemic. Areas of urban poverty with a predominantly large Hispanic population and residential crowding experienced an increase in transmission and community exposure during this period. Thus, neighborhoods with these characteristics will be at an increased risk for airborne diseases. Consequently, the social or

cultural traits in the community may also increase the same area's vulnerability to specific communicable diseases. With the environmental factors allowing for quick transmission of diseases, coupled with risky behavior, people living in these at risk urban environments may be at a higher vulnerability for the transmission of opportunistic diseases that will decrease the life expectancy of HIV infected individuals.

### Health Inequalities in Urban Communities

Understanding the inequality in health status and access to health care of different individuals, groups, or even neighborhoods is essential to understanding the disparity between HIV and AIDS survival rates in Texas. Individuals with lower incomes and less educational achievement are more likely to have health needs that have not been met (van Dis, 2002). Inequality has been classified as a possible determinant of health in urban areas. In the urban realm, wealthy and poor communities and neighborhoods may be located near each other, but they experience completely different levels of prosperity. Empirical research suggests that inequality, measured by the distribution of income and other resources, may influence health status. Although, there is often greater availability of health and social services in urban areas, disparities in income prevent many urban dwellers from receiving care. An individual with low socioeconomic status may live in close proximity to a hospital but not have the economic capacity to receive treatment. Therefore, if these individuals are infected with HIV, they may not be able to afford the highly active antiretroviral therapy (HAART) treatments, and they may also not be able to afford the medications that will treat the opportunistic diseases associated with AIDS.

In addition in lower income areas, there may be a shortage of trained professionals to care for patients. The physical presence of well-equipped hospitals and clinics provide specialized doctors with lucrative practices. Consequently, this will deter many of the best physicians from working at lower paying clinics with limited resources to treat poorer urban residents. As a result, the populations most vulnerable to shortened survival from HIV/AIDS and more likely to spread opportunistic diseases are less likely to receive treatment (Galea, 2005). If interventions and preventative measures to protect from the occurrence of opportunistic diseases are neglected, significant decreases in life expectancy and quality of life among people living with HIV can occur (UNAIDS, 1998).

Lack of private health insurance for the socioeconomically disadvantaged may have a relationship with shortened HIV/AIDS survival. An estimated 50.2 million Americans lack adequate health insurance coverage, as of 2008 (Hadley, Holahan, Coughlin, and Miller, 2008). Numerous studies using a variety of data sources and analytic approaches agree that individuals lacking insurance, even if only for a period of time, have significantly higher mortality rates than the privately insured (Hadley, 2003). Another harmful outcome associated with a lack of health insurance is that uninsured adults may encounter obstacles when trying to access to preventive health services (Ayanian, 1998). Individuals with low income and poor insurance coverage are associated with less specialized procedures, fewer prescriptions, lower quality hospital care and ambulance services (Fiscella, 2004). In addition, they may be less likely to receive treatment for chronic illnesses. Uninsured adults are much more likely to record poor health statuses. Due to high clinical costs, the uninsured poor generally delay receiving medical care and may even decline essential care for serious symptoms until it is too late. The uninsured may make up a large portion of late testers for this reason. Without insurance coverage they may



wait until the more serious symptoms of AIDS appear. At that point, their cell count is very low, their health is rapidly declining, and survival may be greatly reduced.

Over the past decade, attention has been given to the relative racial and ethnic inequalities in health and access to quality care. Differences in groups' relative employment rates, type of occupation, and education levels often reveal socioeconomic differences that result in certain racial and ethnic groups lacking insurance coverage (LaVeist, 2005) In fact, one study found that, minorities make up a large portion of uninsured adults. One in four African Americans lack health insurance. Both African Americans and Hispanics have lower rates of job related coverage than whites, and have also been found to have less access to medical services (Brown, Ojeda, Wyn, Levan, 2000). Therefore, in the case of insurance and health status for African Americans and other minorities, the disparity is due to socioeconomic group characteristics and not a result of racial health differences (Ayanian, 1998).

Medicaid, a government funded health coverage system, has tried to bridge the trend of racial disparity in health insurance coverage. Medicaid provides a comprehensive benefit package for those who qualify. The severely socioeconomically disadvantaged comprise a significantly large portion of those receiving Medicaid benefits. The federal government mandates coverage of services, including inpatient hospital services, outpatient care, physician services, laboratory testing, and prescription drugs. (Weil, 2003) However, nearly half of the nonelderly adults enrolled in Medicaid are granted services due to poor health, disability, or long term major health expenditures, and not simply on the basis of welfare or income (Hadley, 2003). For this reason, Medicaid is the largest provider of medical services for people with AIDS. Over 50 percent of individuals with AIDS, and almost 90 percent of children with the virus utilize the Medicaid program's benefits (Weil, 2003). However, Guwani and Weech-

Maldonado (2004), suggest that African Americans covered by Medicaid still face barriers in access to care, even with the economic support of the program.

HAART is the recommended and prescribed treatment for HIV/AIDS. The onset of AIDS can be significantly prolonged and survival periods for both HIV and AIDS can be lengthened in individuals with the introduction of HAART (Bernell and Shinogle, 2005). The per-person HIV disease treatment survival benefits among those receiving care were associated with a median HIV/AIDS survival increase of 14.8 years through the use of antiretroviral therapy treatments. Therefore, patients who do not have access to proper medical care on average will die almost 15 years sooner from AIDS than those individuals that undergo treatment (Walensky, 2006). Not all Texans benefit equally from these advances in treatments. Urban poor Texans, comprised predominantly of African Americans, are at an economic disadvantage to accessing treatment. Guwani and Weech-Maldonado (2004), found that's even under the Medicaid umbrella, African American patients with HIV were less likely to have access to HAART than their White counterparts. Correspondingly, nationwide, HIV/AIDS is the second leading cause of death in the black population between the ages of 25 and 44 years (Jaffe, 2004). Poor inner-city neighborhoods with minority residents are at a higher risk for shorter survival from HIV/AIDS. Spatially, communities with residents without insurance or access to care will, likewise, be at risk for premature death from HIV/AIDS. The clustering effect of poverty, in turn, may link to a geographic pattern of vulnerability to shortened survival with HIV/AIDS.

### Filling the Gaps

The significance of this study is that it sheds light on the patterns of HIV/AIDS survival length in Dallas and Harris counties in Texas. Many HIV/AIDS studies focus on incidence or

prevalence. Some of the most well-known articles include the CDC's HIV/AIDS Surveillance reports. The CDC established that HIV/AIDS is higher in urban impoverished areas, both nationally and on the global scale. My work looks at this trend on a smaller scale, the actual geographical distribution of the disease within the two largest metropolitan areas in Texas. More importantly, this paper emphasizes the spatial distribution of individuals' survival with the disease. Understanding the characteristics of HIV/AIDS survival is of the utmost importance! With increased life expectancy, due to improvement in treatments and HAART, people are now living much longer with the virus. As of 2002, there has been a steady 6% increase in HIV/AIDS cases per year, not because of increasing incidence and new diagnoses, but because of increasing survival of individuals infected with the virus (Texas State Department of Health Services, 2010). Thus, finding the HIV/AIDS survival of individuals or groups living in specific areas within urban Texas gives a more accurate picture of HIV/AIDS' impact on the area. Lastly, and perhaps the greatest impact of this research will be to compare HIV/AIDS survival and socioeconomic characteristics to see if, like prevalence and SES there is a significant relationship. Survival analysis has been preformed for smaller case studies and on individuals often in the medical field. Finding HIV/AIDS survival in a particular location, and in a geographical context, is much less focused on. In particular, questions about the relationship of poverty, race, and low socioeconomic status to low health outcomes and disease are continually being studied. Less attention focuses on locations vulnerable to shortened survival which eventually may offer important information to health service providers. This work will be the first spatial analysis of HIV/AIDS survival in Texas counties. More importantly, it creates a framework on how neighborhood characteristics can be related to survival over a landscape. Hopefully, using the methodological framework from this study, improvements in HIV/AIDS

prevention and treatment strategies can be made and applied to healthcare planning in the state of Texas. Also, by emphasizing the relationship of SES status to HIV/AIDS survival, gaps in understanding about the dynamics of the full impact of the disease on the population can be filled.

## CHAPTER 3

### CASE STUDY

#### Research Questions

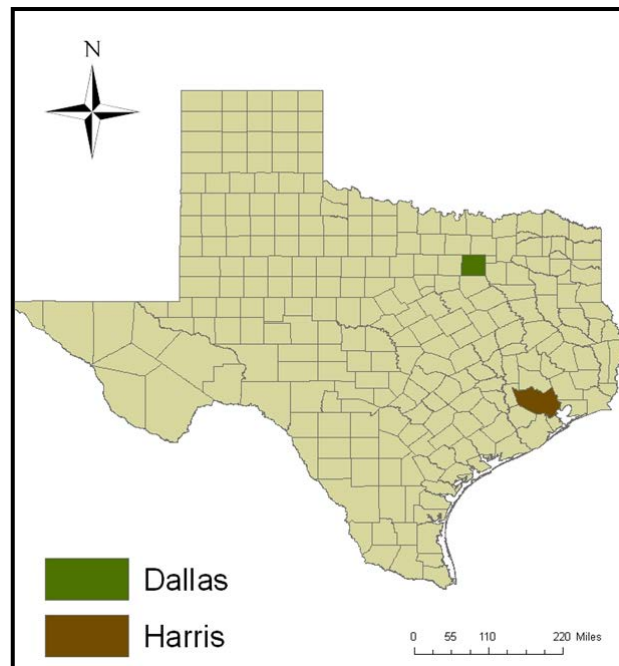
Using Oppong and Harold's place vulnerability framework, the geography of HIV/AIDS survival in Dallas and Harris counties was analyzed. Areas at risk for shortened HIV/AIDS survival were identified. In accordance with previous research, three research questions were formulated.

1. Do zip codes with low socioeconomic status (SES) experience shorter HIV and AIDS survival?
2. Do zip codes with high percentages of minorities suffer from shortened HIV and/or AIDS survival?
3. Do zip codes with high percentages of late testers suffer from shortened HIV and/or AIDS survival?

#### Study Areas

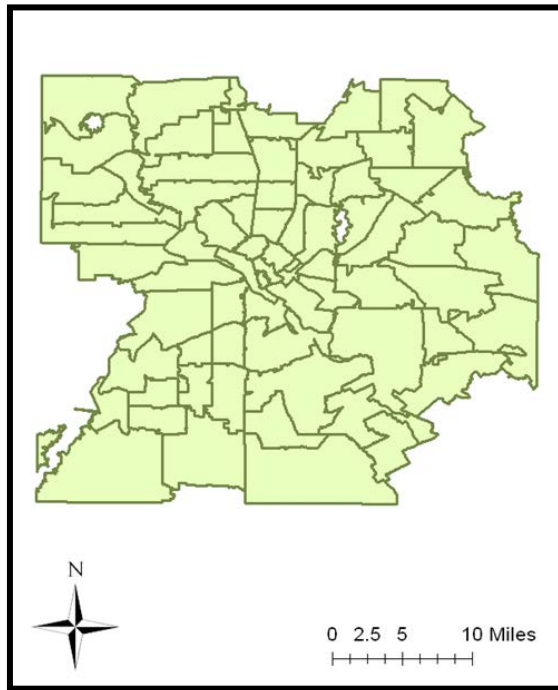
Dallas and Harris counties provided prime locations for this spatial analysis on HIV/AIDS survival. Discovering if there is a significant relationship between socioeconomic status and survival in these counties may provide a more detailed understanding of the vulnerable populations in urban centers in Texas. Both Dallas and Harris counties contain highly populated metropolitan areas with densely crowded urban cores. Within these counties, neighborhoods vary in socioeconomic status. There is a broad range of locations with prosperity and poverty in relatively close proximity to each other. In addition, Dallas and Houston, located within Harris County, have the highest HIV/AIDS prevalence rates within the state of Texas, and some of the

highest in the United States. Therefore, these study areas containing a large number of HIV/AIDS cases and differing degrees of SES may help further the understanding of the geography HIV/AIDS survival in Texas, and ultimately identify characteristics that put certain urban locations at risk for shortened survival. Figure 1 shows the location of the two selected study areas.

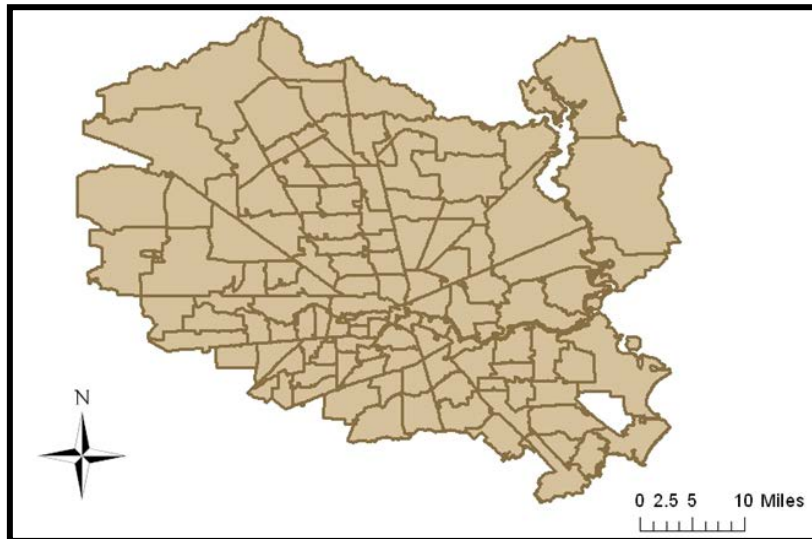


**Figure 1** *The study area of Dallas and Harris Counties, Texas.*

Only zip codes fully contained within the counties were selected for the study. There are 120 zip codes fully contained within Harris County and 72 within Dallas County. Zip code boundaries, historically, were created by the postal service, whereas county boundaries are political entities created by the state, therefore boundaries do not perfectly match. All zip codes partially contained within the counties were excluded in order to get a more accurate representation of the disease burden, survival, and socioeconomic characteristics within the county boundaries. Figures 2 and 3 show the zip codes included in the study areas.



**Figure 2** *The 72 zip codes fully contained within Dallas County.*



**Figure 3** *The 120 zip codes fully contained within Harris County.*

### Data Sources

All HIV/AIDS data for these particular counties were derived from the Texas Department of State Health Services. The data set contained a list of all HIV/AIDS cases in the state of

Texas. Cases were listed at the zip code level in order to maintain the privacy of those infected with HIV/AIDS. Cases selected for the study were all individuals diagnosed with HIV or AIDS from 1999 to 2008 within zip codes fully contained in Dallas and Harris counties. This time frame was preferable because the reporting provided the most reliable and accurate measure during that period. During this time, Dallas County contained 13,169 cases, while Harris County had an overwhelming 17,247 cases.

Socioeconomic measures used to define neighborhood characteristics, were derived from the U.S Census Bureau's 2000 Census, SF3 data set. The socioeconomic variables selected were CDC recommended variables used as indicators of poverty. Measures included those of income, education, and unemployment for all zip codes fully contained within Dallas and Harris counties.

## Methodology

### *Survival by SES Group*

Thirty-eight socioeconomic variables for zip codes within the study area were entered into a Factor Analysis through SPSS software. Variables included measures of educational attainment such as education through the 8<sup>th</sup> grade, 9<sup>th</sup> grade, 10<sup>th</sup> grade, 11<sup>th</sup> grade, and 12<sup>th</sup> grade. Also populations per zip code who obtained their associates degree, bachelor's degree, master's degree, and doctorate degree were used as measures of the degree of education. The labor force of each zip code, unemployment rate, and employment in sectors, including; sales, management, service, construction, farming, and production were input into the factor analysis to measure zip codes' employment characteristics. Median family incomes and median household incomes were SES measures selected to represent zip codes' wealth in Dallas and Harris counties.



The factor analysis, essentially, is a collection of statistical methods used to reduce the selected 38 variables into a smaller number of dimensions or factors. It discovers relationships or natural connections within the correlational data by determining meaningful clusters of shared variance. Highly correlated variables, whether positive or negative, are basically influenced by the same factors. Likewise, uncorrelated variables are influenced by different factors. Variables can then be grouped accordingly, reducing the number of factors, providing a clearer explanation, and allowing easier comparison. Three distinct socioeconomic groups were identified through the factor analysis. The SES groups included extreme low SES, moderate SES, and high SES. These 3 groups explained about 86 percent of the 38 variables' shared variance. The high SES group easily categorized zip codes with higher levels of educational achievement, high median family income, high median household income, and high employment. Zip codes within the extreme low group, on the other hand, had low levels of educational achievement, high unemployment, low family income, and low median household income. Moderate SES zip codes were clearly in the middle range between the high SES and extreme low SES groups. Table 1 shows some of the highest and most significant factor loadings of the three identified SES groups.

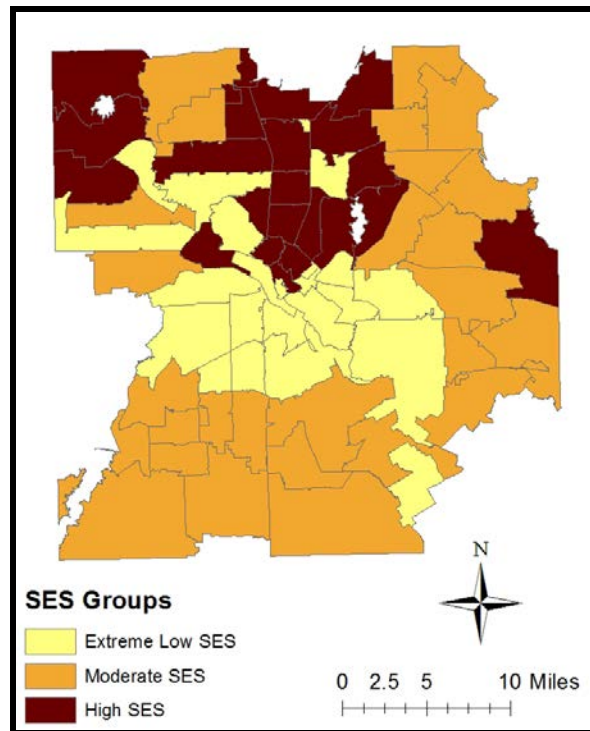
Geographically, the extreme low SES areas were zip codes in or immediately surrounding the urban core of both Houston and Dallas. The moderate SES areas were mostly zip codes surrounding the extreme low SES zip codes. Further in the periphery were areas of high SES. These are most likely, the wealthy suburbs of the counties. In Dallas, high SES areas tended to be located north, and in Harris County, the high SES zip codes were those in the southwest. These three SES groups, identified by factor analysis, were then mapped through

ArcGIS to provide further spatial explanation. Figures 4 and 5 show the distribution of the SES groups throughout Dallas and Harris counties.

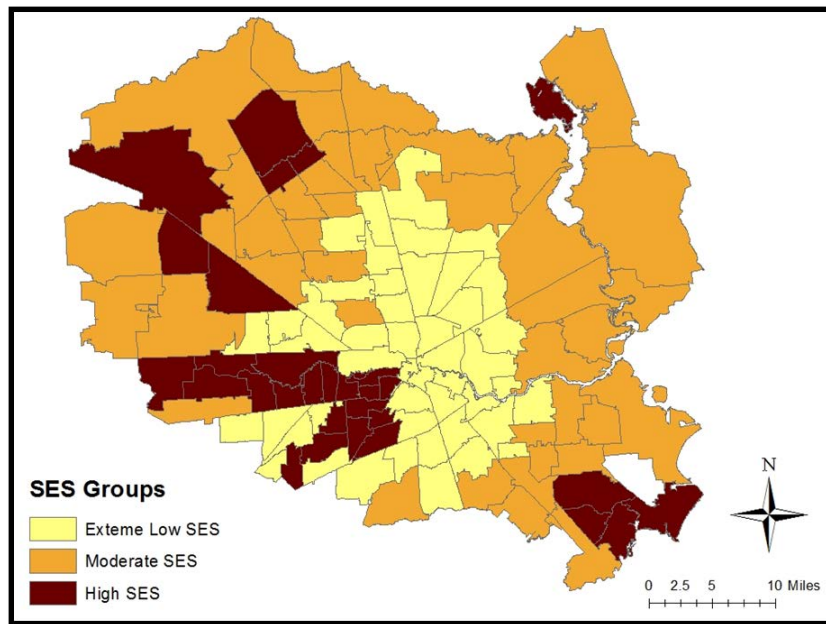
**Table 1** Highest significant factor loadings of the 38 selected variables included in the factor analysis, which identified 3 distinct groups

Variables with High Factor Loadings	Socioeconomic Groups		
	Extreme Low SES	Moderate SES	High SES
Median Family Income 10,000-14,999	<b>.934</b>	.243	.095
Median Family Income 60,000-74,999	.258	<b>.840</b>	.412
Median Family Income 150,000-199,999	-.012	.291	<b>.853</b>
Educational Achievement: Bachelor’s Degree	.114	.507	<b>.824</b>
Educational Achievement: 9th Grade	<b>.915</b>	.311	.016
Unemployed Population Over 16	<b>.809</b>	.411	.244

Note. Bold typeface indicates highest of the high.



**Figure 4** SES classifications of the Dallas County zip codes.



**Figure 5** *SES classifications of the Harris County zip codes.*

Next HIV and AIDS failure or hazard rates were determined for zip codes characterized by the three distinct SES groups identified in the factor analysis. The failure rates indicate the likelihood over time for individuals in each SES group to either develop AIDS or die from AIDS. The higher the failure rate is; the shorter the survival. To determine these rates, the survival months from the diagnosis of HIV to the onset of AIDS and the months from the diagnosis of AIDS until death for each individual living within Dallas and Harris counties' zip codes were calculated. Survival months for the individual cases within the zip code were then entered into a Kaplan Meier survival analysis through STATA, to produce the failure rates.

Kaplan Meier survival analyses were performed and Kaplan-Meier plots were generated for SES groups in Dallas County and then Harris County. The time until individuals in the study reached the defined event or clinical outcome was analyzed for zip codes within the three defined SES groups. HIV survival using the time, in months, until individuals infected with HIV were diagnosed with AIDS was calculated into failure rates per SES group for Dallas County and

then Harris County. AIDS survival using the time, in months, until individuals diagnosed with AIDS died, were calculated into failure rates per SES group for Dallas County and then Harris County. The confidence level was initially set at 95% confidence. In addition, HIV and AIDS survival plots generated through STATA were produced in order to compare the progression of the disease overtime for individuals living in Dallas and Harris counties.

To illustrate these findings, ArcGIS was used to map both HIV and AIDS survival rates for Dallas and Harris counties. Also, the socioeconomic characteristics of the zip codes, derived from the Census Bureau were mapped to see if any noticeable spatial patterns led to further explanation of HIV and AIDS survival in Dallas and Harris counties.

#### *Survival within SES Groups by Race and Ethnicity*

HIV and AIDS survival within the three SES groups by race were also analyzed. Kaplan Meier statistical analyses were ran through STATA to produce HIV and AIDS failure rates for the black, white, and Hispanic populations within the extreme low SES, moderate SES, and high SES areas in Dallas and Harris Counties. Races within the SES groups with the highest HIV and AIDS failure rates will reveal which populations within those classified SES group areas are at the highest risk for shortened survival over time.

#### *Survival and Late Testers*

The percent of late testers within zip codes in Dallas County, from 1999 to 2008, were calculated by the number of cases diagnosed with AIDS within 12 months or less of their positive HIV test divided by the total number of cases in the county. The same procedures were

followed to calculate the percent of late testers within Harris County. These were compared to the overall state percentage of late testers.

Next, late testers within each SES group in Dallas County, from 1999-2008, were calculated. The number of late testers within zip codes classified as extreme low SES, in Dallas County, was divided by the total number of cases in extreme low SES Dallas County zip codes. The percentages of late testers within the moderate SES and high SES areas have been derived in the same way. Late tester percentages in extreme low, moderate, and high SES areas of Harris County were then calculated following the same procedures as in Dallas County SES groups.

The percentages of late testers within zip codes in Dallas and Harris counties were mapped using ArcGIS software. Maps showing the HIV and AIDS survival within the extreme low SES, moderate SES, and high SES areas were then compared to those illustrating percentages of late testers. This may help to visibly show whether areas with shortened survival overlap with areas with high percentages of late testers.

## CHAPTER 4

### RESULTS

#### Survival by Socioeconomic Status (SES) Group

Surprisingly, individuals in moderate SES areas seemed to suffer the most from shortened HIV and AIDS survival times. Kaplan Meier results revealed that the moderate SES group has a higher failure rate for HIV to AIDS survival in both Dallas and Harris Counties. The failure or hazard rate is, essentially, the computed number of failures per units of time during a specific time interval, divided by the average number of cases not reaching the event at the mid-point of the interval. Basically, this means that the likelihood, over time, for cases reaching the event, classified as AIDS, is higher for those individuals living in areas characterized as moderate SES in both Dallas and Harris counties. In respect to HIV survival in Dallas County, the failure rate for the moderate SES zip codes is .0816626, while the rate for individuals living in high SES zip codes is .0667606 and extreme low SES zip codes is .0611298. The total failure rate for all of Dallas County is .06728. This reveals that the individuals living in areas of extreme low SES actually survive the longest with the HIV; in contrast moderate SES areas have the shortest survival with the disease. Individuals with HIV/AIDS living within zip codes classified in the moderate SES group also have significantly shorter HIV survival compared to survival in Dallas County as a whole (Table 2).

**Table 2** HIV survival months and failure rates in Dallas County

SES Group	Avg. Survival Months	Failure Rate	Cases
Extreme Low SES	16.35	.0611298	2436
Moderate SES	<b>12.25</b>	<b>.0816626</b>	1479
High SES	14.97	.0667606	1980
Total	14.52	.06728	5895

Harris County has a similar pattern when looking at HIV to AIDS survival. Again, individuals within the extreme low SES areas actually survive the longest with the HIV, while the moderate SES group has the shortest survival with the disease. In Harris County, the failure rate for the moderate SES group is .0933428, while the rate individuals living in high SES zip codes is .0827735 and the extreme low is .0751949. Moderate SES also has the lowest average months survived with HIV. Table 3 shows the Kaplan Meier results for HIV to AIDS survival in Harris County.

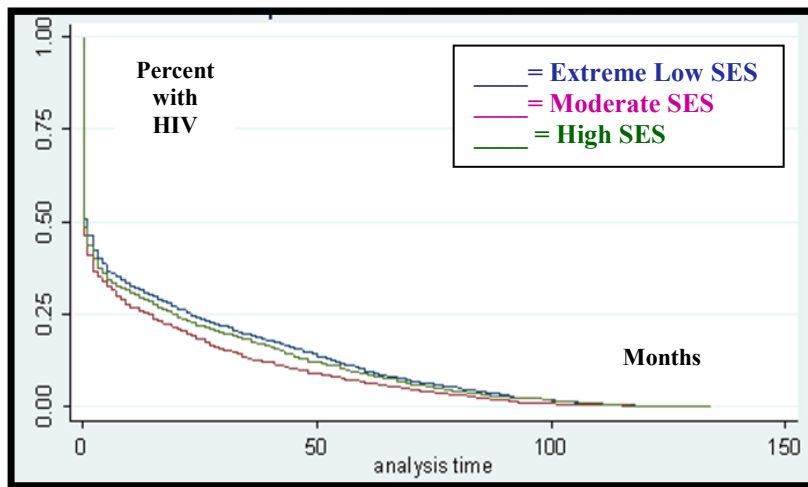
**Table 3** HIV to AIDS survival months and failure rates in Harris County

SES Group	Avg. Survival Months	Failure Rate	Cases
Extreme Low SES	13.30	.0751949	5186
Moderate SES	<b>10.7</b>	<b>.0933428</b>	1583
High SES	12.08	.0827735	1497
Total	12.03	.0794717	8266

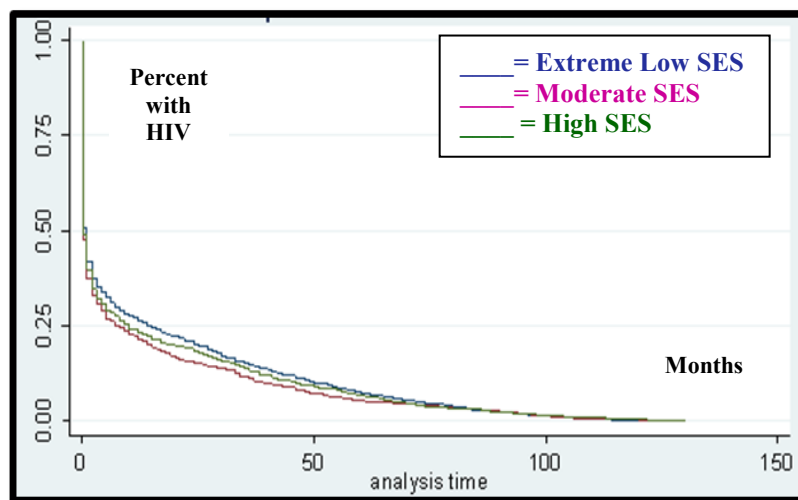
Through this HIV survival analysis, Kaplan-Meier plots were also generated. The time in months before individuals with HIV, living within areas classified by the three socioeconomic groups, were diagnosed with AIDS was plotted. Figure 6 shows Dallas County’s Kaplan Meier HIV survival plot. From the first month of HIV diagnosis until after 100 months, the percent of the population developing AIDS is the highest in areas of moderate SES. At about 15 months, 75 percent of the HIV infected individuals, living in zip codes classified as the moderate SES group, have developed AIDS. In contrast, it takes nearly 21 months for 75 percent of individuals within the high SES zip codes to receive an AIDS diagnosis, and about 22 months for individuals within areas of extreme low SES. Therefore, in Dallas County, HIV patients living in areas of moderate SES have the shortest survival with HIV.

Kaplan-Meier plots revealed similar findings for HIV to AIDS survival in Harris County.

Figure 7 shows Dallas County’s Kaplan Meier HIV survival plot. From the first month of HIV diagnosis until after 5 years, the percent of the population developing AIDS is the highest among the moderate SES group. At about 10 months, 75 percent of the HIV infected individuals living in zip codes classified as the moderate SES group, have developed AIDS. In contrast, it takes nearly 11 months for 75 percent of individuals within the high SES zip codes to receive an AIDS diagnosis, and about 15 months for individuals within areas of extreme low SES.



**Figure 6** Kaplan Meier HIV survival plot for Dallas County showing the percent of individuals within each SES groups’ progression from HIV to AIDS.



**Figure 7** Kaplan Meier HIV survival plot for Harris County showing the percent of individuals within each SES group progression from HIV to AIDS.



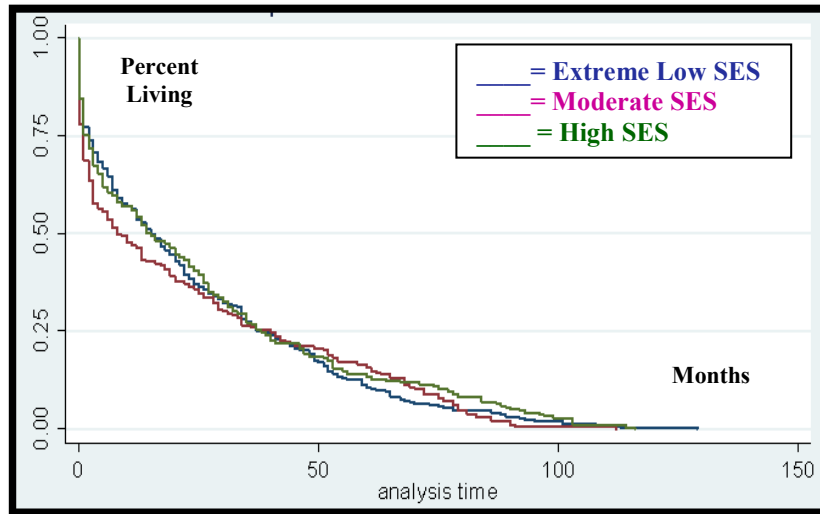
When concentrating on the time period survived with AIDS until death, individuals, in Dallas County, living in zip codes classified as moderate SES were again at a deficit. Kaplan Meier results revealed that the moderate SES group has a higher failure rate for AIDS to death in Dallas County, thus the probability, over time, for AIDS patients dying is higher in those areas. The failure rate for the moderate SES zip codes is .0436164. The failure rate for individuals living in zip codes with extreme low SES is .0412465. The high SES areas, actually, have the lowest failure rate of .0389264 and the lengthiest survival with AIDS. The total failure rate for all of Dallas County is .0411185, which is also lower than the moderate SES group's rate of reaching death. Table 4 illustrates these Kaplan Meier results.

**Table 4** AIDS to death survival months and failure rates for Dallas County

SES Group	Avg. Survival Months	Failure Rate	Cases
Extreme Low SES	24.24	.0412465	524
Middle SES	<b>20.19</b>	<b>.0436164</b>	243
High SES	25.69	.0389264	276
Total	23.37	.0411185	1043

The Kaplan-Meier plot for AIDS survival in Dallas County provides an illustration of populations' progression with the disease over time (Figure 8). The median survival, or when 50 percent of the population in each group has died, shows that, once again, the patients living within moderate SES areas have shortened survival. Around 10 months, 50 percent of the individuals with AIDS have died in zip codes classified as moderate SES. However, 50 percent of the populations in both the extreme low SES areas and high SES zip codes do not die until nearly 18 months. There is a period, after about 4 years, that individuals within extreme low SES areas do begin to lag behind in survival. Again, though, the last five percent of individuals

living in moderate SES areas do experience death before the remaining populations in the other areas.



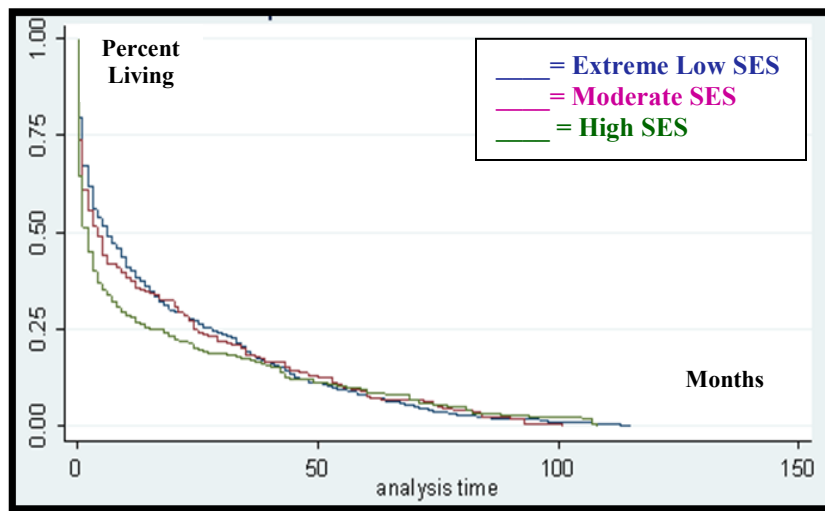
**Figure 8** Kaplan Meier AIDS survival plot for Dallas County showing the percent of individuals within each SES groups' progression from AIDS.

Harris County AIDS survival appears to be slightly different than Dallas County (Table 5). Individuals, in Harris County, living in zip codes classified as high SES have a higher failure rate for AIDS survival at .0681454. The failure rate for individuals living in zip codes of moderate SES is the second highest at .0584444. Survival time in areas of extreme low SES seems to be the highest for AIDS in Harris County. The failure rate for individuals in extreme low SES areas is .0569835.

**Table 5** AIDS Survival months and failure rates in Harris County

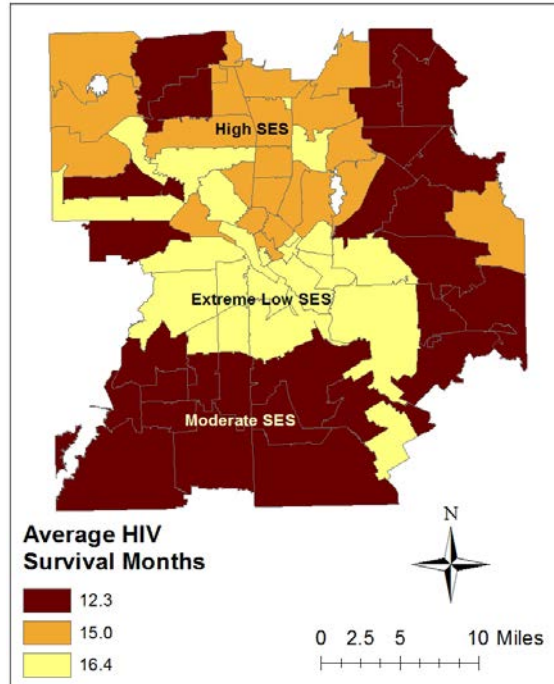
SES Group	Avg. Survival Months	Failure Rate	Cases
Extreme Low SES	17.54	.0569835	1283
Moderate SES	17.11	.0584444	321
High SES	<b>14.67</b>	<b>.0681454</b>	255
Total	16.44	.0585517	1859

AIDS survival for individuals infected with HIV/AIDS in Harris County from 1999 to 2008 was plotted to reveal shortened survival for the high SES areas (Figure 9). The median survival of infected individuals in areas of high SES was the shortest at 6 months. Fifty percent of the individuals with AIDS in areas of high SES was the shortest at 6 months. Fifty percent of the individuals with AIDS in moderate SES zip codes lived only 8 months, while it took about ten months for half of the AIDS patients in extreme low SES areas to die. Therefore, unlike AIDS survival in Dallas County, high SES areas fall victim to shortened survival. However, all individuals with AIDS in moderate SES zip codes die before 100 percent of the other SES groups' individuals reach death.

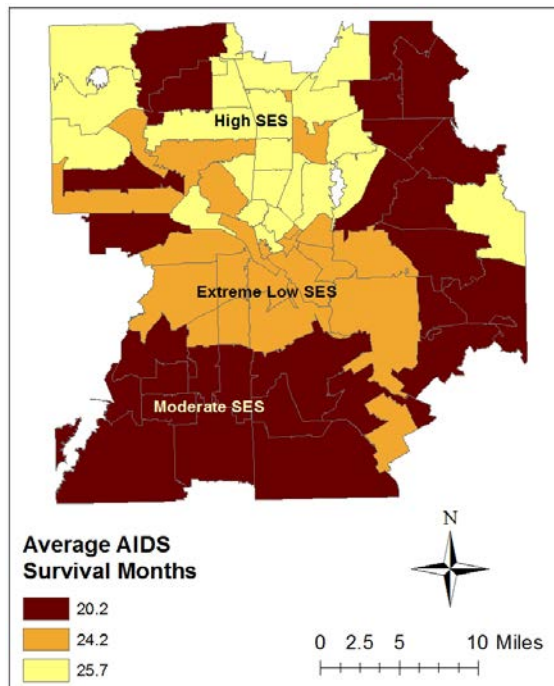


**Figure 9** Kaplan Meier AIDS survival plot for Harris County showing the percent of individuals within each SES group progression from AIDS to death in Harris County.

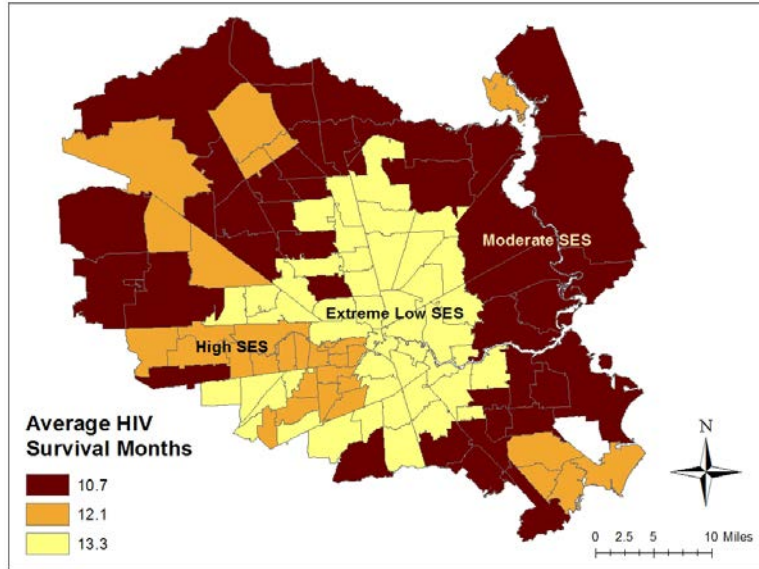
The average survival months of the three SES groups were mapped to illustrate the locations where individuals with HIV and AIDS in Dallas and Harris Counties have the shortest survival. Areas of extreme low SES are mostly located within the urban core of both Dallas and Houston. Contrary to previous thought, these urban extreme low SES regions have the highest average survival across the board (Figure 10-13)



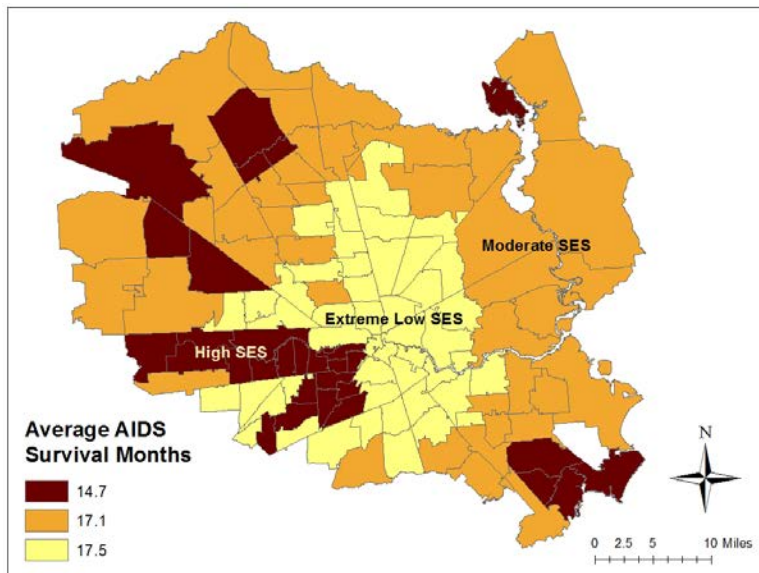
**Figure 10** Average HIV survival months for individuals living within the 3 SES regions in Dallas County.



**Figure 11** Average AIDS survival months for individuals living within the 3 SES regions in Dallas County.



**Figure 12** Average HIV survival months for individuals living within the 3 SES regions in Harris County.



**Figure 13** Average AIDS survival months for individuals living within the 3 SES regions in Harris County.

### Survival within Socioeconomic Status (SES) Groups by Race

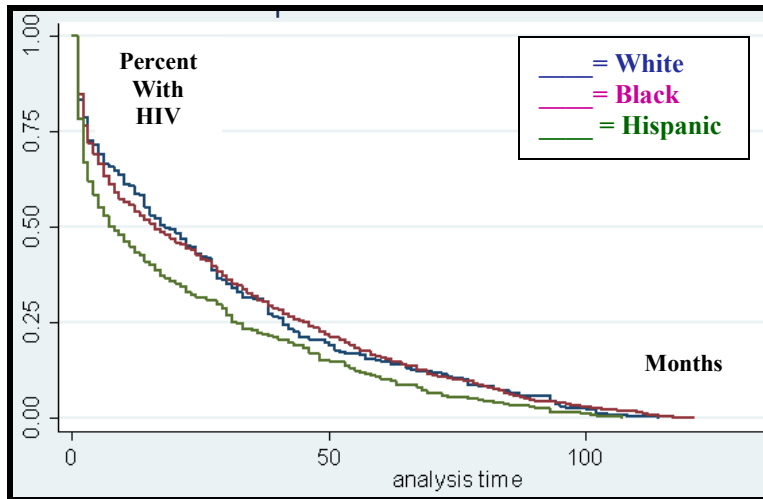
Survival with HIV and AIDS is not the same for everyone within areas characterized with similar SES. In each SES region, certain race and ethnic groups have shorter life expectancies

with the disease than others. In areas classified as extreme low SES, Hispanics suffered shortened survival in Harris County for both HIV and AIDS. They also had a higher failure rate for HIV survival in Dallas County. White individuals living in extreme low SES areas had a significantly shorter life expectancy with AIDS (Table 6).

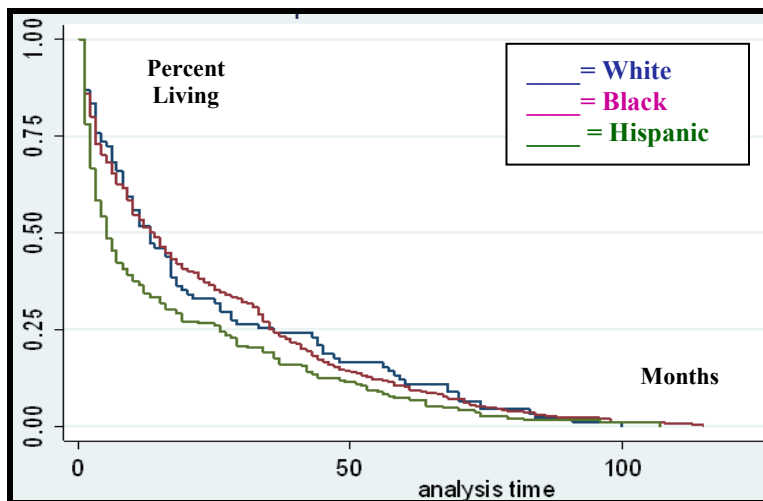
**Table 6** *Extreme low SES Group’s HIV and AIDS survival by race in Dallas and Harris Counties*

<b>Race</b>	<b>Dallas HIV Failure Rates</b>	<b>Dallas AIDS Failure Rates</b>	<b>Harris HIV Failure Rates</b>	<b>Harris AIDS Failure Rates</b>
White	.0314581	<b>.0484740</b>	.0361005	.0430871
Black	.0296976	.0344141	.0359436	.0430152
Hispanic	<b>.0371532</b>	.0301928	<b>.0478283</b>	<b>.0593692</b>

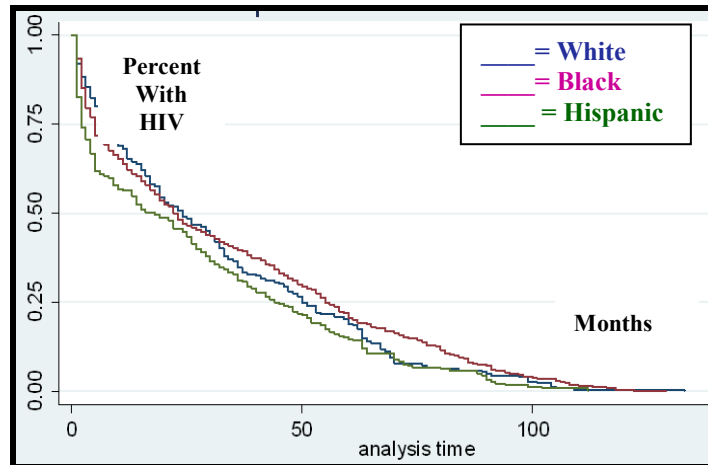
Kaplan Meier plots reveal the percent of each race group, within the extreme low SES area, that are developing AIDS or dying with AIDS. It is clear that the Hispanic populations experience shortened survival within the first months with HIV in Dallas and Harris counties, as well as AIDS in Harris County. Median survival for Hispanics with HIV living in extreme low SES Harris County is ten months, while extreme low SES Whites and Blacks median survival is about twice as long (Figures 14). Harris County extreme low SES areas’ AIDS survival in respect to race follows a similar pattern, with both African Americans and Whites median survival is over two times longer than Hispanics (Figure 15). In Dallas, the percent of the Hispanic population developing AIDS is higher consistently throughout the over eight year period represented in the Kaplan Meier plot (Figure 16). Whites with AIDS in extreme low SES Dallas zip codes are the exception to the pattern of Hispanics having the shortest survival in extreme low SES areas. Their life expectancy is significantly shorter than both Hispanics and African Americans in these areas (Figure 17).



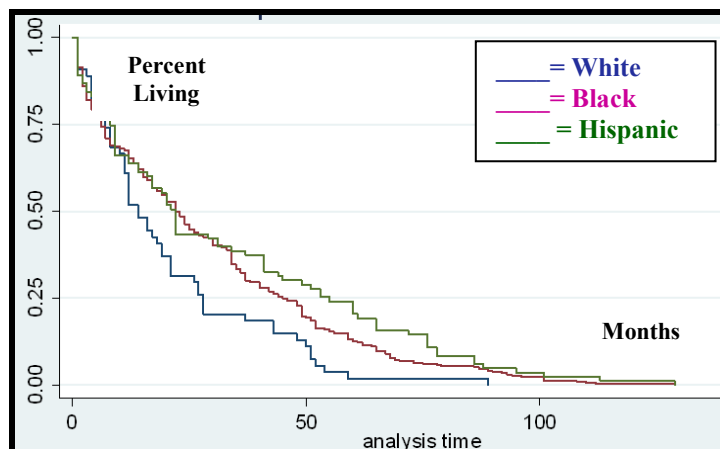
**Figure 14** *The percent of individuals' within Harris County extreme low SES areas progression from HIV to AIDS by race.*



**Figure 15** *The percent of individuals, by race, within Harris County extreme low SES dying from AIDS over time.*



**Figure 16** *The percent of individuals' within Dallas extreme low SES areas progression from HIV to AIDS by race.*



**Figure 17** *The percent of individuals, by race, within Dallas County extreme low SES dying from AIDS over time.*

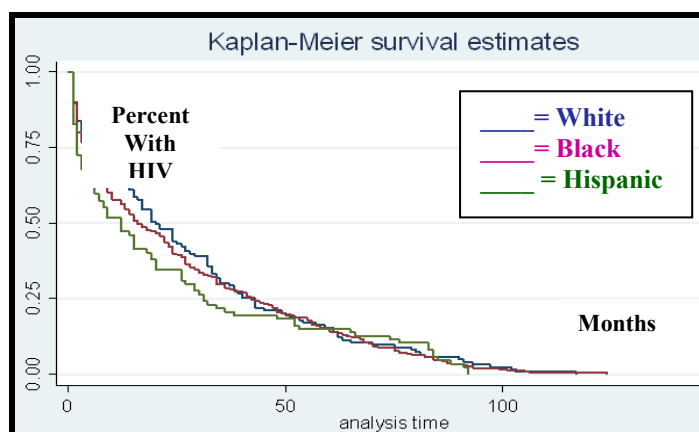
Racial disparities in survival also appeared in areas characterized by moderate SES. Again, predominantly, Hispanics had the highest failure rates and shortened survival. In Dallas County, Hispanics experienced the lowest HIV and AIDS survival times. Hispanic individuals infected with HIV, in Harris County, were the group most likely to be diagnosed with AIDS over the shortest time, while African Americans were more likely to die from AIDS quickly (Table 7).



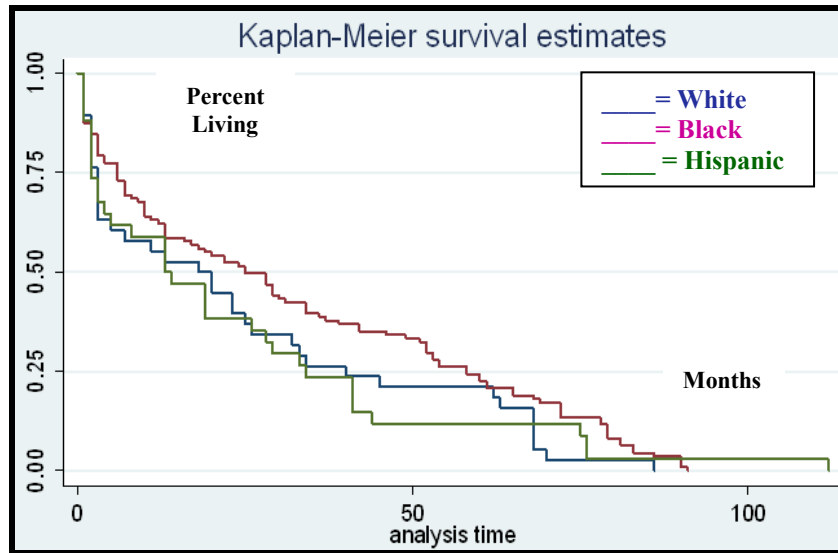
**Table 7** Moderate SES area's HIV and AIDS survival by race in Dallas and Harris Counties

Race	Dallas HIV Failure Rates	Dallas AIDS Failure Rates	Harris HIV Failure Rates	Harris AIDS Failure Rates
White	.0350527	.0397074	.0380472	.0319026
Black	.0372915	.0304110	.0450726	<b>.0493537</b>
Hispanic	<b>.0426889</b>	<b>.0423412</b>	<b>.0501222</b>	.0447192

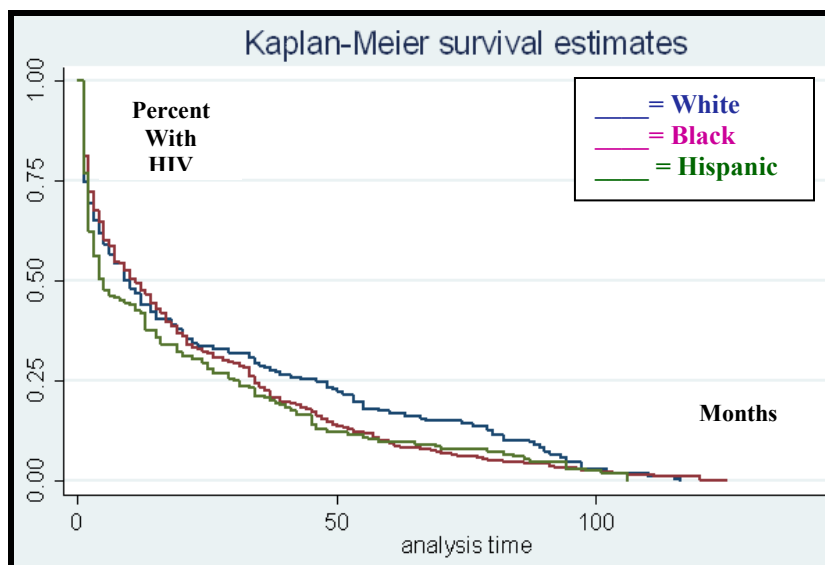
In Dallas zip codes classified as moderate SES, the Hispanic population survival has a greater reduction in the percent surviving with HIV and AIDS than the other two groups. The Kaplan Meier plots produced below in Figures 18 and 19 reveal this trend. Seventy-five percent of Hispanics in Dallas County develop AIDS after 3 years with HIV; it takes about ten more months, on average, for Whites and Blacks to receive an AIDS diagnosis. When focusing on HIV survival in moderate SES Harris County, a similar pattern can be observed. Hispanics median HIV survival is about a half year shorter than the African American and White populations (Figure 20). However, Blacks living in areas of moderate SES in Harris County, on average, have the greatest reduction in life expectancy at 22 months, much sooner than the other races (Figure 21).



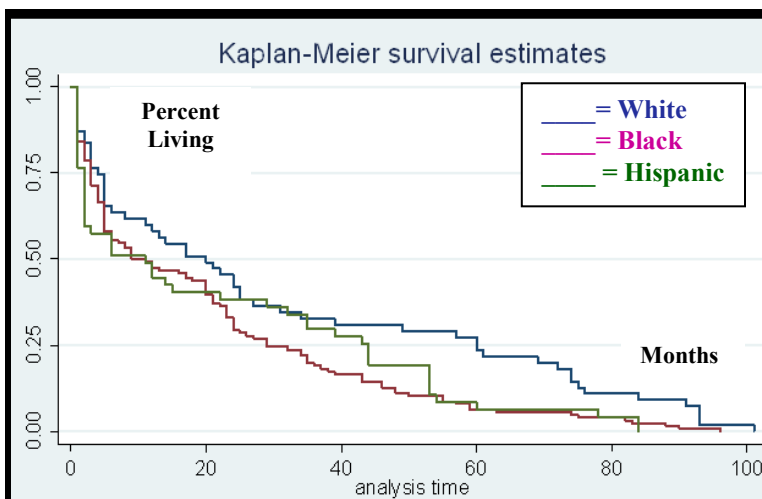
**Figure 18** The percent of individuals' within Dallas County moderate SES areas progression from HIV to AIDS by race.



**Figure 19** The percent of individuals, by race, within Dallas County moderate SES dying from AIDS over time.



**Figure 20** The percent of individuals' within Harris County moderate SES areas progression from HIV to AIDS by race.



**Figure 21** *The percent of individuals, by race, within Harris County moderate SES dying from AIDS over time.*

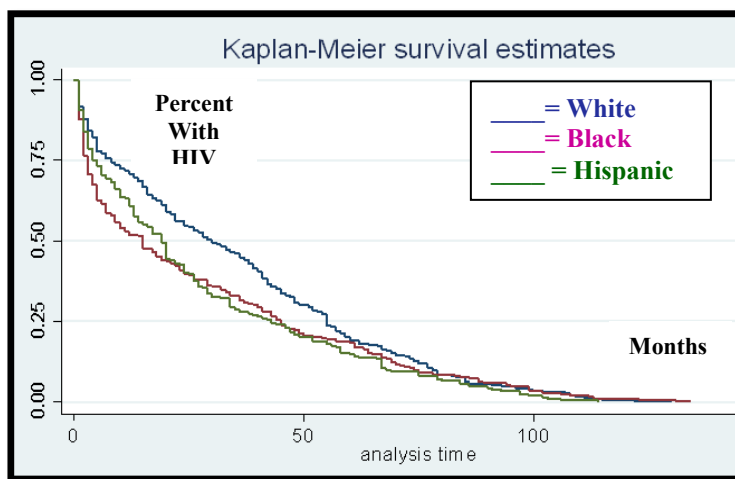
In areas classified as high SES, the Hispanic population’s HIV and AIDS survival was the shortest in Dallas County. In Harris County, Hispanics with HIV developed AIDS more quickly than the other race groups. In contrast, life expectancy for high SES whites is the shortest, however, Hispanics’ AIDS survival is not that much higher than Whites in these areas (Table 8).

**Table 8** *High SES area’s HIV and AIDS survival by race in Dallas and Harris Counties*

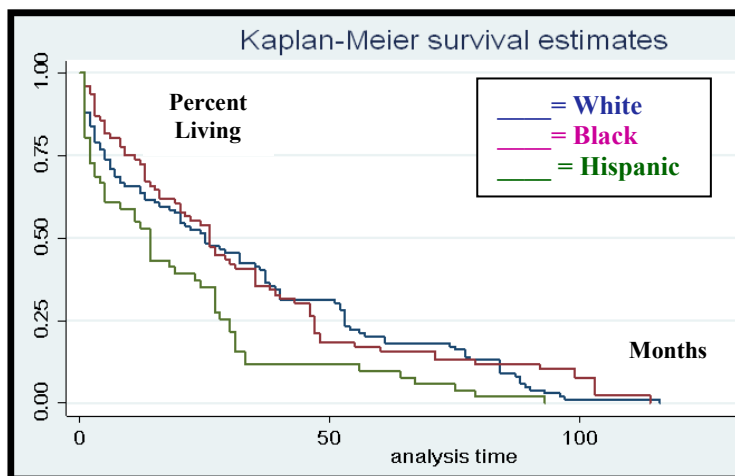
Race	Dallas HIV Failure Rates	Dallas AIDS Failure Rates	Harris HIV Failure Rates	Harris AIDS Failure Rates
White	.0281371	.0300000	.0352039	<b>.0480769</b>
Black	.0358229	.0291747	.0435109	.0413917
Hispanic	<b>.0362084</b>	<b>.0496109</b>	<b>.0465331</b>	.0460317

Kaplan Meier plots illustrate survival by race in high SES areas. The greatest drop in any high SES race groups’ life expectancy is observed in Dallas County. Only 25 percent of Hispanics are living after two and a half years. It takes nearly 18 months longer for 75 percent of the Black population to die. Even more shocking, 25 percent of Whites are still living with

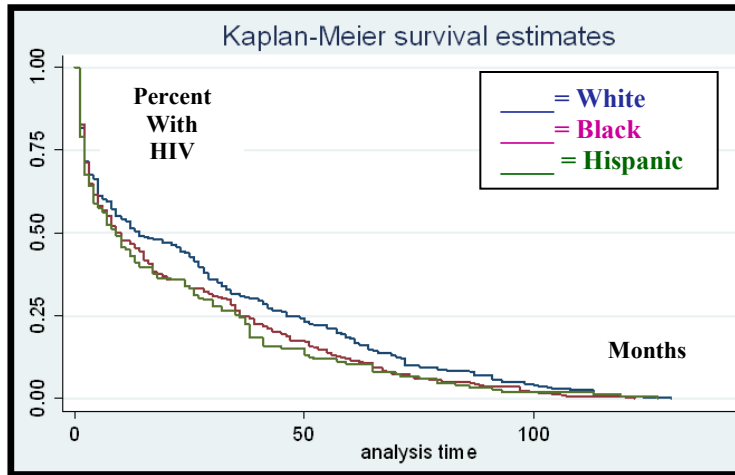
AIDS two years longer than Hispanics (Figure 23). While the differences in HIV Survival are not as great, Hispanics living in high SES zip codes in Dallas and Harris County do experience shorter survival as well (Figures 22 & 24). Conversely, Whites living in areas of high SES in Harris County are more vulnerable to shortened AIDS survival. Between 4 and 6 years living with AIDS, high SES Whites experience greater declines in survival than the other two races (Figure 25).



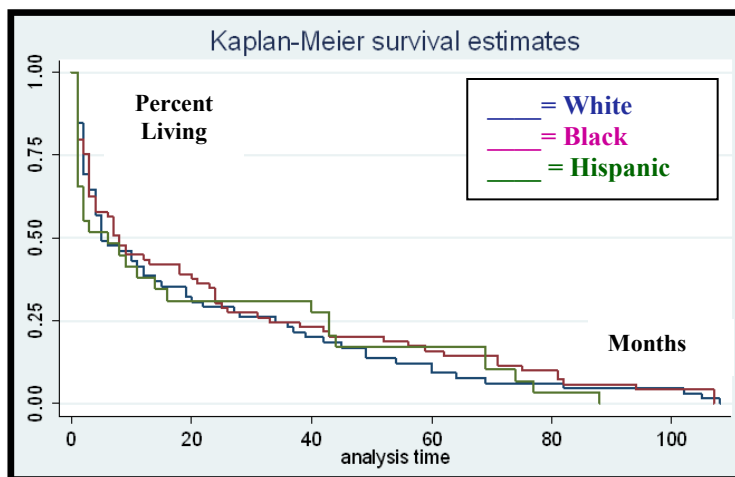
**Figure 22** *The percent of individuals' within Dallas County high SES areas progression from HIV to AIDS by race.*



**Figure 23** *The percent of individuals, by race, within Dallas County high SES dying from AIDS over time.*



**Figure 24** The percent of individuals' within Harris County high SES areas progression from HIV to AIDS by race.



**Figure 25** The percent of individuals, by race, within Harris County High SES dying from AIDS over time.

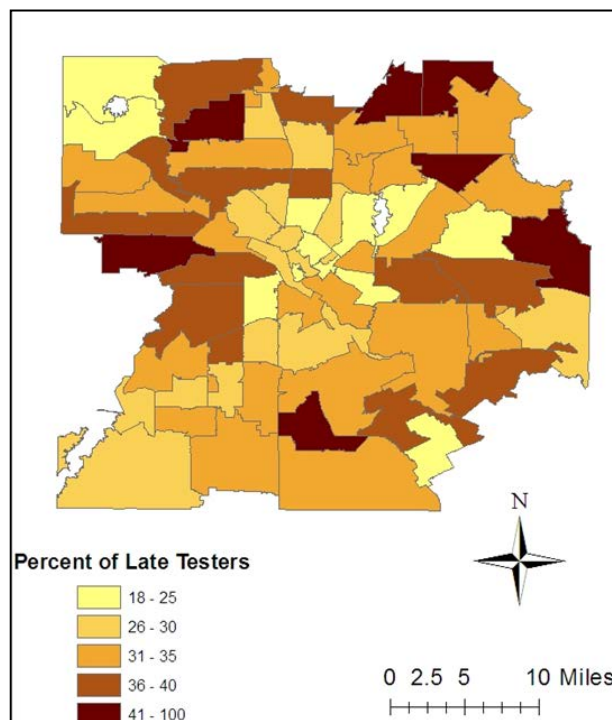
### Survival and Late Testers

One third of the individuals infected with HIV/AIDS, in Texas, were late testers. In Dallas County, from 1999 to 2008, late testing is below the state average with only 31.6 percent of patients with HIV/AIDS testing late. In the same time period, Harris County had 36% of the HIV/AIDS infected population testing late. Of the three classified SES groups in Dallas and Harris Counties, moderate SES areas were comprised of the most late testers. Meaning, of all

HIV/AIDS infected individuals within zip codes characterized by the three SES groups, the moderate SES areas had a higher percentage of those testing late (Table 9). In both Harris and Dallas Counties, the percent of late testers in areas of moderate SES are higher than the state average.

**Table 9** *The percentages of Late Testers in the 3 SES areas of Dallas and Harris Counties*

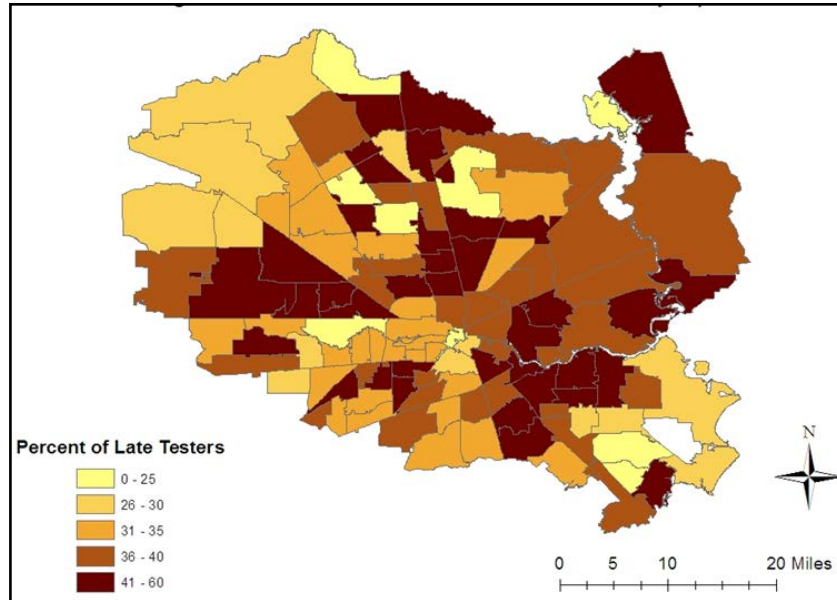
SES Groups	Dallas County	Harris County
Extreme Low SES	30%	36%
Moderate SES	<b>34%</b>	<b>38%</b>
High SES	32%	34%



**Figure 26** *Percentages of Late Testers in Dallas County zip codes.*

The spatial distribution of late testing in Dallas and Harris counties is represented in figures 26 and 27. Many of the zip codes with the highest percentages of late testers are not in the urban core, but in the periphery. When compared to the SES group maps, figures 4 and 5, a

significant number of the zip codes with the highest percentage of late testers coincide with those zip codes characterized as areas of moderate and high SES.



**Figure 27** Percentages of Late Testers in Harris County zip codes.

HIV/AIDS survival of late testers compared to those who tested positive for AIDS over one year after testing positive for HIV is drastically lower. In Dallas County, late testers on average, live approximately 25 months with HIV/AIDS while non-late testers live almost 44 months longer. In Harris County, late testers have an even shorter life expectancy on average, living only 18.1 months. Non-late testers, on the other hand, live 58.3 months on average in Harris County.

## CHAPTER 5

### DISCUSSION

Analyzing HIV and AIDS survival in the two largest urban centers in Texas, with the highest HIV/AIDS rates, can further understanding on the dynamic nature of HIV/AIDS in Texas. Important gains in knowledge were made as survival was measured on a more detailed scale. By dividing Dallas and Harris County into three distinct socioeconomic status (SES) groups, with the factor analysis method, a more intricate understanding of survival and place vulnerability could be made.

Both HIV and AIDS survival were higher in Dallas County as compared to Harris County. Though, when focusing on HIV and AIDS survival in areas of similar SES, patterns were found. Individuals living with HIV in moderate SES zip codes in Harris and Dallas Counties experienced shorter survival. Also, in Dallas, individuals within moderate SES areas died of AIDS more quickly than in regions of extreme low SES and high SES. This contrasted with previous research, which suggested that areas of poverty and urban decay consistently have poorer health outcomes. Extreme low SES areas, actually, had significantly higher HIV and AIDS survival in Dallas and Harris Counties.

These findings seem surprising, but may actually make logical sense. It could, in fact, be a case of the “haves” and “have nots.” However, the “haves” and “have nots” are simply not who we would expect them to be. Medicaid, a governmental benefit program, provides many Texans with free or reduced fee health care. One way to qualify for these benefits is to fall below the poverty line. Therefore, the very poor are, most likely, receiving government help and are able to afford Highly Active Antiretroviral Therapy (HAART) and other treatments to meet their health needs. This may help explain why areas of extreme low SES in Dallas and Harris



Counties have higher survival. Table 10 outlines the Texas poverty guidelines for Medicaid qualification (US Department of Health and Human Services, 2011).

**Table 10** 2011 US Poverty Guidelines, which outlines the financial criteria necessary to qualify for Medicaid health benefits

Persons in Family	Poverty Guideline's Annual Income
<b>1</b>	<b>\$10,890</b>
<b>2</b>	<b>\$14,710</b>
<b>3</b>	<b>\$18,530</b>
<b>4</b>	<b>\$22,350</b>
<b>5</b>	<b>\$26,170</b>
<b>6</b>	<b>\$29,990</b>
<b>7</b>	<b>\$33,810</b>
<b>8</b>	<b>\$37,630</b>
*	<b>For families with more than 8 persons, add \$3,820 for each additional person.</b>

Regular testing may be another factor in this group's extended survival. Individuals in this area may be more aware of their risk for the disease. They are likely to know or interact with individuals with HIV/AIDS because the extreme low SES areas have the highest number of cases. Also, within the extreme low SES zip codes, especially in Dallas, there are smaller percentages of Late Testers.

In high SES zip codes, individuals may have enough money to afford the best treatments and care. This can explain why, they too, have higher HIV survival in Dallas and Harris Counties than individuals living in moderate SES. Dallas County high SES zip codes, also, are comprised of individuals living the longest with AIDS. Interestingly, this group has the second highest percentages of Late Testers and experiences the largest decreases in population in the first months after HIV and AIDS diagnosis. However, their greater income allows for many

individuals in the high SES areas, to prolong their survival with their ability to purchase the best treatments.

One anomaly appears when focusing on AIDS survival in high SES areas in Harris County. Individuals in these areas, on average, actually, die about 2.5 months sooner than the moderate SES population and 3 months sooner than people in areas of extreme low SES. White individuals with AIDS in Harris County high SES zip codes are particularly at risk. In my data set, specifically, zip code 77006, the area of the Montrose district comprises 18% of all the cases in the high SES area. Nearly 78% of the HIV/AIDS cases in this area were passed by men having sex with men, or MSM, mode of transmission. The life expectancy with AIDS, in average months, for individuals in this zip code is only 13 months, compared to over 14 months in the high SES areas as a whole. Within the 77006 zip code data, there is a noticeable division between a large number of the population living much less than 24 months and the other portion living much longer than 2 years with AIDS.

A possible factor to consider when focusing on this phenomenon is that the Harris County high SES area includes a predominantly white and homosexual community called Montrose. Montrose has a relatively large dense population and a high HIV/AIDS prevalence. It is comprised of a significant number of gay bars, is located near a museum district, and is basically the cultural hub of the gay community in Harris County (City of Houston Department of Health and Human Services, 2004). People may live in this high SES area because they fit in socially, however, their income may be much lower. These individuals then are daily interacting with others vulnerable to shortened survival from opportunistic diseases. They may be aware of their AIDS status but not be able to afford continuous treatment. Additionally, these individuals may be too wealthy to receive governmental benefits. Other factors probably impact this area's

survival, but these attributes do, to some extent, help explain Harris County's high SES zip codes reduced life expectancy.

One limitation, however, is that I do not have SES data for individual cases. I am only looking at the characteristics of the zip code because I do not have each person's income, living with AIDS. Without this individualized SES data, these ideas cannot be confirmed. However, a more in-depth study on survival in this at-risk area can prove valuable in the future.

The moderate SES populations are the groups most vulnerable to shortened survival. More than likely, they are too poor to afford the costly treatments, but too wealthy for Medicaid in the initial stages with HIV/AIDS. Eventually, they may qualify for Medicaid, once they are considered disabled, but by this time their disease has progressed and they have missed valuable treatment time. Affordability and access to treatment is an obstacle moderate SES populations face. In this case, they are the actual "have nots", while the extreme low and high SES areas are composed of populations with greater accessibility. Ironically, with Medicaid removing many financial barriers to treatment, the extreme low areas seem to be included in the "haves."

Another at risk group seems to be Hispanics. Hispanics in Dallas and Harris counties have shorter HIV and AIDS survival, on average, than both Blacks and Whites. Previous research suggested that minorities, especially African Americans, experience poorer health outcomes and higher mortality overall. Even under the Medicaid umbrella, there were reports of Blacks facing barriers to healthcare. Contrastingly, in several Kaplan Meier results, Blacks had higher rates of HIV and AIDS survival than did Hispanics or Whites. This trend may be due to increased awareness and improved regular testing within African Americans' communities. Within both extreme low and moderate SES, African Americans have the highest proportion of HIV/AIDS. Thus, a significant portion of African Americans with HIV/AIDS may have low

enough incomes to qualify for Medicaid. In high SES areas, Whites have the highest percent of HIV/AIDS cases. Therefore, a large percent of Whites may have the ability to afford life extending HAART treatments.

Hispanics, on the other hand, have the lowest percentages of HIV/AIDS cases within all SES group areas in Dallas and Harris County, except in the extreme low Harris County, in which they have higher rates than Whites. The smaller percentage of cases may contribute to this groups growing number of Late Testers. Hispanics testing late will have a greater risk for shortened survival. Additionally, they may experience language barriers in accessing healthcare. Many Hispanics live in zip codes corresponding with areas characterized by moderate SES and they may make too much money to qualify for Medicaid, initially. Socially, it is common for Hispanics to have larger household size, so it is conceivable that opportunistic disease such as TB or Hepatitis could easily spread and drastically shorten the life of Hispanic individuals infected with HIV/AIDS. Lastly, to receive Medicaid benefits, one must be a U.S. citizen, in the process of naturalization, or have a valid work Visa (US Department of Health and Human Services, 2011). Some Hispanics may be living in Texas illegally, and unable to qualify for Medicaid or afford treatment. These individuals will be highly vulnerable to shortened HIV and AIDS Survival. In this instance, the “have nots” are Hispanic Texans with HIV/AIDS.

Once again, a large limitation is that I do not have SES data for individual cases. I am only looking at the characteristics of the zip code because I do not have each person’s income, living with HIV/AIDS. I also do not have citizenship data or household size off the Hispanic HIV/AIDS patients. Without these sources of individualized data, these assumptions cannot be confirmed. A focused study on Hispanic HIV/AIDS survival in Texas will be essential in

helping prevent, diagnose, and treat this disease more effectively in the future. It may also aid in extending life expectancies for these at risk individuals.

## CHAPTER 6

### CONCLUSION

The spatial distribution of HIV and AIDS survival in Dallas and Harris Counties is a complex and multifaceted subject with no one simple answer. Patterns and trends of survival over the urban landscape, however, can provide important clues to which groups are at the highest risk for shortened HIV and AIDS survival and their locations. As previous research suggested, differences in socioeconomic status (SES) do seem to play a significant role in life expectancy with HIV/AIDS. However, in Dallas County, it was individuals living within the moderate SES areas that had the shortest survival from both HIV and AIDS. Moderate SES zip codes in Harris County were also comprised of individuals surviving the shortest time with HIV. Those living with AIDS in high SES areas within Harris County died more quickly on average than individuals living in areas characterized by moderate or extreme low SES. These results contradict the previous notion that individuals with low socioeconomic status have poorer health outcomes and higher mortality.

The disparity in life expectancy with HIV and AIDS for individuals in moderate SES areas may be attributed to increased Medicaid funding for the poor. Individuals with moderate incomes may find themselves too wealthy to receive governmental healthcare benefits, but too poor to afford the best treatments. Without the continual access to Highly Active Antiretroviral Therapy (HAART), middle class individuals infected with HIV/AIDS, survival may be drastically reduced.

Even within areas characterized as similar SES, racial differences in survival exist. In accordance with previous research, in both Dallas and Harris Counties, on average, Hispanics had poorer survival with HIV and AIDS. Zip codes with high percentages of Hispanics

corresponded with SES group areas characterized with shortened survival. This may be due, in part, to several factors; barriers in accessing care, barriers in language, affordability of treatment, lack of citizenship, and large household size.

Early testing is essential for lengthening survival with HIV and AIDS. Late testers, on average, live over three years less than non-late testers in Dallas and Harris Counties. Areas of moderate SES had the greatest percentage of late testers within their SES group. Also, many zip codes with the highest percentages of late testers were found within the moderate SES and high SES areas. This may provide more insight as to why moderate SES areas seem to suffer the most from shortened survival. Studies have shown that the Hispanic male population in Texas is also more likely to test late, providing further explanation for Hispanics' decreased life expectancy with HIV/AIDS.

In the future, increased attention must be focused on populations living in areas at risk for shortened HIV and AIDS survival. Understanding which groups, living in specific areas, are at risk for decreases in survival at certain time periods after diagnosis, allows for a more detailed knowledge of what healthcare providers should offer in that area. The location of treatment centers and the allocation of resources can be improved to maximize HIV/AIDS healthcare. This more targeted approach may be able to help decrease the number of new cases throughout the state, and increase the length and quality of survival for Texans living with HIV/AIDS.

### Implications

A spatial analysis of HIV/AIDS is crucial for understanding the full impact of this dynamic and continuously increasing disease. As more and more of the Texas population contract the virus, and as technology and treatments for the virus have evolved, the disease has

almost been transformed into a chronic condition. Therefore, new strategies must address those living with the virus. Pinpointing vulnerable populations for shortened survival, in this manor, will not only strengthen the healthcare system but the health of Texas communities. Although a finer scale of measure would have been preferred, because of confidentiality, only zip code data could be used. However, classifying the SES of zip codes and finding the relative survival of each SES area allows for a more detailed look at survival, as well as improving the ability to compare different urban areas' HIV/AIDS survival.



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