EXPLORING INDIVIDUAL- AND COMMUNITY-LEVEL PREDICTORS AND MEDIATORS OF SUBOPTIMAL HIV PRIMARY CARE APPOINTMENT ADHERENCE: THE IMPORTANCE OF PLACE

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A DISSERTATION

Submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in the School of Social Work
in the Graduate School of
The University of Alabama

TUSCALOOSA, ALABAMA

2013

ABSTRACT

The advent of highly active antiretroviral therapy (HAART) for the treatment of human immunodeficiency virus (HIV) has provided prolonged viral suppression and an extended quality of life for HIV-infected persons. Research focusing on factors associated with suboptimal HIV medication adherence has been the principal antecedent to more contemporary research suggesting that absolute adherence to HIV primary care appointments is vitally important to achieve successful clinical management of the disease, as well, and missed visits have been independently associated with HIV virologic failure when other factors are controlled.

Generally speaking, research examining the role of community correlates in shaping behaviors is somewhat scant in the HIV treatment literature. Existing research suggests that HIV-infected persons may experience unique patterns of negative health outcomes, such as quality of life, access to and retention in treatment, and morbidity. It stands to reason that these patterns may be the result of certain characteristics of many communities that are conducive to poor health, in general, such as low high school graduation rates, high rates of un- and underemployment, substandard housing, and extensive poverty.

This study, conducted in two distinct phases, involves secondary data analysis of individual-level factors collected through a prospective cohort study (the 1917 Clinic Cohort) that includes HIV positive individuals who receive primary and sub-specialty medical care at the University of Alabama at Birmingham (UAB) 1917 Clinic. The second phase involves investigation of community-level data (census tract- or county-level) for each participant's

residence address at the time of initial presentation to HIV primary medical care. The mediation effect of community-level variables on the association between individual-level predictors and linkage to and retention in care outcomes was then investigated. A non-probability, convenience sample of HIV-infected adults initially presenting for HIV primary medical care at the UAB 1917 Clinic was selected from larger cohort studies, including the CFAR Network of Integrated Clinical Systems (CNICS) and Project CONNECT, a local UAB 1917 Clinic new patient orientation protocol which provides systematic linkage to HIV medical care. Study eligibility included age 19 or over, an HIV diagnosis with a Project CONNECT interview during the study period (7/01/09-6/30/11), normal cognitive functioning, ability to speak and communicate in English, and self-reported residence within the State of Alabama.

The principal exposures for this study included three measures of linkage to care (a general linkage to care measure, effective linkage to care, and efficient linkage to care) and five measures of retention in care (appointment no show, visit adherence, visit constancy, gaps in care, and the HRSA-HAB). All measures are widely used in the literature. Bivariate logistic regression was used to determine relationships between individual- and community-level independent variables and the study outcomes. To determine mediation, bivariate logistic regression and Ordinary Least Squares (OLS) regression was used to identify associations between individual- and community-level independent variables and measures of strain.

The study replicated existing findings in the literature that have established relationships between individual- and community-level independent variables and linkage to and retention in HIV primary medical care. Additionally, findings suggest that some concepts of community-level strain—specifically, aggregate community measures of age structure, crime, and family structure—may also predict principal outcomes. While a measure of composite strain was not

found to mediate the relationship between independent variables and the study outcomes, two aggregate strain measures (age structure and family structure) were found to mediate the relationship between self-reported trouble remembering and HIV transmission risk, respectively, and HIV primary medical care visit adherence.

The findings are highly relevant to social work practice, research, and policy in the HIV/AIDS linkage to and retention in care field, and they suggest a number of future directions to further investigate the role of the community—and community strain specifically—in facilitating and/or preventing optimal HIV treatment.

DEDICATION

Seven years is a very long time to work—days, nights, and weekends—on anything. This seven-year journey included its ups and downs, tears in celebration and tears in despair. The final product is a culmination of experiences that transpired directly through my work on the dissertation, but also from those experiences that continued to occur as a part of everyday life.

For all of the patience, advice, support, and love, I dedicate this dissertation to my partner, L. Bryan Hobson. If selfishness is a catalyst to seeing a personal goal to completion, it was Bryan's selflessness that allowed me to focus on this goal. Now in our 20th year together, I owe him so much more than a dedication in a dissertation. You have been my pillar, and I look forward to spending the rest of my days doing the same for you.

I also dedicate this work to my parents, B.J. and Virginia Batey. Your support gave me the confidence to succeed early in life, and it continues to be unwavering as I, now more often, need that extra push when I question my abilities. Without ever speaking the words, I learned more about social and economic justice in our household than I could ever learn in a classroom; your care and concern for your fellow man has played a pivotal role in this study and, in fact, in whom I am today. My greatest regret is the loss of my dad as I entered my fourth year of this journey; but, one of the last things he said to me was, "You must finish this dissertation. You have invested too much." As I put the finishing touches on this work, I miss my dad tremendously, and I love both you and Mom very, very much.

LIST OF ABBREVATIONS AND SYMBOLS

ACTU	AIDS Clinical Trial Unit, ACTU-4 is a measure of HIV medication adherence
AIDS	Acquired Immune Deficiency Syndrome
ART	antiretroviral therapy
ARTAS	Antiretroviral Treatment and Access Study
ARV	antiretroviral
ASI	Addiction Severity Index
ASSIST	Alcohol, Smoking, and Substance Involvement Screening Test, a measure of substance use
AUDIT-C	Alcohol Use Disorders Identification Test-Hepatitis C, a measure of alcohol use
AYP	Adequate Yearly Progress, national scale of school performance
β	standardized regression coefficient
CARE	Comprehensive AIDS Resources Emergency, also known as the Ryan White Act
CD4	cluster of differentiation 4; CD4 + T cells are white blood cells that are the cornerstone of the immune system
CDC	Centers for Disease Control and Prevention
CFAR	Center for AIDS Research

CI	confidence interval
CNICS	CFAR Network of Integrated Clinical Systems
CONNECT	Client-Oriented New Patient Navigation to Encourage Connection to Treatment, as in Project CONNECT
CTR	counseling, testing, and referral, as in CDC's standardized guidelines
DHHS	U.S. Department of Health and Human Services
EHS	education-health-services, as in types of employment
EMR	electronic medical record
EuroQOL-5D	European Quality of Life, quality of life instrument
FBI	Federal Bureau of Investigation
FPL	Federal Poverty Level
GST	general strain theory
HAART	highly active antiretroviral therapy
HIV	human immunodefiency virus
HIVSI	HIV Symptom Index, a measure of the frequency of HIV symptoms
HPTN	HIV Prevention Trials Network
HRAP-R	HIV Risk Assessment for Prevention-Revised, a measure of HIV risks
HRSA	Health Resources and Services Administration
HRSA HAB	HRSA HIV/AIDS Bureau, as in a commonly used measure of retention in HIV primary medical care
IDU (or IVDU)	intravenous drug use
IMB	Information, Motivation, and Behavior, as in Fisher's model
IRB	Institutional Review Board

KVP	kept-visit proportion, one interpretation of the visit adherence retention in HIV primary medical care measure
MEMS	Medication Event Monitoring System
MSM	men who have sex with men
MVP	missed visit proportion, one interpretation of the visit adherence retention in HIV primary medical care measure
N (or n)	number
NAIC	National Association of Insurance Commissioners
NASW	National Association of Social Workers
NHAS	National HIV/AIDS Strategy
NIAID	National Institute of Allergy and Infectious Diseases
NIC	Never in Care, as in the NIC Pilot Project
NIH	National Institutes of Health
NMAC	National Minority AIDS Council
OR	odds ratio
p	probability associated with the occurrence of the null hypothesis
PHQ	Patient Health Questionnaire
PRO (or PBM)	patient-reported outcome (or patient-based metrics)
RCT	randomized controlled trial
SD	standard deviation
SES	socio-economic status
SOC	standard of care
SSI	Social Security Income

STD	sexually transmitted disease
UA	The University of Alabama
UAB	University of Alabama at Birmingham
vL	viral load, the amount of virus copies per mL
ZIP	Zone Improvement Plan, as in ZIP codes

ACKNOWLEDGEMENTS

Thank you, L. Bryan Hobson, for your commitment over the last 20 years, for countless nights that our paths barely crossed because I was sequestered in the studio studying, researching, and writing, and for listening over and over again to the same presentations. Whether it was the early work on the study conceptualization, the dissertation proposal defense, or the dissertation defense, you were always willing to do anything necessary for me to reach this goal. Thank you for teaching me to be kind, to be patient, to sacrifice, and to love.

I thank my family for all of the support and patience shown to me during the past seven years. Even if you didn't fully understand the dissertation work itself, you were committed to helping me see this through, and you made sure that I remained committed, as well. I want to especially thank my mother, Virginia Batey, who edited this dissertation from start to finish in between wiping the blood, sweat, and tears that frequently flowed.

I am forever indebted to my Dissertation Committee. I have been incredibly fortunate to receive mentoring from such a distinguished group of academicians. This dissertation would not have been possible without you. To my Dissertation Committee Chair, Dr. David E. Pollio, I thank you for our scholarly debates, for your guidance, for your candid feedback, and, most of all, for your commitment to my academic development. You were always available with your time, your reviews, and your support, and, for that, I am most grateful. To Dr. Carol S. Drolen, I thank you for your dedication in serving on my committee. More than any other, you have been there for me from the very beginning of my journey with thoughtful input and encouragement.

To Dr. Michael J. Mugavero, I thank you for sharing your expertise on linkage to and retention in HIV primary medical care. I consider myself most fortunate to work with a national expert in this field, and I have learned so much during the past six years working with you. To Dr. Joseph E. Schumacher, I thank you for recognizing my potential 15 years ago. From you, I first learned how to be a researcher and how to be inquisitive about the world around me. You have been an excellent mentor, and I am so proud to call you my friend. And, to Dr. Brenda D. Smith, thank you for your critical feedback. I appreciate your attention to detail in each and every review, and I am grateful that you provided me with the encouragement to think of this work as more than a dissertation, but as a meaningful study with potential beyond doctoral education. As a group, I do not believe I could have convened a stronger Committee, and I am sure that I will be a better academician as a result.

I may not have made it through this process without the encouragement of Dr. James H. Willig. Purely out of the goodness of your heart, you motivated me. You insisted that I make progress, and you taught me the importance of staying focused. For unequivocal support and friendship, I am grateful to you.

I am so appreciative of the statistical support that I received from Andy Westfall. Your keen understanding of statistical analysis, coupled with your willingness to always make time to discuss data outputs and results, is unsurpassed. I could not have completed this dissertation without you.

I try to live my life with the understanding—and responsibility—that the influence I may have on people, even those with whom I only briefly come in contact, may have the power to change a life. The same is true for the impact that others have on me. Certainly, the number of

people who have influenced the completion of this dissertation, but also, often influenced my life in a much broader sense, is too many to name. However, I would like to thank a few: Dr. Pablo Arriazza, Dr. Ellen Csikai, Dr. Sophia Dziegelewski, Joan E. Esser-Stuart, Heidi Helmer, Dr. Laurel Hitchcock, Matthew Knapp, Dr. Allison Li, Dr. Shadi Martin, Dr. Jesse Milby, Dr. Linda Moneyham, Dr. Mally Moody, Dr. James L. Raper, Dr. Lesley Reid, Dr. Misty Samya, Dr. Paul Stuart, Dr. Jessica Taylor, Julie Taylor Hopkins, Dr. Amanda Willig, and Dr. Anne Zinski.

Finally, I want to make a special thanks to the patients of the University of Alabama at Birmingham (UAB) 1917 Clinic. Without their commitment to participate in the many research studies conducted at the clinic, the science on linkage to and retention in HIV primary medical care would be much more scarce. I am forever indebted to each patient for their study participation through the 1917 Clinic Cohort, as well as to the many other HIV patients who have touched my life so significantly through the years.

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CHAPTER 1

INTRODUCTION

On June 5, 1981, the first medical report in the United States on cases of pneumocystic pneumonia—eventually identified as Human Immunodeficiency Virus (HIV) and the associated condition, Acquired Immune Deficiency Syndrome (AIDS)—among residents of Los Angeles, California was distributed by the Centers for Disease Control and Prevention (CDC) (Centers for Disease Control, 1981). In the past 30 years, HIV/AIDS cases have been reported in all corners of the globe. Initially, little was known about the disease, and, although we still seek the evasive cure, tremendous steps in the treatment of the virus have been taken. The most significant of these treatment advancements is the development of highly active antiretroviral therapy (HAART) in 1995. Within two years of HAART availability, researchers discovered substantial decreases in morbidity and mortality among individuals diagnosed with HIV (Palella, et al., 1998). However, the same investigators identified that individuals whose prescriptions were covered under the Federally-funded Ryan White HIV/AIDS Program, Medicare, and Medicaid were less likely to be prescribed the life-saving antiretroviral (ARV) regimens (Palella, et al., 1998). Hence, these individuals also experienced higher mortality rates than individuals privately insured—a commentary on healthcare disparities within the HIV/AIDS field that has narrowed but has been far from erased in subsequent years. The disconnect between remarkable medical advances in the treatment of HIV and persistent struggles for disadvantaged populations affected by HIV justifies and serves as a springboard for additional research in the field.

Furthermore, it is indeed a challenge to investigate the HIV/AIDS pandemic without addressing the apparent influences of the social environment in which the HIV-infected person lives and the impact of economic hardship. HIV considerably impacts disadvantaged populations, and much of the burden of the disease is carried by the disenfranchised (CDC, 2011).

Persons living with HIV/AIDS, particularly those residing in distressed areas, are confronted daily—rather than weekly or monthly—with problems in accessibility to adequate medical care, mental health services, educational and prevention information, and substance abuse treatment (Reif, Golin, & Smith, 2005). Valuable time is spent planning, scheduling, and securing resources (e.g., transportation) to meet these needs. Additionally, lack of money or employment requires a HIV-infected person's attention and, once these are obtained, may reduce their flexibility to meet other demands, such as adhering to medication regimens, attending medical appointments, and/or seeking ancillary social services. After these considerations, good health and its demands are more often an afterthought than a necessity, and mild chronic illnesses are ignored until they become acute or lead to other complications that require a health care visit. Lack of transportation, long distances to medical clinics, long waiting times in community health provider's facilities, lack of extended operating hours, limited mental health and substance abuse treatment facilities and vacancies within those programs, perceived lack of confidentiality, low literacy and lack of education, and fear all prohibit the HIV-infected person from obtaining needed services (Cohn, et al., 2001; Cunningham, et al., 2000; Southern AIDS Coalition, Inc., 2008).

Given the tremendous psychological, social, and environmental challenges faced by the HIV-infected individual, it is surprising that more research emanating from a social-ecological,

or person-in-environment, perspective has not occurred. The recent surge of research on the importance (or un-importance) of place adds to this quandary. In their meta-analysis of over 40 studies completed between the mid-1990s and 2001, Sampson, Morenoff, and Gannon-Rowley (2002) synthesized results of contemporary "neighborhood effects" research and investigated the social processes that led to, among other things, health-related outcomes. Although much of the research on neighborhood effects, or place, focuses on the behavioral and health outcomes for children and adolescents, relatively consistent facts about neighborhoods may be generalized for the broader population and remain persistent in American society. For example, existing literature supports that socioeconomic and racial segregation contributes to considerable social inequality among neighborhoods, and, additionally, that the construct of neighborhood allows social problems to bundle together. Furthermore, not only has poverty become more concentrated during the most recent decades, but so has affluence at the upper end of the income scale (Sampson, Morenoff, & Gannon-Rowley, 2002), widening the chasm between the "haves" and the "have nots."

The final component of this perfect storm is the 2008 financial disaster and its resultant economic downturn beginning in 2009. During this period, even the health care sector has been affected by reduced spending by consumers. In the aftermath, the strain on the purse strings of America has been widespread and spanned all economic levels, but it has been especially difficult for the poor. In 2008, a survey by the National Association of Insurance Commissioners (NAIC, 2008) found that an array of health care spending is under pressure. Specifically, 22% of the 686 participants in the NAIC's survey stated that economic-related concerns resulted in them not going to the doctor as often, and 11% of respondents indicated that their purchase of

prescriptions was reduced in order to save money. In a *Wall Street Journal* article, Fuhrmans (2008) relays accounts of individuals who have delayed important laboratory tests necessary to monitor chronic conditions and those who are not able to pay for their medications because they fall within Medicare's coverage gap. For these individuals, the costs to cool and heat their homes and food prices take precedence over preventive medical attention.

The 30-year anniversary of the most devastating disease in U.S. history, contemporary interest into structural influences on health outcomes, the calamitous effects of the worst economic shifts since the Great Depression, and repeated calls for additional research into the social-ecological determinants and "neighborhood effects" on health outcomes suggest that a timely investigation of individual characteristics (e.g., age, race, and employment status) and community characteristics (e.g., local labor market viability, availability of public transportation, poverty rates, and drug availability) associated with linkage and retention in HIV primary medical care is pertinent. Specifically, research that is missing in the current literature regarding how identified community characteristics potentially mediate individual-level effects on HIV primary care appointment adherence should be explored.

Social Work Relevance

The International Federation of Social Workers (2000) defines the social work profession as one that promotes the principles of human rights and social justice and, in doing so, also promotes social change and intervenes at the points where people interact with their environments. At its theoretical and practical foundation, social work is in a unique position to address social problems through an emphasis on the potential relationship between the individual and their environment. In her seminal article in 1973, Carel Germain draws on the work of

William Gordon to suggest “an ecological perspective in casework practice” (p. 323). Germain (1973) proposes that social work’s distinction from other helping professions is its focus on the interface between the person and his or her respective environment. From an ecological perspective, therapeutic success is measured by what is good for the client, what is good for the environment, or what is good for both. Germain (1973) reiterates fundamental components of ecology, such as the tendency to maintain equilibrium and mutuality between the person and his or her environment, while suggesting that an ecological perspective also “fosters a passionate concern for human aspirations and for the development of milieus to promote them” (p. 326). Hence, the adoption of an ecological perspective in social work allows practitioners to transcend the one-dimensional observation of the individual, and, instead, to focus on the interaction between the individual, their adaptive potentialities, and their rapidly evolving physical and social environments. However, despite social work’s fondness for and ownership of a viable, person-in-environment model and its long-time participation in the care of individuals who are HIV-infected, the profession’s contribution to HIV/AIDS literature on relevant practice, research, and policy has been virtually nonexistent.

A Pub-Med search of the existing literature (dated 1984 to 2011) including either “HIV” or “AIDS” and “social work” as search terms in the journal title yields a meager 30 articles (excluding non-English articles). Of these, few demonstrate explicit social work interventions for practice, research, and policy. For example, much of the identified literature focuses on the extent of HIV/AIDS curricula in social work education (Rowan & Shears, 2011; Natale, Biswas, Urada, & Scheyett, 2010; Strug, Grube, & Beckerman, 2002; Diaz & Kelly, 1991) or HIV/AIDS knowledge among social work students (Sachdev, 2005; Owen, 1995; Silberman, 1991), or it

merely provides implications for social work practice in the HIV/AIDS field (Lichtenstein, Sturdevant, & Mujumdar, 2010; Vance, Struzick, & Childs, 2010; Newman, 2009; Vance, Struzick, & Masten, 2008; Rutledge, Siebert, & Wilke, 2008). The fact that many of these articles are authored by individuals who do not have social work training is also disconcerting. Nonetheless, a thread through the domestic social work and HIV/AIDS literature is a call to action for social workers to increase community-informed and community-engaged research on practice and policy that focuses on the significant structural barriers that contribute to the HIV burden in the United States (Wheeler, 2011; Rowan & Honeycutt, 2010; Wheeler, 2009; Wheeler, 2007).

Purpose of the Study

The purpose of this study is to increase knowledge related to how structural factors, or community-level variables present in one's environment, are associated with known individual-level predictors of suboptimal linkage and retention in HIV primary medical care. Past research in HIV appointment adherence (retention in care) has not extensively considered the role of community in an HIV-infected person's decisions to link to primary medical care or to remain engaged in that care.

This study provides valuable information on the interplay of individual and community factors in shaping HIV-related health. Emerging research suggests that prevention and treatment strategies may be enhanced by knowing more about the relationships between individuals and the neighborhoods within which they live (Bauermeister, Zimmerman, & Caldwell, 2010; Hixon, Omer, del Rio, & Frew, 2011; Ludwig, et al., 2011; McMahon, Wanke, Terrin, Skinner, & Knox, 2011; Meditz, et al., 2011). The findings from this research can be used by social workers and

other health care providers to develop effective interventions that will address the unique needs of individuals who are HIV infected and most at-risk for poorer health. In that the role of the community has been too little researched in this area, the study is both important and timely.

CHAPTER 2

RELEVANT LITERATURE REVIEW

The advent of highly active antiretroviral therapy (HAART) for the treatment of HIV has provided prolonged viral suppression and an extended quality of life for HIV-infected persons (Mannheimer, Friedland, Matts, Child, & Chesney, 2002; Garcia de Olalla, Knobel, Carmona, Guelar, Lopez-Colomes, & Cayla, 2002). Early and strict adherence to antiretroviral (ARV) therapy is imperative to achieve optimal health outcomes, extend life, and prevent disease progression (Valdez, et al., 1999; Bangsberg, et al., 2001; Chesney, 2003; Ballif, et al., 2009). The benefits of ARV are so compelling that both the International AIDS Society-USA Panel (Thompson, et al., 2010) and the U.S. Department of Health and Human Services (DHHS) Panel on Antiretroviral Guidelines for Adults and Adolescents (2011) suggest that asymptomatic HIV-infected individuals with CD4 counts of greater than 500 should begin ARV treatment early. This indicates that, in order to diminish the harmful effects of uncontrolled viremia at all CD4 levels and the emergence of resistance, ARV is necessary in an HIV-infected person's early treatment regimen. Further, early treatment with ARVs allows the provider and the patient to take advantage of more treatment options, such as improved medication potency, tolerability, durability, and simplicity, and increases the ability to suppress HIV with multidrug resistance (Conway, 2007; M. Saag, personal communication, May 18, 2011). However, the extremely stringent adherence standard (95%) for maintaining viral suppression is difficult for many patients to achieve (Chesney, 2003).

Emphasis on adherence to ARVs transcends benefits solely to the individual as early HIV treatment also has tremendous public health implications. In their intriguing research, Marks, Crepaz, and Janssen (2006) estimated the percent of new sexually-transmitted HIV infections attributed to individuals who were aware of their serostatus and those who were not. The estimations were devised based on, at least partly, the knowledge that individuals who know their HIV status will account for a smaller proportion of HIV transmission because these individuals have suppressed viral loads and safer sexual behaviors. Consequently, the researchers estimated that approximately 75% of those with known HIV accounted for 46% of new infections, and about 25% of those with unknown HIV accounted for 54% of new infections (Marks, Crepaz, & Jannsen, 2006). Additionally, in their study of 415 sero-discordant couples in Uganda, Africa, Quinn, et al. (2000), determined that the viral load is the chief predictor of the risk of heterosexual transmission of HIV and that transmission is rare among people with viral loads of less than 1500 copies. A larger study in Zambia, Africa, with 1,022 sero-discordant couples yielded similar results (Fideli, et al., 2001). These previous studies suggest that early initiation of ARVs to suppress the HIV virus may be a critical component for HIV prevention. Another finding that points directly to the relationship between suppressed viral load and reduced HIV transmission was recently released by the HIV Prevention Trials Network (HPTN) in the United States. In the study known as HPTN 052 (HPTN, 2011), researchers investigated a sample of 1,763 sero-discordant couples and randomly assigned the HIV-infected partner with a CD4 count between 350 and 500 to groups of early or delayed ARV prescription. Results from the study indicate 27 transmissions among the delayed ARV prescription group (n=882) versus one transmission among the early ARV prescription group (n=880), or a 96% reduction in HIV

transmission with use of ARVs (HPTN, 2011). Additionally, results from this study indicate some reduction in other clinical events such as tuberculosis and death for the early ARV prescription group (HPTN, 2011). Clearly, treatment of HIV not only improves health outcomes among those infected, but HIV treatment is also HIV prevention (*The Lancet*, 2011).

Suboptimal HIV Medication Adherence: Multiple Influences

Extant research conducted in the United States has identified sociodemographic, biomedical, and behavioral influences on suboptimal medication adherence. Golin, et al. (2002), sought to identify long-term predictors of HIV medication adherence to newly-initiated antiretroviral therapy (ART) among 117 HIV-infected participants in a prospective cohort study followed for at least two consecutive four-week periods. The researchers reviewed data from Medication Event Monitoring System (MEMS) caps, pill count, and self-reported adherence every four weeks to determine that 71% of prescribed doses of HIV medication were taken, and over 95% of participants failed to achieve optimal adherence (Golin, et al., 2002). Through multivariate analysis, factors identified as associated with worse medication adherence included African-American race, lower income and education, higher alcohol and drug use, and fewer adherence aids such as pillboxes or timers. Also of interest, bivariate analyses found a weak correlation ($p=0.10$) between participants' self-reported ARV access and adherence (Golin, et al., 2002). A larger study completed concurrently (Keruly, Conviser, & Moore, 2002) sought to identify medical insurance and socioeconomic factors associated with receipt of HAART (a proxy measure for HAART adherence) among 959 HIV-infected patients at the Johns Hopkins HIV Clinic in Maryland. While focusing on the challenge of absence of medical insurance or lack of adequate medical insurance, Keruly and her colleagues found through bivariate

associations that established patients (≥90 days in care) are less likely to be adherent to HAART early in their prescribed regimen if they are female, non-white, had lower education, had higher CD4 counts, were less adherent to clinic visits, or were injection drug users. Central to their study questions, the authors determined that the disparity of privately insured individuals having greater receipt of ARV in 1996 compared to individuals with public insurance and the uninsured had narrowed but still existed in analysis of 1997 patient ARV receipt data (Keruly, Conviser, & Moore, 2002). This study also found that patients living within the city of Baltimore, Maryland, were less likely than those residing in more rural Maryland counties or outside of Maryland to receive HAART. This somewhat latent finding could result from provider selection in the early years of HAART to prescribe the medication regimen only to those individuals most likely to achieve optimal medication adherence, as Keruly and her colleagues would likely suggest, or the finding could be an issue of "place" and the yet unstudied "neighborhood effects" that correlate with poorer health outcomes. Later, Mugavero, et al. (2006), confirmed greater suboptimal medication adherence to ARVs among uninsured individuals. In addition to the independent relationship between insurance status and ARV adherence, Mugavero and colleagues (2006) sought to evaluate the association between depression, abuse, and lifetime traumatic events on ARV adherence. Their study included a multi-site cohort of HIV-infected men and women in the Southeastern U.S. (N=474) who primarily resided in non-urban areas. Among this cohort, 91% reported at least one lifetime traumatic event, and the number of categories of lifetime traumatic events reported by participants was independently associated with ARV non-adherence. Lifetime traumatic events were defined as disturbances before the age of 18 years such as imprisonment of a parent and domestic violence and as an adult such as murder of a

close family member and death of a child or spouse/partner—all traumatic events which may be more frequent in families residing in strained locales. The results of bivariate analyses identified behavioral associations with ARV non-adherence, as well, including negative coping techniques and Addiction Severity Index (ASI) alcohol and drug scores (Mugavero, et al., 2006). While each of these studies contributed significantly to our knowledge about who is more likely to be non-adherent to HIV medication regimens, the research abruptly stops short of further investigation regarding why individuals may be more likely to be HIV medication non-adherent. This is a particularly perplexing exclusion in light of study results that suggest structural and environmental influences on medication-taking behaviors that transcend the individual.

Other studies have suggested the role of psychological and social factors in suboptimal HIV medication adherence. Extending the existing HIV and stigma literature, Rintamaki, Davis, Skripkauskas, Bennett, & Wolf (2006) used self-administered questionnaires and the Patient Medication Adherence Questionnaire (previously developed by the researchers) to evaluate the effects of patients' concerns about social stigma on ARV adherence. From a sample of 204 HIV-infected patients enrolled at two geographically different sites (Chicago, Illinois and Shreveport, Louisiana), the researchers determined that persons with high HIV stigma concerns are greater than three times more likely to be non-adherent to medication regimens than individuals with low concerns. Patients' concerns over revealing their HIV status—a factor closely linked to HIV stigma in previous studies—was found to be an independent predictor of missed medication doses in the past four days when controlling for sociodemographic and clinical covariates (Rintamaki, et al., 2006). Studies utilizing the same data subsequently investigated the relationship between limited health literacy and HIV medication adherence and

the potential role of HIV treatment knowledge and/or self-efficacy as mediators of the literacy-adherence relationship (Wolf, et al., 2007). Using the same patient cohort, Wolf and his colleagues (2007) used bivariate analyses to determine that patients with low literacy were more likely to be African-American, less educated, male, employed, without insurance, and from the Southern, less-urban Shreveport study site. Not surprisingly, patients with low literacy also reported more HIV medication non-adherence compared to patients with marginal or adequate literacy skills. Additionally, multivariate analyses found that patients with low literacy were over three times more likely to be ARV non-adherent, defined in this study as missing medication doses in the past four days. Perhaps most striking among their findings, Wolf and his colleagues were the first researchers to suggest that patients' self-efficacy—a construct central to Social Cognitive Theory referring to an individual's own perception of their ability to perform a task/behavior and not knowledge of the task/behavior alone—mediates the impact of low literacy on HIV medication non-adherence (Wolf, et al., 2007). Waite, Paasche-Orlow, Rintamaki, Davis, and Wolf (2007) expanded on both of the previous studies by determining that social stigma also mediates the relationship between low literacy and ARV non-adherence. As a result of their research, Waite, et al., (2008) suggests that high concern for social stigma among individuals with low literacy is a significant independent predictor of suboptimal HIV medication adherence. The authors frankly assert that improving health information to target individuals with low literacy has not been widely shown to be an effective strategy; therefore, complementing these strategies by addressing patients' understanding, including assessment of patients' self-efficacy and ability to perform necessary tasks to promote health, may be a more comprehensive approach (Waite, et al., 2008). Certainly, these studies inarguably contribute to

our knowledge regarding the association between and, to some extent, the role of, psychological and social factors and HIV medication non-adherence, and other studies have supported the results. However, the studies are limited by their relationship to a single research project that relied on a minimal sample size (N=204) with self-reported medication adherence over a relatively short period of time (within the past four days). These limitations notwithstanding, the research by Wolf and his colleagues (2007) sufficiently demonstrates the influence of social stigma and low literacy on HIV medication non-adherence and, by doing so, confirms the workings of psychological and social factors in one's motivation and/or ability to successfully adhere to the high clinical standards for HIV medication adherence.

The interplay of psychological and social factors on HIV medication adherence has likewise been suggested by qualitative methodological research. In a qualitative study of 52 active illegal drug users who were receiving primary or infectious diseases care for HIV in one of six sites in the Boston, Massachusetts area, participants identified reviews of medication compliance as a central purpose for their medical visits (Tugenberg, Ware, & Wyatt, 2006). From a grounded theory methodology, Tugenberg and her team conducted a series of interviews over a two-year period. The researchers identified themes that highlighted the patients' deep respect for their physician; however, these patients stated that this respect is often jeopardized by the indebtedness that they feel to the physician who has provided them with life-saving medications and access to social and ancillary services that often require the physician's written referral. Tugenberg, Ware, and Wyatt's (2006) research suggests that even good intentions on the part of a primary care provider can be misinterpreted as insisting on adherence perfection;

sensing inability to meet this high standard results in some patients ceasing to take their medications at all.

In his exegesis of the integral roles of biomedical, behavioral, and social sciences and HIV clinical practice, Friedland (2006) introduced a schema for HIV therapeutic success, and he acknowledged the imminent importance of a multidisciplinary approach to address HIV medication acceptance and adherence in addressing determinants of drug efficacy. Friedland's intrinsic proposition is that therapeutic success, in general, and HIV medication adherence, specifically, depends on a multidisciplinary approach that is a priori and less inductive than many of the existing behavioral and social science studies in the field. While an abundance of multidisciplinary studies has focused on factors associated with suboptimal medication adherence, there have been few which attempt to establish pathways between these sociodemographic, biomedical, behavioral, psychological, and/or social factors and HIV medication non-adherence.

HIV Primary Care Appointment Adherence

Relevance of HIV Primary Care Appointment Adherence

Research on factors associated with suboptimal HIV medication adherence has been the principal antecedent to more contemporary, domestic research suggesting that absolute adherence to HIV primary care appointments is vitally important to achieve successful clinical management of the disease as well (Lucas, Chaisson, & Moore, 1999; Valdez, et al., 1999; Mugavero, et al., 2009; Brennan, Maskew, Sanne, & Fox, 2010; Ross-Degnan, et al., 2010), and missed visits have been independently associated with HIV virologic failure when other factors are controlled (Mugavero, Lin, Willig, et al., 2007). With its 2006 revised recommendations for

HIV testing, the Centers for Disease Control and Prevention (CDC) underscored direct challenges to increased identification of individuals with HIV through expanded HIV testing by further provocating providers to link newly-diagnosed individuals to HIV medical care and, subsequently, retain them in care in order to optimize the individual's exposure to advances in HIV treatment (Branson, et al., 2006). This has been an ambitious goal as frequency of primary care evaluation can range from every three to four months for patients with low CD4 counts, high viral loads, and/or prescribed ARVs to once every six months for asymptomatic patients (Aberg, et al., 2009).

In his "blueprint for HIV treatment success," Mugavero (2008) differentiates the processes of initial *linkage* to HIV medical care and *retention* in HIV medical care. As one third of newly-diagnosed individuals fail to establish care within six months of diagnosis (Mugavero, Lin, Allison, et al., 2007), it is necessary to recognize initial linkage to care as a necessary component in HIV treatment success, but a component that can be improved. Further, estimates indicate that 17%-50% of individuals with known HIV are not engaged in care (Fleming, et al., 2002; Beer, Fagan, Valverde, & Bertolli, 2009; Gardner, et al., 2011), suggesting considerable room for improvement in efforts to retain (or "engage") individuals in care, as well. The "no show" phenomenon among a single-site cohort of more than 1,400 HIV-infected patients was characterized by Mugavero, Lin, Allison, et al., (2007) as being more prevalent among females, racial minorities, and individuals who do not have private health insurance. Mugavero's team (2007) referred to "no show" as when individuals new to clinic during the two-year study period failed to attend a primary medical care appointment within 180 days (approximately six months) of their initial scheduled appointment; hence, an individual categorized as "no show" failed to

initially link to care. Ulett, et al., (2009) extended the work by Mugavero, Lin, Allison, et al., (2007) by determining an association of older age and African American race and delayed linkage to care. However, Ulett and her colleagues (2009) also investigated factors associated with early retention in care and identified younger age, better baseline CD4, and substance use as influences on poorer treatment retention (defined as frequency of missed visits over the first two years of care). The Ulett study also proposes a conceptual framework for ensuring optimal health outcomes for HIV-infected individuals that takes into account the multiple, inherent successive steps in Mugavero's (2008) "blueprint for HIV treatment success." The authors suggest that this framework promotes additional investigation into patient-level—as well as environmental-level—factors that may shape the processes of initial linkage to HIV primary care and subsequent retention in care, including ARV receipt and adherence. As previously stated, the association between better retention in care and improved antiretroviral therapy receipt and adherence has been established (Keruly, Conviser, & Moore, 2002). Despite these important findings, contemporary research on HIV primary care appointment adherence, similar to that of suboptimal ARV adherence, has identified only associations to substandard appointment adherence and, as yet, has neglected to establish pathways through which this behavior occurs.

Multiple Associations of Suboptimal HIV Primary Care Appointment Adherence

Poor HIV primary care appointment adherence has a profound impact on the overall well-being of HIV-infected individuals. Only recently has research begun to investigate the factors associated with HIV primary care appointment adherence, and the research that is currently available identifies many of the same biomedical, behavioral, psychological, and social associations with appointment adherence that are established in the HIV medication adherence

literature. In one of the earliest studies on HIV medical care compliance that even preceded the introduction of HAART, Kissinger and her colleagues (1995) noted that, among their sample of 1,824 HIV-infected patients who had attended at least two visits at one of two HIV outpatient clinic sites in New Orleans, Louisiana, African-Americans, those with a history of intravenous drug use (IDU), and those who presented for treatment with advanced HIV disease (AIDS)—defined as care entry CD4<500 and/or care entry with a 1987 AIDS-defining opportunistic infection—were more likely to miss scheduled HIV outpatient clinic visits and to have at least one emergency room visit. Kissinger's team calculated an attendance rate for study participants that replaced the number of visits as the outcome. This method allowed the researchers to control for confounding variables such as clinical trial enrollment (which would likely inflate clinic attendance) and non-hospitalization emergency room visits (an indicator of primary care noncompliance). Their findings suggest that, despite the availability of free or low-cost HIV primary care through the Federally-funded Ryan White Comprehensive AIDS Resources Emergency (CARE) Act, improving access to HIV primary care alone is not enough to improve primary care appointment adherence. Perhaps a bit ahead of their time (at least in the HIV/AIDS field), the authors make a suggestion that echoes foundational components of social-ecological theory: "It is essential that the client be considered as a member of a whole social network and not just a sole entity" (p. 22). In a sample of 1,404 HIV-infected adult participants in the rural Southeastern United States, Napravnik and colleagues (2006) reviewed chart abstractions and electronic medical record (EMR) data at the University of North Carolina HIV Clinic and calculated clinic attendance via the number of scheduled visits per patient-year to find poorer access to HIV primary care—and, hence, more missed primary care visits—among African-

Americans, recently-diagnosed and healthier younger persons, individuals without health insurance, and individuals who resided greater distances from the clinic. However, their results also suggested that study participants (individuals residing primarily in rural areas of the Southeast U.S.) generally maintain regular contact with their HIV primary care provider once the initial link to primary care is achieved (Napravnik, et al., 2006). In a cross-sectional comparison of 1,000 established patients receiving "no care" for HIV during the past six months and patients receiving "some care" for HIV during the past six months at 10 programs across the United States, Tobias, et al., (2007) discovered that individuals who received "no care" were more likely than those with some HIV care to have lower mental health scores, to report illegal substance use, to be without health insurance, to have greater support service needs, and to report that a health belief contributed to their poorer treatment seeking. Although the study's sample was purposive in that it included individuals at the study sites who were thought to be at higher risk for suboptimal retention in HIV primary care based on their sociodemographic characteristics, Tobias and colleague's (2007) study substantiated results of previous research on individuals with suboptimal HIV primary care appointment adherence. Each of the aforementioned studies offers important insight into behavioral, psychological, and social associations with suboptimal retention in HIV primary care. However, limitations do exist. For example, both the Kissinger, et al., (1995) and the Napravnik, et al., (2006) studies draw from single geographic locations in the southeastern United States (New Orleans, Louisiana and Chapel Hill, North Carolina). While authors on both studies describe diverse study samples, the homogeneity of each population cannot be denied (similar demographics for gender, race, and age and similarity in terms of HIV-related illness status). Certainly, the contribution of Tobias and her colleagues (2007) expands

on the existing literature by providing results from a multi-site study cohort of individuals who have, at some level, accessed HIV primary care; however, similar to studies by Kissinger, et al., (1995) and Napravnik, et al., (2006), the Tobias' Targeted Outreach Intervention Initiative demonstrates social sciences' inability to accurately investigate individuals who are not currently engaged in HIV primary care or who have yet to link to HIV primary care, and, therefore, falls short of identifying why certain individuals experience the myriad of challenges that prevent them from seeking recommended routine clinical care.

Multiple Consequences of Suboptimal HIV Primary Care Appointment Adherence

Not only has research in the area of retention in HIV primary care demonstrated behavioral, psychological, and social factors associated with suboptimal appointment adherence, but noteworthy biomedical implications have been identified, as well. Giordano, et al., (2007) sought to quantify the relationship between retention in care and survival. In their retrospective study of 2,619 HIV-positive men receiving care through a U.S. Veterans Administration facility, Giordano and his collaborators (2007) operationalized "retention in care" as an outpatient primary care visit in each three-month quarter (4, 3, 2, and 1) in the 12 months following an identified index visit. Through multivariate regression analyses, it was determined that the fewer quarters of the year in which study participants were seen in primary care, the mortality hazards increased. From these findings, the researchers concluded (not unlike Kissinger in 1995) that a low financial barrier system does not prevent suboptimal appointment adherence. But, perhaps more striking, Giordano and colleagues (2007) were the first to link poor retention in HIV medical care to poor survival. In 2009, Giordano, Hartman, Gifford, Backus, and Morgan (2009)

substantiated the 2007 results by demonstrating through multivariable survival analysis that retention in care is an independent predictor of survival.

Research Gaps in the Area of HIV Primary Care Appointment Adherence

Although much of the recent research on HIV primary care appointment adherence parallels the more established research on ARV medication adherence, there are potential influences on missed visits that have yet to be explained. For example, research into predictors of ARV medication adherence has suggested that influencing factors can be categorized into four groups. These groups include medication regimen and the patient-healthcare provider relationship. Additionally, individual-level factors such as drug and alcohol use and, paralleling the past 15 years of public health research that has begun to appreciate the role of the environment, community-level factors such as system of care are noted as predictors of ARV medication adherence (Chesney, 2000). Similarly, researchers on adherence to HIV primary care have identified categories for barriers to health care as structural, financial, personal, cultural, and related comorbidities (Institute of Medicine, 1993; Tobias, Cunningham, Cunningham, & Pounds, 2007; Andersen, et al., 2000). However, relatively little research has explored the potential importance of broader, community-level factors as predictors of HIV primary care appointment adherence although such factors have often been hinted. In a 2007 study, Rumptz, et al., found a significant relationship between structural barriers (including difficulty in paying for care, inability to make an appointment because of no available convenient times, no telephone, or no one to answer appointment calls, locating care, and finding providers who speak the same language) and retention among established HIV patients not fully engaged in care. Further, the researchers identified a significant relationship between stable and

non-negative health beliefs and engagement in care. Notwithstanding the established relationship between mezzo- and macro-level factors and HIV primary care appointment adherence, sociological and behavioral sciences have missed the opportunity to identify individual- and community-level pathways to optimal health outcomes in the linkage to and retention in care field(s).

Conceptual Framework

Generally speaking, the role of community correlates in shaping behaviors has somewhat scant attention in the HIV treatment literature. However, this is less true in both the epidemiological and criminological literatures. Both disciplines have increasingly recognized the effects of community context on individual behavior, be those behaviors related to health or crime. In the epidemiology literature, research demonstrates that aggregate community characteristics (e.g., concentrated poverty, inadequate housing, and inequality) affect health outcomes above and beyond individual-level characteristics (Cagney, Browning, & Wen, 2005; Diez Roux, et al., 2001; Morenoff, 2003; Robert, 1998). Likewise, in criminology, research on community context has become "something of a cottage industry" (Sampson, Morenoff, & Gannon-Rowley, 2002, p. 444). While too little of this research has been applied to studies of health outcomes, in general (Compton, et al., 2005; Galea, Nandi, & Vlahov, 2004), and to studies of factors associated with HIV care, specifically (Ohl, et al., 2010), virtually none of it has been explored in work on linkage to and retention in HIV primary care. This is a particularly vexing omission in that researchers have acknowledged systemic issues as related to suboptimal linkage and adherence to HIV primary medical care and other HIV clinical outcomes, such as poverty (Denning & DiNenno, 2010), region of recruitment (Meditz, et al., 2011), transportation

(Wong, Sarkisian, Davis, Kinsler, & Cunningham, 2007), and distance to the clinic (Napravnik, et al., 2006). Existing research suggests that HIV-infected persons may experience unique patterns of negative health outcomes (Israelski, Gore-Felton, Power, Wood, & Knopman, 2001; Giordano, 2011; Hixson, Omer, del Rio, & Frew, 2011; Feldacker, Ennett, & Speizer, 2011). It stands to reason that these patterns may be the result of certain characteristics of many communities that are conducive to poor health, in general, such as low high school graduation rates, high rates of un- and underemployment, substandard housing, and extensive poverty.

A conceptual model that demonstrates the manner by which community context mediates individual- and community-level characteristics in shaping suboptimal linkage and adherence to HIV primary medical care is necessitated to address the aggregation of factors associated with these health outcomes. One such model draws on prominent research by Stephanie Robert and Jeffrey Morenoff in social epidemiology and Robert Agnew in criminology. The works of Robert, Morenoff, and Agnew do not address linkage and adherence to HIV primary medical care specifically; therefore, this conceptual model integrates their ideas, expands on them, and applies them to this context.

Contribution of Stephanie Robert

In her overview of the literature on socioeconomic context and health, Robert (1999) identifies two interconnected pathways by which individual- and community-level attributes affect health outcomes. Based on extant literature, she argues that ascribed characteristics, specifically age, race, and gender, influence individual socioeconomic attributes and community socioeconomic context. Socioeconomic conditions at both levels then influence health outcomes via either individual pathways or community pathways. Of specific interest is her discussion of

the manner by which community pathways influence individuals' health. She argues that community socioeconomic context (e.g., poverty, inequality), in part, determines individuals' socioeconomic status (e.g., income, educational attainment, employment prospects) as well as the community resources at their disposal (e.g., adequate social services, quality schools, safe neighborhoods), thereby affecting the more proximate individual-level causes of health outcomes.

Contribution of Jeffrey Morenoff

In his work on the spatial dynamics of low birth weight, Morenoff (2003) proposes a heuristic that adds important dimensions to the understanding of community effects on health detailed in Robert's (1999) model. Drawing heavily on contemporary social disorganization literature, Morenoff argues that, after having established community context matters, research on community effects in sociology has recently taken a "process turn" toward explaining why communities matter (2003, p. 979). Applying this process turn to an explanation of health outcomes, specifically low birth weight, Morenoff (2003) includes three important aspects of community processes not addressed by Robert (1999). First, Morenoff (2003) suggests that, to understand why communities matter, research must take into account aggregate conditions conducive to stress. These include levels of violent crime and ambient physical disorder. Second, research needs to investigate the role of informal resources that can be generated by efficacious social networks within communities. While stress-inducing community characteristics, such as concentrated poverty, can generate negative health outcomes, these effects can be offset by positive social relationships and active civic engagement among residents. Finally, Morenoff argues that community context is not the only spatial context that is

important in understanding health outcomes. Research must also take into account characteristics of the broader environment in which communities are embedded (e.g., surrounding neighborhoods and local governments).

Contribution of Robert Agnew and General Strain Theory

A final model that can add to those outlined by Robert (1999) and Morenoff (2003) is Agnew's general strain theory (GST). Although typically the purview of criminologists and not health researchers, GST may offer a stronger linkage between community processes and individual health outcomes than either Robert's (1999) or Morenoff's (2003) models. GST draws on classical strain theory, which asserts that within any culture there are certain values that are equated with shared definitions of success (Merton, 1938). Structural conditions, however, often prevent large segments of the population from achieving this shared definition of success. Limited access to culturally-defined success yields a distance between individuals' aspirations and their expectations; the stress induced by this distance is referred to as strain. In GST, Agnew (1992) expands on classical strain theory by identifying two additional mechanisms that lead to strain. While strain can simply be the result of the failure to achieve culturally-valued goals, it can also result from the loss of positive stimuli (e.g., the loss of community businesses) or the presence of aversive stimuli (e.g., high crime rates) (Agnew, 1992; Brezina, 1996).

GST has a broader application than previous variants of strain theory in that it attempts to explain both individual and community differences. Most relevant to structural-level predictors of linkage and adherence to HIV primary medical care is Agnew's (1999) extension of GST to understand aggregate differences in strain across communities. Agnew (1999) argues that typical social problems such as poverty, inequality, and neighborhood decay will contribute to

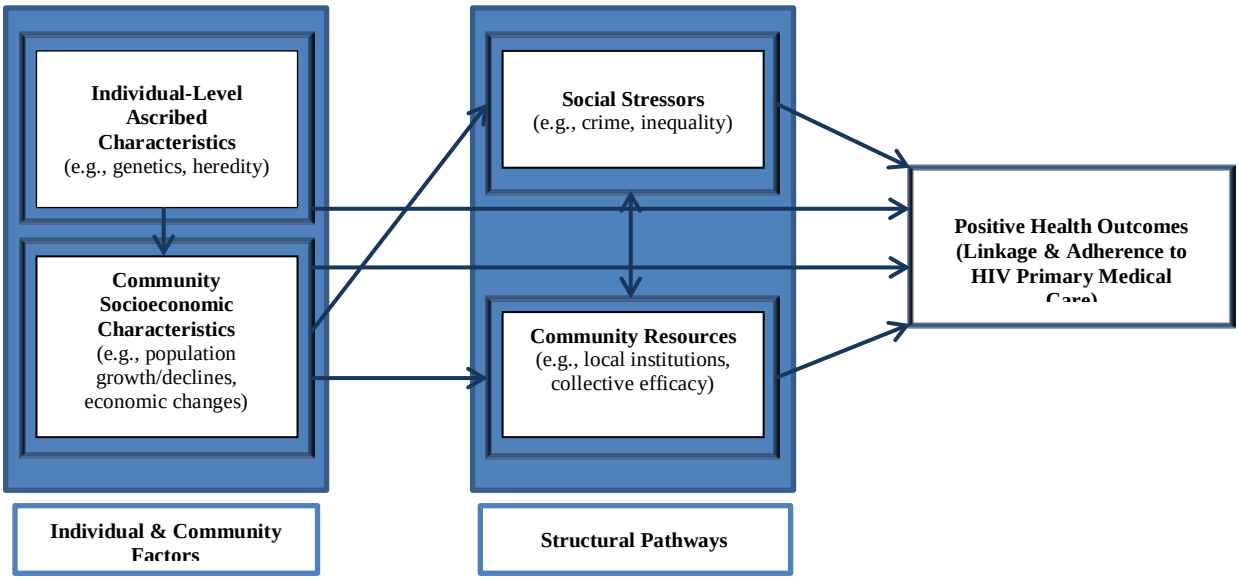
strain by increasing aggregate inability to achieve goals, by removing positive stimuli, and by magnifying the presence of negative stimuli. At the community level, the loss of positive stimuli could take the form of the loss of major industries or the out-migration of middle class residents (Agnew, 1999). The presence of aversive stimuli at the community level could be blight, concentrated poverty or high crime rates. An increase in the negative effects of each type of strain, in the presence of a negative community context, will yield higher aggregate rates of negative behaviors. Hence, GST provides a clear, sociological understanding of how community conditions operate to influence individual behaviors, especially those related to health.

Resultant Theoretical Framework

The foundation of this study is a conceptual framework that integrates the models of Robert (1999), Morenoff (2003), and Agnew (1999) discussed above and adapts those models to explain linkage and adherence to HIV primary medical care (see Figure 1).

Figure 1

Conceptual Model of Community Pathways to HIV-Related Health Outcomes



The starting point for this model is the biological and psychological characteristics of individuals that are either innate or developed early in life. While the biological and psychological characteristics of individuals influence health outcomes—specifically, linkage and adherence to HIV primary medical care—more often their effects are mediated by individual-level socioeconomic characteristics and community-level characteristics, be they stressors or resources (Robert, 1998; Robert & House, 1994). As an example of how this model operates to explain health, take the case of living in a neighborhood of concentrated poverty. Numerous studies indicate that living in such a neighborhood tends to have negative effects on health, including incidence of coronary heart disease (Diez-Roux, et al., 2001), drug use mortality (Hannon & Cuddy, 2006) and cancer- and cardiovascular disease-related mortality (Major, et al., 2010). Clearly, the primary individual-level determinant of living in a high poverty neighborhood is one's own poverty status, an individual-level socioeconomic characteristic. However, biological and psychological characteristics of the individual influence his/her poverty status. In turn, both types of individual-level characteristics will influence health directly. However, individual poverty status also affects health through the stressors and resources that a community of concentrated poverty provides, or fails to provide. Community stressors may increase the strain caused by living in concentrated poverty (e.g., a high poverty neighborhood with little crime will be less strain-inducing than a high poverty neighborhood with a high rate of crime). Conversely, the effects of living in a neighborhood with concentrated poverty will create less strain in the presence of community resources (e.g., a high poverty neighborhood that exhibits collective efficacy, or a large degree of neighborhood cohesion, will be less strain-inducing than an isolated, anomic, high-poverty neighborhood). Hence, one's individual

characteristics have many pathways by which to influence health. It is this focus on the many pathways to optimal health outcomes—both individual- and community-level—that separates the conceptual framework from alternative explanations, including the behavioral model of health-care utilization, barriers to care, systems theory, and social disorganization theory.

Alternate Explanations

Behavioural Model of Health-Care Utilization. A model of health services' utilization first purported by Andersen in 1968 has been used with some success by social work researchers (Oser, et al., 2011; Leukefeld, et al., 1998; Padgett, Patrick, Burns, & Schlesinger, 1994). While the model may be an appropriate framework to explain some associations including very recent applications to HIV primary care appointment adherence (Anthony, et al., 2007), there are some concerns about the model's inclusion in this study. The health services' utilization model has been revised numerous times (Andersen, 1995). Each time, the model has become more socio-ecological, but, in its most current revision, the model still lacks emphasis on many of the environmental factors that the Robert/Morenoff/Agnew conceptual framework considers important, e.g., stigma, self-efficacy, shared definitions of success, and resultant "strain" when these factors are not achieved. Additionally, even Andersen admits that the model has been criticized "for not paying enough attention to social networks, social interactions, and culture" (Andersen, 1995, p. 2). Finally, the model fails to acknowledge how individuals are nested in their neighborhoods/communities. Andersen, instead, sees individual-level and structural-level contributions as independent, and this may be a significant fallacy of the model.

Barriers to Care. This study's conceptual framework transcends the "barriers to care" literature. In short, barriers to care research is often limited to healthcare accessibility. In their

recent article on contemporary barriers to care, Berry-Millett, Bandara, and Bodenheimer (2007) identify the shortage of primary care physicians as the primary challenge for attaining adequate healthcare access. Further, the authors highlight panel size (the number of patients that a primary care physician sees), capacity (the number of hours per week that a physician sees patients), distance, Medicaid/Medicare issues, after-hours care, scheduling, virtual visits, and trouble with the care team as sub-challenges to address in improving access to care. Other reports relate barriers to care to healthcare accessibility, as well (Institute of Medicine, 1993). While this study's conceptual framework addresses barriers, or access, to healthcare in the context of community-level factors predicting suboptimal linkage and adherence to HIV primary medical care, it additionally attempts to explain pathways to a specified behavior and provides a more comprehensive explanation for suboptimal linkage and retention in care than access to care alone.

Systems Theory. The use of systems theory has been prevalent in social science research since it was formalized by von Bertalanffy in 1972. The field of social work has been especially welcoming to the theory because it supports the fundamental social work concept of *person-in-environment*. Contemporary systems theory originated from the biological sciences' general systems theory that promulgated the human body as composed of multiple systems working together, each having a unique influence on the other (Payne, 2005). In social sciences, the theory is applied to such systems as the individual, its social support system, the entities with which the individual routinely interacts (e.g., church, work, or school), and the broader society such as the local government, community, health care system, and health care policy. However, the strength of systems theory has been its application to the "wholes," or the mezzo- and macro-

level systems, instead of the individual (Hanson, 1995). Herein lay the central distinction between the study's conceptual framework and systems theory. Additionally, the way that various systems exist and interact with one another through a systems theory framework (e.g., the characteristic constructs of entropy, homeostasis, and equilibrium, for example) does not contribute additionally to the current conceptual framework.

Social Disorganization. The earliest version of social disorganization theory held that neighborhoods are comprised of interrelated networks of individuals, organizations, and institutions (Kasarda & Janowitz, 1974), and these networks control crime by (1) instilling a shared sense of cultural values among residents and (2) sanctioning those who deviate from those values (Krohn, 1986). Social disorganization is simply the inability of a neighborhood to fulfill either of these two functions (Sampson, 2002). This foundational version of social disorganization theory proposed that, together, concentrated disadvantage and social disorganization determine differences in crime rates. Shaw and McKay's (1942) version of the theory allowed for little variation in the relationship between concentrated disadvantage and social disorganization, however. For the most part, the theory took a deficits-based approach (Almgren, 2005). If a neighborhood exhibited concentrated disadvantage, it would also exhibit social disorganization. In this manner, social disorganization theory fails to inform the current conceptual framework in terms of individual-level influences on health outcomes. Additionally, social disorganization theory's emphasis on social deficits counteracts the Robert/Morenoff/Agnew conceptual framework's account of individual- and community-level protective factors especially through the contribution of GST.

Significance

Research on the individual- and structural-level pathways to optimal linkage to and retention in HIV primary medical care may be significant and innovative in three ways. First, it examines community-level influences on linkage and adherence to HIV primary medical care. Despite calls for increased research on the community correlates of health, too little research has done this. Second, it draws on community research in the areas of health and crime, specifically the work of Robert (1999), Morenoff (2003), and Agnew (1999), to develop a conceptual model to understand HIV-related health outcomes such as linkage and adherence to HIV primary medical care. This is a particularly salient innovation in HIV research that has recently suggested the importance of multidisciplinary approaches to prevention and treatment (Friedland, 2006). Current research fails to outline a strong conceptual framework to explain linkage to and retention in care; even the most recent research tends to be descriptive in nature (Kissinger, et al., 1995; Napravnik, et al., 2006; Tobias, et al., 2007; Mugavero, et al., 2007; Ulett, et al., 2009). Finally, the proposed setting for this type of study will be a large, urban, university-based HIV clinic serving a predominantly rural state that encompasses communities that differ in the degree to which they are classified, from large urban areas and rural areas that are part of Census-defined metropolitan areas to small, isolated rural areas (U.S. Department of Agriculture, 2004). Hence, unlike previous research on the importance of place and health, this type of investigation would capture the heterogeneity of urban and rural places.

As a growing body of research on linkage and adherence to HIV primary medical care emerges, scientists are beginning to look beyond the identification of associated factors on engagement in care to the implications for future research, empirically-validated practice

interventions and public health policy. Social work researchers, practitioners, and policy experts are uniquely situated to impact the nation's response to HIV/AIDS as we move into the fourth decade of the epidemic. However, in order to significantly affect the prevention of HIV transmission and the treatment of individuals living with HIV and their caregivers, social work must define its role in this specialized field.

Social Work Contributions

Social work and research. HIV research emanating from the social work discipline is exiguous at best, and social work-driven research on linkage and adherence to HIV primary medical care is virtually non-existent. The lack of social work and HIV research, in general, is especially difficult to explain given the emphasis on a continuum of care for the HIV-infected (Poindexter, 1996; Mugavero, 2007; Gardner, McLees, Steiner, del Rio, & Burman, 2011) and the significant service provided by social workers to HIV-infected individuals, their families, and medical and ancillary care professionals. Through the late-2000s—more than 25 years since the first documented cases of HIV—social work's contribution to the scientific literature on HIV/AIDS care was limited to colloquy in mostly social work journals considering the roles of the social worker in HIV/AIDS care. In response to the question "what can social workers do" to affect the increasingly important international and domestic HIV policies, some researchers have frankly noted "in a nutshell—a lot more" (Hall, 2008). In 1996, Beckerman and Rock published results from their qualitative study on challenges and rewards faced by social workers in hospital settings who work with the HIV-infected. Admitting the lack of research regarding stress among HIV social workers, Beckerman and Rock (1996) distributed a three-item, written open-ended questionnaire which they developed to ascertain major practice issues as identified by 20 front-

line HIV social workers in four urban, inpatient hospitals. Not surprisingly, "death and dying" was the most frequently reported challenge among participants; but the theme of "systems," or negotiating a complex array of social and supportive services in a system that is often uncooperative when dealing with individuals diagnosed with HIV, was also stated by over one-third of the participants (Beckerman & Rock, 1996). Still, the qualified scope and exploratory nature of their study was a considerable limitation. Strug, Grube, and Beckerman (2002) underscored new challenges presented to social workers in HIV care resulting from a dearth of medical (and social) interventions and the spread of the disease beyond men who have sex with men (MSM) to intravenous drug users (IVDUs), women, youth, and persons of color. These social work academicians predicted that social work's role in the fight against HIV would evolve to the fundamental provision of primary prevention for high risk individuals who are sero-negative or who are unaware of their HIV status and of secondary prevention for individuals who have already contracted the virus. The potential role for social workers in the linkage of HIV-infected individuals into primary medical care was identified as paramount since successes in treatment would likely continue to reduce mortality (Strug, Grube, & Beckerman, 2002). The changing roles of social workers in the HIV field resulting from medical advances would necessitate the inclusion of both theory and practice skills in the discipline's education and training programs (Strug, Grube, & Beckerman, 2002). Surprisingly, five years later, Wheeler (2007) and the social work field still questioned the direction of the profession in its work with HIV/AIDS. In his article, Wheeler (2007) boldly takes a step beyond the suggestion that social workers' roles in HIV will be primarily prevention-related. He calls on social workers to develop empirically-based prevention interventions, through rigorous research methods, rather

than to merely be consumers and facilitators of manualized interventions. Additionally, Wheeler (2007) makes a compelling argument that social workers should utilize their inimitable perspective and skills to resolve structural inequalities in the HIV-related health and human services systems. In fact, social work would be "naïve" should it continue to rely on simplified behavioral interventions to address multifarious socio-ecological issues (Wheeler, 2007, p. 157).

While social work struggled to find its identity in the HIV/AIDS field, a noteworthy development in social work research—not unlike Wheeler's (2007) suggestion—was simultaneously taking place. As with sociology, medicine, and other professions, the influence of the community in social work research was being addressed. For example, Coulton (2005) advanced the community as a fundamental aspect of social work practice, and she suggested that it was this inherent relationship that distinguishes social work from other professions. However, research on communities is fraught with challenges such as defining community boundaries, specifying community interventions, developing community measures, applying multilevel statistical models, establishing the counterfactual (e.g., causal inference), and assessing spatial and geographical processes (Coulton, 2005). Based on recent conceptual and methodological developments such as matching and time-series designs and multilevel statistical analyses and spatial statistics, Coulton (2005) encourages social workers to improve the rigor of community research. Perhaps it is this paradigm shift that also influenced Wheeler (2007), Hall (2008), and other social work researchers to look introspectively at the deficits of social work research, in general, and to begin vigorously investigating "the community as agent, target, and context for social work practice" (Coulton, 2005, p. 73).

More recently, social work research on HIV has become more sophisticated. Contemporary research has progressed from discussing social work roles in HIV care and implications for social work practice to important scientific contributions in the areas of HIV prevention interventions targeting unique populations, socio-behavioral predictors of HIV medication adherence, predictors of death, socio-cultural needs of individuals seeking HIV testing, and complexities that influence engagement in and utilization of HIV treatment.

As predicted by Beckerman & Rock (2002) and Wheeler (2007), some social work researchers have made significant contributions to the science of HIV. In an effort to investigate influences on behaviors linked to chronic diseases among African-Americans in HIV sero-discordant couples, El-Bassel, et al., (2011) randomly assigned 1,070 participants to one of two interventions, each consisting of eight, weekly, structured two-hour sessions: 1) An individual-focused health promotion or 2) a couple-focused HIV/STD risk reduction. Results from this study, the first randomized controlled trial (RCT) to assess a health promotion intervention with the targeted population, confirmed previous research that indicates low rates of preventive behaviors for chronic conditions (cardiovascular disease, diabetes, breast cancer, and prostate cancer to name a few) among African-American individuals in HIV sero-discordant couples. El-Bassel and her colleagues (2011) found that a theory-based (Social Cognitive Theory) intervention that teaches skills results in positive changes on multiple behaviors linked to chronic diseases in the population. Specifically, individuals randomized to the health promotion intervention were more likely to achieve the suggested five per day servings of fruits and vegetables, to meet physical activity guidelines, to have a mammogram for women, and to be screened for prostate cancer for men (El-Bassel, et al., 2011). In other work with couples, El-

Bassel has studied the relationship between intimate partner violence and HIV transmission (El-Bassel, Gilbert, Witte, Wu, & Chang, 2011) and couple-based HIV prevention (El-Bassel, et al., 2010). Additional implications for HIV prevention stemming from social work-driven research include Auerbach and Beckerman's (2010) work on the socio-cultural needs of a community. In this study, formative research was conducted on the diversity, reliability, and validity of a questionnaire developed by the authors to determine the demographic profile of individuals accessing HIV services in Northern Manhattan, New York City, the perception of types of HIV prevention services that were effective, and the potential obstacles in the community for obtaining adequate HIV prevention services. Ninety-eight individuals accessing HIV services at one of 11 local AIDS service organizations were included in the study. Though their sample size is considerably small compared to the number of individuals in New York City living with HIV and their study is limited by the geography of the participants, Auerbach and Beckerman's (2010) work yielded significant programmatic suggestions for the delivery of HIV prevention, especially to minority women, in this urban area. Through the use of Structural Equation Modeling, the authors found that "AIDS/HIV knowledge" is highly predictive of "AIDS/HIV stigma;" therefore, more efforts to disseminate accurate and culturally-appropriate HIV prevention education could decrease the effect of HIV stigma on HIV-related prevention and treatment behaviors (Auerbach & Beckerman, 2010). It was also determined that the majority of participants selected HIV-related services based on proximity and familiarity with the community agency which may speak to the importance of the structural influences on prevention (and, potentially, treatment) adherence.

While research on predictors of HIV medication adherence is abundant, recent social work research has contributed to this area of science in ways unique to the profession—through a socio-ecological, or person-in-environment, lens. Research has identified many individual-level, socio-demographic influences on suboptimal HIV medication adherence (Golin, et al., 2002; Keruly, Conviser, & Moore, 2002; Mugavero, et al., 2006; Rintamaki, et al., 2006; Wolf, et al., 2007; Waite, et al., 2008; Tugenberg, Ware, & Wyatt, 2006). However, this literature does not discuss the influence of one's motivation to be adherent as an ultimate predictor of medication adherence. Research by Pomeroy, Thompson, Gober, and Noel (2007) attempted to address this gap. Pomeroy, et al., (2007) sought to identify factors that predict HIV medication adherence using Fisher's Information, Motivation, and Behavior (IMB) model which illustrates how obtaining prevention information, having motivation and behavioral intent to adhere to medication regimens, and employing behavioral skills can lead to adherence behaviors. Applying this conceptual framework to their sample of 225 adults living with HIV in an urban area of central Texas, Pomeroy and her team (2007) identified significant independent variables through bivariate analyses that were then included in a multiple regression model. Results from the analyses suggested that getting medical care within the first year of HIV diagnosis, receiving information about adherence issues, being motivated to adhere to their regimen due to feelings of vulnerability, and intentions to adhere to treatment were significantly associated with medication adherence. Despite obvious limitations such as inability to generalize to other populations outside of central Texas, the work of Pomeroy and her colleagues (2007) considerably contributes to our understanding of the intrapsychic incitation of health behavior, especially HIV medication adherence.

Social work research has also recently begun to address the importance of HIV primary care appointment adherence. For example, the Mount Sinai School of Medicine solicited the assistance of Cavaleri, et al., (2010) to investigate the increase in hospitalizations for HIV-related illnesses among HIV-infected individuals and the reasons associated with the inability of these individuals to successfully manage their care on an outpatient basis. Cavaleri's team used a semi-structured questionnaire with open-ended items to investigate participants' use of outpatient medical care and medications, mental health and substance abuse conditions, social support, concerns about stigma, HIV knowledge, and perceptions of HIV (including HIV itself and related providers and treatment) as they impacted treatment decision-making (Cavaleri, et al., 2010). Using qualitative methodology to conduct the research, the authors identified significant themes among the 24 HIV-infected, currently hospitalized patients. Prominent themes associated with poorer HIV treatment and medication adherence included competing obligations that required the patient's attention (such as childcare) and concerns about stigma. Cavaleri, et al., (2010) suggest that participants' lack of comfort in attending care or perceived inability to adequately discuss treatment issues with their providers could have influenced the sample's self-reported obstacles and service use. While interesting and, indeed, a contribution to the literature on HIV primary care appointment adherence, social work's initial efforts at investigating this issue risks falling into the same trap as researchers from other disciplines—the emphasis on who is not adherent to their HIV primary medical care instead of why these individuals do not attend appointments.

In light of the limited research on community effects on health, empirically testing a conceptual model that takes into account the role of community stressors and resources from a

social work perspective is warranted. Most areas do not have the capacity to address all of the community pathways through which individual characteristics are translated into negative health outcomes. However, identifying those pathways that are most salient will enable federal, state, and local policy-makers, as well as grassroots organizations, to target programs that alleviate the most damaging stressors or strengthen the most beneficial resources.

Social work and practice

Case management and ancillary services. Ancillary services for HIV/AIDS care—especially those catering to a specific need—have been shown to be effective in improving access to and retention in HIV primary care (Ashman, Conviser, & Pounds, 2002; Conviser & Pounds, 2002, Messeri, Abramson, Aidala, Lee, & Lee, 2002; Sherer, et al., 2002). The role of social workers as brokers of support services for individuals in these client-centered systems of care is undeniable.

In their study of 2,647 individuals receiving HIV primary care in Chicago, Sherer, et al., (2002) found that case management services were provided in higher volume (79% of participants received case management) than other ancillary services. Receipt of case management services surpassed other competing ancillary needs such as transportation, mental health treatment, and chemical dependency treatment (Sherer, et al., 2002). Study participants who received case management were more likely to receive any care and regular care compared to patients who did not receive case management services ($p<0.05$) during a one-year period and a two-year period. The study also demonstrated that an identified need for case management was apparent for 85% of the sample followed by an identified need for transportation services (65%), a need often facilitated by case management providers. Results from the study suggested that

individuals receiving ancillary services, especially case management, have better access to and retention in HIV primary medical care (Sherer, et al., 2002). Sherer and his colleagues (2002) note that the multidisciplinary team approach in HIV primary care is more effective in linkage to and retention in care than ambulatory care alone when competing needs of the patients are identified and met. Similarly, Messeri, et al., (2002) used a longitudinal sample of 577 HIV-infected individuals in New York City to investigate if the provision of ancillary services increased the rate of entry into HIV medical care and retention in medical care. Their findings demonstrate that individuals who are provided some ancillary services alone (a single-service model of case management, mental health treatment, substance abuse treatment, or housing) are more likely to enter medical care. Through their investigation into the more common, multi-service model, Messeri, et al., (2002) found that case management was among the most impactful ancillary services on medical care entry. Additionally, their analysis determined that it was the social service planning aspect of case management (versus medical referrals and personal counseling) that was most associated with better access to medical care. The team also studied the effect of case management and other ancillary service provision on retention in care. Individuals who received any of the three case management models (social service planning, medical referral, and personal counseling) were more than twice as likely as individuals who did not receive the service to remain in medical care. Again, Messeri and his colleagues (2002) found that the social service planning aspect of case management was the "driving" force in the established association between case management and retention in care (p. S25). These findings suggest that the provision of ancillary services, especially the social services planning aspect of case management, supports individuals receiving HIV primary care in ways more complex than

the simple removal of barriers to care alone; the results also speak to the importance of case managers as gatekeepers to additional social support services (Messeri, et al., 2002).

In the first study of primary medical care and ancillary services received by all patients at Ryan White CARE Act-funded clinics from multiple sites (Los Angeles, Orange County, California, San Francisco, District of Columbia, Michigan, and Virginia), Ashman, Conviser, and Pounds (2002) were not able to replicate the direct association of case management to entry into HIV medical care or retention in HIV medical care. The study sample (N=29,153) consisted of HIV-infected individuals over the age of 12 who received any qualified Ryan White CARE Act-covered service during a six–month period in 1997. Participants' utilization of ancillary services and other relevant data was collected over a two-year period. Although their findings about the role of case management in linkage and retention in HIV primary medical care contradicts results from other studies, Ashman, Conviser, and Pounds (2002) identified that case management was the most widely accessed service among ancillary care—utilized at least once during the study period by 73% of the population. Additionally, results from the study illustrate that individuals who received case management were more likely to also receive mental health treatment for provider-identified mental health needs or substance abuse treatment for provider-identified substance abuse needs. In turn, both mental health and substance abuse treatment were found to be significantly associated with receipt of medical care ($p<0.001$) (Ashman, Conviser, & Pounds, 2002). Nonetheless, Conviser and Pounds (2002) synthesized the literature on the role of ancillary services in client-centered systems of care and found the majority of available studies—but not all—have noted that receipt of case management services are generally

positively associated with both HIV primary care entry (linkage) and retention in primary medical care.

While the studies on the role of ancillary services in facilitating entry into medical care and maintaining retention in care provide significant contributions to our knowledge about service provision to the HIV-infected, limitations of these studies do exist. Of particular concern is their urban setting. Only the multisite Health Resources and Services Administration's (HRSA) Client Demonstration Project (Ashman, Conviser, & Pounds, 2002) includes rural areas in the analysis, but results solely based on the rural portion of the study sample are not available. This is noteworthy in light of the Robert/Morenoff/Agnew conceptual framework which seeks to explain community-level pathways to HIV primary medical care adherence. The absence of rural areas in existing studies prohibits investigation of community, or neighborhood, strain and the potential social service gaps on a more heterogeneous sample.

The promise of a brief case management intervention is encouraging in light of the research that has suggested that the HIV/AIDS epidemic is increasing among disenfranchised individuals with multiple needs. In the first randomized controlled trial (RCT) to investigate the efficacy of a brief case management intervention (defined as time-limited assistance to link newly-diagnosed HIV-infected individuals to medical care), Gardner and the Antiretroviral Treatment and Access Study (ARTAS) Study Group (2004) found that individuals receiving two or more case management contacts within a 12-month period were highly significantly more likely to establish HIV primary care linkage (defined as at least two visits to a primary care provider) than individuals in the standard of care (SOC), or control, group. Individuals receiving a single case management visit were also significantly more likely—although less so than those

with two such visits—to be linked to HIV primary medical care than their SOC counterparts. Among their sample of 316 HIV-infected adults enrolled at one of four study sites (Miami, Baltimore, Los Angeles, and Atlanta), Gardner, et al., (2004) found that their conceptualized brief case management intervention resulted in a 40% relative increase and a 15% absolute increase in linkage to HIV care at six and 12 month follow-ups. A second ARTAS study (ARTAS-II) built upon the results from the previous study (ARTAS-I, Gardner, et al., 2004) to investigate the feasibility of the developed brief, strengths-based case management intervention at the local health department and community-based organization level (Craw, et al., 2008). This study confirmed that 79% of enrolled newly-diagnosed HIV-infected individuals who received the brief case management intervention at either a local health department or community-based organization were receiving HIV primary medical care within six months of diagnosis, replicating the 78% linkage rate established in the ARTAS-I study (Craw, et al., 2008). This translation of the intervention is important given the heterogeneity of the study sites (community-based sites in urban Atlanta, Baltimore, Chicago, and Miami with additional less urban and rural sites in Anniston, Alabama, Baton Rouge and New Orleans, Louisiana, Jacksonville and Tallahassee, Florida, Kansas City, Missouri, and Columbia and Greenville, South Carolina).

Patient navigation. Another model that has shown promise in improving access to and retention in HIV medical care is patient navigation. In this model, culturally-matched individuals—often, patients themselves—are paired with individuals with multiple needs to navigate the complex medical and social service delivery system. Patient navigators generally are not social workers; however, the model is largely based on the strengths-based perspective in

social work so the practice roles for social workers are inherent in the training and supervision of these peers.

Bradford, Coleman, and Cunningham (2007) report remarkable results from their study on a patient navigation intervention with 437 HIV-infected individuals conducted at four locations (Portland, Seattle, Boston, and Washington, D.C.). All assessed barriers (structural, financial, personal) were found to be significantly reduced from baseline to six month and 12-month follow-up, including proportion of uninsured participants, belief and structural barriers, mean number of total worries/concerns/stigma, and total number of unmet needs (Bradford, Coleman, & Cunningham, 2007). The results also provided further evidence of significant improvement in medical provider contact. Subsequently, overall health outcomes were also significantly improved including proportion of individuals with an undetectable viral load, decreased number of participants who had no care in the previous six months, and the proportion of clients with two or more visits to primary medical care (Bradford, Coleman, & Cunningham, 2007).

Counseling, testing, and referral (CTR). Social work and HIV-related research has suggested that the primary role of social workers in the post-ARV era of HIV care is the provision of primary and secondary prevention (Strug, Grube, & Beckerman, 2002; Wheeler, 2007). While the role of social work in HIV prevention is potentially quite vast, counseling, testing, and referral (CTR), a standardized set of guidelines from the CDC, provides a particularly opportune moment for social work intervention and initial linkage to HIV primary medical care for those who receive positive results.

From their work on the Never in Care (NIC) Pilot Project, Garland, et al., (2011) used qualitative methodology to interview 42 HIV-infected individuals who had not entered medical care within at least 90 days from diagnosis. The overall purpose of the NIC Project was to identify and describe those individuals who never accessed care for HIV. However, in analysis of the qualitative data, Garland and her colleagues (2011) specifically investigated the role of the CTR encounter on individuals' decisions to access HIV primary medical care. Their analysis yielded information about CTR contact and the participants' perceptions of these contacts including, but not limited to, CTR contacts limited to one visit and other individual-level barriers (e.g., fear of disclosure, privacy, and distrust of the medical provider) and system-level barriers (e.g., lack of finances/insurance and difficulty navigating the follow-up services). Participants noted that CTR could have been improved, and perhaps could have facilitated their initial linkage to medical care, with more intensive counseling and more active referral to social services. In short, Garland, et al., (2011) specifically note the important role of case managers in not only linking newly-diagnosed individuals to HIV medical care, but also in linking them to other services and activities that give them a better chance of accessing medical care when the time comes.

In his piece on the status of social work in the international response to the HIV/AIDS pandemic, Hall (2008) also suggests social work's viability in the provision of voluntary counseling and testing and the subsequent support for the HIV-infected individual. However, Hall (2008) suggests that social workers' participation in CTR is a means for addressing the continued stigma and discrimination faced by HIV-infected individuals. By increasing access to voluntary counseling and testing for HIV, Hall (2008) purports that stigma and discrimination

around HIV can be reduced, and social workers are appropriately trained about and strategically situated at the frontlines of the illness.

Additional areas for social work practice.

> It is morally, ethically, socially and economically unsustainable to have the majority of those living with HIV/AIDS to have no access to life-sustaining treatment. Equitable access to treatment is fundamental to social work…(Hall, 2008, p. 58).

Hall's straightforward charge to the social work profession regarding its role in the HIV/AIDS pandemic speaks to the most basic of social work ethical principles, social justice. The National Association of Social Workers (NASW) Code of Ethics (2008) mandates social workers to challenge social injustice. Specifically, "social workers pursue social change, particularly with and on behalf of vulnerable and oppressed individuals and groups of people" (NASW, 2008). Hence, disparities that directly impact public health should be of the utmost priority for social work practitioners. These disparities may be addressed by social work practitioners through accessing treatment for vulnerable groups, empowering the disenfranchised, fighting poverty and the causes of poverty, defending human rights including gender equality, and community coalition building (Hall, 2008). So, while some have opined that social workers have failed to make an impact in the fight against HIV/AIDS, perhaps social workers have not yet realized their potential broad role in the HIV/AIDS challenge.

Research of this nature is paramount to social work practice with HIV-infected individuals. As established, many individuals with HIV do not adhere to optimal primary medical care even though poor adherence predicts poorer survival (Giordano, et al., 2007; Giordano, et al., 2009). Despite the introduction of life-sustaining ARV therapy in 1996 and the resultant decrease in AIDS diagnoses in the United States, the proportion of AIDS diagnoses

have continued to increase among minority races and ethnicities (CDC, 2010). As a result, clinic caseloads continue to grow exponentially, especially with individuals who may be considered at highest risk for contracting HIV. However, armed with knowledge about an HIV-infected person's individual-level profile (history of mental illness and/or substance abuse history, health beliefs, and trust of medical care providers, for instance) and community-level influences such as residence, neighborhood, and/or community, social workers and other helping practitioners may prevent suboptimal primary care appointment adherence and optimize a newly-diagnosed individual's initial linkage to care and potential for retention in care at the most critical, early stage of HIV medical treatment. Of course, similar outcomes are possible for HIV-infected individuals who have previously established a medical home but who have fallen out of routine care, as well. An additional challenge for social workers in the post-ARV era is the provision of expanded social services to those individuals with HIV who are adherent to their primary care appointments and ARV regimen and are now confronted with differential social problems (Cain & Todd, 2009). Possessing an understanding of the contribution of individual and community pathways, including the effects of lack of resources and social stressors, social workers can maximize case management services, efficiently assist HIV-infected individuals maneuver the local, state, and federal social welfare landscape, and mitigate social relationships between the HIV-infected person and their environment. Finally, research in this area may provide explanation for HIV testing behaviors and other preventive issues. Ultimately, contributions from research in this area may include the development of empirically-based, primary and secondary prevention interventions and may provide the proverbial "missing link" between

established individual-level influences and the broader community-level influences that play a role in HIV primary care appointment adherence-related behaviors.

Social work and policy

In 2010, President Barack Obama released the U.S. government's first comprehensive strategy for addressing the U.S. HIV/AIDS crisis. The National HIV/AIDS Strategy (NHAS) provides specific, measurable steps to ultimately reduce HIV/AIDS transmission (NHAS, 2010). The NHAS's vision statement is candid:

> The United States will become a place where new HIV infections are rare and when they do occur, every person, regardless of age, gender, race/ethnicity, sexual orientation, gender identity or socio-economic circumstance, will have unfettered access to high quality, life-extending care, free from stigma and discrimination (NHAS, 2010).

Within this vision, the NHAS sets forth three basic goals: 1) Reducing new HIV infections, 2) increasing access to care and improving health outcomes for people living with HIV, and 3) reducing HIV-related health disparities. Perhaps now more than ever before through the history of the HIV pandemic, social workers have a tremendous opportunity to broaden their focus in terms of HIV/AIDS policy. The NHAS provides a clear directive.

NHAS: Reducing new HIV infections. As we learn more about the roles of community-level influences on linkage and adherence to HIV primary medical care and how these influences may mediate individual-level factors, the opportunity to develop policies to respond to these issues becomes an increasingly important process to address macro-level challenges.

Contemporary research suggests that HIV treatment is effective prevention (*The Lancet*, 2011). As such, to progress toward the reduction of new infections, efforts must be focused on identifying the estimated vast number of individuals who are HIV-positive but unaware of their status (Yehia & Frank, 2011; Gardner, et al., 2011). To achieve this, support of the CDC's

revised guidelines for HIV testing (Branson, et al., 2006)—which suggests routine HIV testing for all individuals between the age of 13 and 64 years in all health care settings, especially acute care centers—must be advocated for at the state level. Once state laws are in-line with CDC recommendations, specific strategies to assist individuals who face community- and structural-level barriers to accessing appropriate preventive care are imperative.

The broad use of targeted evidence-based prevention interventions is currently the most effective and sustainable means to prevent the spread of HIV (Lagakos & Gable, 2008). Social workers are often relied upon to deliver these "canned" interventions (Wheeler, 2007). Behavioral science and institutional conduits, such as the CDC, have been remarkably successful at developing and disseminating empirically-validated interventions; however, effective implementation of these interventions has yet to see similar success (Norton, Amico, Cornman, Fisher, & Fisher, 2009). Challenges to implementation can, in part, be explained by the organizational context (including specific organizational needs and priorities considered in tandem with available resources) in which the implementation of the intervention takes place (Norton, et al., 2009). As key players in both the development and delivery of evidence-based HIV prevention interventions, social workers are essential in furthering policy development related to effective, organizational-specific dissemination of these interventions.

Clearly, social workers stand uniquely armed to increase the identification of individuals who may be HIV-infected but unaware of their serostatus in disenfranchised populations and to increase access to standardized prevention activities for organizations that serve those most in need.

NHAS: Increasing access to care and improving health outcomes for People Living with HIV. The NHAS emphasizes the importance of access to care for the HIV-infected (2010). Policies emanating from research investigating structural-level influences on health outcomes are fundamental to getting individuals into primary medical care. Foundations of the social work profession include strengths-based strategies to improve the holistic person-in-environment. This position results in social work practitioners who value the multiple influences on a person's condition, who understand the need to assess the person's situation outside of the clinic setting, and who will utilize all available resources to promote the person's well-being. While not new to social work thought, this socio-ecological lens may promote a radical shift in how linkage and adherence to HIV primary medical care is viewed.

For example, Mugavero, Norton, and Saag (2011) use a socio-ecological framework to describe the fractured health care service delivery system for HIV treatment and prevention. They suggest that a better understanding of factors associated with, or predictive of, suboptimal primary care adherence (linkage, engagement, and re-engagement in care) may have implications for the HIV health care system, HIV-related health care policy, fragmentation of funding, and HIV service delivery. Their recommended future strategies for improving engagement in care among the HIV-infected transcends the limitations of their socio-ecological lens (very similar to systems theory framework as described above) and includes case management, navigation models, and integrated health care systems as model programs (Mugavero, Norton, & Saag, 2011). In fact, applying the Robert/Morenoff/Agnew conceptual framework to future research, the implications of these model programs significantly increase.

NHAS: Reducing HIV-related health disparities. Inherent to social work philosophy is the challenge of social injustices. To experience any success in achieving the NHAS's challenge to reduce HIV-related health disparities, policymakers must increase attention on the social determinants of health.

In response to a report by the Robert Wood Johnson Foundation, *Overcoming Obstacles to Health*, Braveman, Egerter, and Mockenhaupt (2011) suggest that reducing HIV infections and increasing access to medical care for the HIV-infected is paramount; however, they present a compelling argument for the increased investigation into effective solutions that consider a broader focus on health and health behavior contexts. Acknowledging that personal behaviors are often a choice and some individuals elect choices that are detrimental to their health, Braveman, Egerter, and Mockenhaupt (2011) warn that these decisions do not occur independently of the context in which they are made. Specifically, the role of the home, work, school, and neighborhood environment must be taken into account, and policies that influence individual choices within these environments are essential to improve overall health. To achieve this, research, practice, and policy must scrutinize such issues as the influence of stressful events and the benefit of social advantage. Moving from discussion to demonstration, a recent study by Galea, et al., (2011) supports the importance of social factors in health. Through a meta-analysis of 47 articles between 1980 and 2007, Galea and his colleagues (2011) calculated the relative risk estimates of death associated with several key social factors. Similar to previous findings by other researchers, the team demonstrated the number of deaths in the U.S. in 2000 attributable to low education (245,000), poverty (133,000), low social support (162,000), area-level poverty (39,000), income inequality (119,000), and racial segregation (176,000) (Galea, et al., 2011).

These results set the foundation for a paradigm shift in how we view the relationship between social environment and health, and they suggest an assertive move to establish policies that provide opportunities for individuals to improve their health regardless of where they reside. Further, these policies should be guided by cost-effectiveness and potential population impact as assessed in RCTs (Shattock, Warren, McCormack, & Hankins, 2011; Fauci, 2011).

Community viral load. The relatively new concept of community viral load is an important consideration in advancing social work and HIV research, practice, and policy and, especially, in responding to the NHAS (Morin, et al., 2011). The term community viral load refers to an aggregate biological measure of viral load for a specific location defined by its social connectedness, shared networks, and demographic, geographic, or behavioral similarities (Das, et al., 2010). In their study of 12,512 HIV-positive individuals with at least one measure of viral load between 2005 and 2008 included in the San Francisco HIV/AIDS Case Surveillance System, Das, et al., (2010) calculated mean community viral load (the average of the most recent viral load of all reported HIV-infected individuals in a particular population in each year from 2005 to 2008) for subpopulations and for neighborhoods and total community viral load (sum of the most recent viral load of all reported HIV-infected individuals in a particular population from 2005-2008) for geographic analysis. The team demonstrated that decreases in community viral load are associated with decreased HIV infections. Specifically, San Francisco neighborhoods such as the Tenderloin and South of Market inhabited by socially isolated and disenfranchised populations had a mean community viral load of 28,093 copies/mL, a measure higher than the San Francisco overall community viral load of 23,348 copies/mL. Contrary to this finding, Das and her colleagues (2010) identified a lower mean community viral load (21,352 copies/mL) in

the Castro district (an area historically inhabited by upper-income, gay individuals) than the overall community viral load for San Francisco. This finding was surprising since the Castro included a higher number of individuals who were HIV-infected than other districts. The results suggest that widespread dissemination of antiretroviral therapy may have a positive impact on HIV transmissions at the population level. Another study by Montaner and colleagues (2010) in British Columbia, Canada, echoed the findings of Das, et al., (2010). Montaner, et al., (2010) analyzed HIV testing and new diagnosis data over a broader time period than the previous study (1996 to 2009). The Canadian team found that the number of new HIV cases decreased by 0.97 (95% CI, 0.96-0.98) for every 100 additional individuals on ARVs; additionally, the community viral load and number of new HIV cases also decreased systematically as a result of 100 additional individuals on appropriate medication regimens (Montaner, et al., 2010). These findings suggest a strong association between individual behaviors in ARV medication initiation and adherence to community-level health, and we now have substantial opportunities to develop community-level interventions to improve both individual and community health, particularly as related to long-term survival with HIV.

Statement of the Problem

The goal of the study is to examine the key community factors that may precipitate negative health outcomes for the HIV-infected, especially suboptimal linkage and adherence to primary medical care. Specifically, the study aimed to answer the following research questions and support the respective hypotheses:

1. What are the individual characteristics (e.g., age, race, and employment status) associated with suboptimal linkage and adherence to HIV primary medical care?

H_1: Individual-level demographic characteristics are associated with suboptimal linkage and adherence to HIV primary medical care;

H_2: Individual-level psychosocial characteristics are associated with suboptimal linkage and adherence to HIV primary medical care;

H_3: Individual-level biologic markers/characteristics are associated with suboptimal linkage and adherence to HIV primary medical care;

H_4: Lower individual-level economic status (operationalized by insurance status and/or enrollment in the Ryan White C.A.R.E. Act program) will predict suboptimal linkage and adherence to HIV primary medical care;

H_5: Lower educational attainment will predict suboptimal linkage and adherence to HIV primary medical care;

H_6: Lack of stable employment (unemployed, part-time work, and/or low-skilled employment) will predict suboptimal linkage and adherence to HIV primary medical care; and

H_7: Family status is associated with suboptimal linkage and adherence to HIV primary medical care.

2. What are the community characteristics (e.g., community socioeconomic factors, social stressors, and community resources) associated with suboptimal linkage and adherence to HIV primary medical care?

H_1: *Community Socioeconomic Factors* - Community socioeconomic factors are associated with suboptimal linkage and adherence to HIV primary medical care;

H_2: *Social Stressors* - Community-level economic deprivation is associated with suboptimal linkage and adherence to HIV primary medical care;

H_3: *Social Stressors* - Higher community-level income inequality will predict suboptimal linkage and adherence to HIV primary medical care;

H_4: *Social Stressors* - Higher community-level racial segregation will predict suboptimal linkage and adherence to HIV primary medical care;

H_5: *Social Stressors* - Age structure discrepancies (defined by higher youth dependency ratios and/or elderly dependency ratios) will predict suboptimal linkage and adherence to HIV primary medical care;

H_6: *Social Stressors* - Higher community-level crime will predict suboptimal linkage and adherence to HIV primary medical care;

H_7: *Community Resources* - Lower community-level labor market viability will predict suboptimal linkage and adherence to HIV primary medical care;

H_8: *Community Resources* - The presence (or availability) of local businesses will predict suboptimal linkage and adherence to HIV primary medical care;

H_9: *Community Resources* - Community-level housing characteristics are associated with suboptimal linkage and adherence to HIV primary medical care;

H_{10}: *Community Resources* - Lack of access to transportation will predict suboptimal linkage and adherence to HIV primary medical care;

H_{11}: *Community Resources* - Lack of access to social and health services will predict suboptimal linkage and adherence to HIV primary medical care; and

H_{12}: *Community Resources* - Lack of access to and performance of local schools will predict suboptimal linkage and adherence to HIV primary medical care;

3. Do community-level variables mediate the effects of individual-level factors on suboptimal linkage and adherence to HIV primary medical care?

H_1: Community-level variables mediate the effects of individual-level factors on suboptimal linkage and adherence to HIV primary medical care.

These research questions and research hypotheses emanate from the previously described conceptual framework that accounts for the various pathways through which community-level factors may influence the relationship between individual characteristics and health outcomes.

The study provides valuable information on the interplay of individual and community factors in shaping HIV-related health. Emerging research suggests that prevention and treatment strategies may be enhanced by knowing more about the relationships between individuals and the neighborhoods within which they live (Bauermeister, Zimmerman, & Caldwell, 2010; Hixon, Omer, del Rio, & Frew, 2011; Ludwig, et al., 2011; McMahon, Wanke, Terrin, Skinner, & Knox, 2011; Meditz, et al., 2011). The findings from this research can be used by social workers and other health care providers to develop effective interventions that will address the unique needs of individuals who are HIV infected and most at-risk for poorer health. In that the role of the community has been too little researched in this area, the study is both important and timely.

CHAPTER 3

METHODOLOGY

The study includes two distinct phases. The first phase involves the analysis of secondary data available through the University of Alabama at Birmingham (UAB) 1917 Clinic Cohort (www.1917cliniccohort.org). Data for the study is derived from a sample of participants who include new-to-care, HIV-infected adults initially presenting to primary medical care at the UAB 1917 Clinic between July 1, 2009 and June 30, 2011. For the purposes of this study, "new-to-care" refers to newly-diagnosed 1917 Clinic patients whose first presentation to HIV primary medical care (baseline) occurred during the study period. After initial approval was received (both to access the secondary data and to conduct the research through The University of Alabama Office for Research Compliance), demographic variables were analyzed, descriptive statistics were determined, and bivariate methods were used to analyze variability and predictability of each variable. Next, multivariate methods (specifically, logistic regression) were used to assess relationships. In the second stage, community-level data (census tract- or county-level) for each participant's residence address at the time of initial presentation to HIV primary medical care was collected. The mediation effect of community-level variables on the association between individual-level predictors and linkage to and retention in care outcomes was then investigated.

Research Setting

Research was conducted at the University of Alabama at Birmingham (UAB) 1917 HIV Clinic. The clinic works in tandem with UAB's Center for AIDS Research (CFAR), one of only 21 U.S. sites designated by the National Institutes of Health (NIH)/National Institute of Allergy

Table 1

Rural-Urban Continuum Codes, 2003.

County	2003 Rural-Urban Continuum Code	2000 Population	Major City
Autauga	2	43,671	
Bibb	1	20,826	
Calhoun	3	112,249	Anniston
Cherokee	8	23,988	
Chilton	1	39,593	
Choctaw	9	15,922	
Colbert	3	54,984	Tuscumbia
Conecuh	9	14,089	
Covington	7	37,631	
Cullman	6	77,483	Cullman
Dallas	4	46,365	
Elmore	2	65,874	Wetumpka
Etowah	3	103,459	Gadsden
Henry	3	16,310	
Houston	3	88,787	Dothan
Jefferson	1	662,047	Birmingham
Lamar	9	15,904	
Lee	3	115,092	Opelika
Lowndes	2	13,473	
Macon	6	24,105	
Madison	2	276,700	Huntsville
Montgomery	2	223,510	Montgomery
Perry	8	11,861	
Russell	2	49,756	
St. Clair	1	64,742	Pell City
Shelby	1	143,293	Hoover
Talladega	4	80,321	Talladega
Tallapoosa	6	41,475	
Tuscaloosa	3	164,875	Tuscaloosa
Walker	1	70,713	Jasper
Winston	6	24,843	

1 = County in metro area with 1 million population or more
2 = County in metro area with 250,000 to 1 million population
3 = County in metro area of fewer than 250,000 population
4 = Nonmetro county with urban population of 20,000 or more, adjacent to a metro area
6 = Nonmetro county with urban population of 2,500-19,999, adjacent to a metro area
7 = Nonmetro county with urban population of 2,500-19,999, not adjacent to a metro area
8 = Nonmetro county completely rural or less than 2,500 urban population, adj. to metro area
9 = Nonmetro county completely rural or less than 2,500 urban population, not adj. to metro area
Source: *U.S. Department of Agriculture (2004)*

and Infectious Diseases (NIAID) as locations providing scientific leadership in AIDS research. All study participants had provided a residence address within Alabama at the time of their initial contact with the 1917 Clinic. Alabama represented an ideal site for research on the importance of place and health because its 67 counties exhibit significant diversity of types of residential areas. Research on place, in general, is critical of the use of a crude rural-urban dichotomy (Brown & Swanson, 2003; Conger, 1997; Rountree & Clayton, 1999; Warner & Leukefeld, 2001). This region captures a broad swath of the types of areas that can be considered rural or urban (see Table 1). Census tracts included in the community-level analysis existed within counties that ranged from a moderately large urban county (e.g., Jefferson County) and less urban counties that are part of major metropolitan areas (e.g., Elmore County) to small, completely rural counties (e.g., Lamar County).

Research Design

This study involves exploratory research with a retrospective cohort. No random assignment nor control group was included in this design. The results of the study demonstrate associations between individual-level variables and study outcomes, community-level variables and study outcomes, and mediation relationships between community-level strain variables and the association between individual- and community-level variables and study outcomes.

Sampling Procedures

A convenience sample of HIV-infected adults initially presenting for HIV primary medical care at the UAB 1917 HIV Outpatient Clinic was selected for this study. Non-probability sampling techniques, such as convenience sampling, are often used in social and behavioral science research because it is easier, quicker, and cheaper (Rubin & Babbie, 1993). For this study, a more salient reason for using non-probability convenience sampling was

concern for a relatively small sample size. While this type of sampling prohibits generalizability of study results, it allows for the use of the maximum number of participants conveniently available for the research.

The study sample was drawn from larger cohort studies, including the CFAR Network of Integrated Clinical Systems (CNICS) and Project CONNECT, a local UAB 1917 Clinic new patient orientation protocol which provides systematic linkage to HIV medical care. Provision of secondary data from both the CNICS and Project CONNECT studies, as well as information routinely abstracted from medical records, was provided by the 1917 Clinic Cohort.

CFAR Network of Integrated Clinical Systems (CNICS)

CNICS (http://www.uab.edu/cnics/) is a research consortium consisting of eight national sites (Case Western Reserve University, Harvard University, Johns Hopkins University, UAB, University of California-San Francisco, University of California-San Diego, University of North Carolina-Chapel Hill, and the University of Washington) that utilizes standardized elements within the electronic medical record (EMR) to integrate clinical data from a large, diverse population of HIV-infected individuals. CNICS was originally funded via the R24 mechanism in 2006. Currently, CNICS allows for systematic data collection on HIV-infected patients receiving medical care at any of the university-based HIV primary care facilities affiliated with CNICS-site campuses.

Only secondary data collected at the UAB CNICS site was accessed for the study. Although recruitment for the CNICS study varies slightly from site to site, at UAB, potential participants are approached in their exam room during a scheduled primary medical care appointment. The study is described to the patient, and informed consent is obtained. Initial participation in study activities does not begin until the next scheduled primary medical care

appointment after consent, and individuals participate in CNICS study activities once every four to six months thereafter. At UAB, eligibility for the CNICS study is limited to HIV-infected adults over the age of 19 (age of majority in Alabama), English-speakers, and individuals demonstrating normal cognitive functioning. To date, approximately 83% (n=2317) of all 1917 Clinic patients are enrolled in CNICS, and 10,097 patient-reported outcomes (PROs) have been completed by study participants. CNICS activities, including recruitment, are approved by the UAB Institutional Review Board (Protocol #X020923009, Michael S. Saag, Principal Investigator).

Project CONNECT

In 2006, the 1917 Clinic implemented Project "Client-Oriented New Patient Navigation to Encourage Connection to Treatment" (CONNECT) to improve linkage to HIV medical care for individuals new to the 1917 Clinic. Since that time, this project has become standard of care at the clinic, and all patients new to the clinic (newly-diagnosed and individuals transferring care from another provider) and patients who have been out-of-care for more than 12 months participate in the structured clinic orientation prior to their first primary medical care appointment. Project CONNECT consists of a semi-structured interview, usually conducted by a social worker, and a battery of standardized instruments that assess domains such as depression, anxiety, quality of life, stigma, social support, safety, and alcohol and substance use. Since Project CONNECT is considered usual care at the 1917 Clinic, informed consent is not obtained. As with the CNICS data, secondary data was accessed through Project CONNECT. Activities included in Project CONNECT are approved by the UAB Institutional Review Board (Protocol #X070405006, Michael J. Mugavero, Principal Investigator).

The 1917 Clinic Cohort

The 1917 Clinic Cohort (http://www.uab1917cliniccohort.org/index.html) is a prospective cohort study established in 1992 that includes HIV positive individuals who receive primary and sub-specialty medical care at the UAB 1917 Clinic. The Cohort provides single-center, longitudinal HIV observational clinical data, collected as standard of care, for the purposes of advancing the local (and, ultimately, national) HIV scientific research agenda. Hence, 1917 Clinic Cohort data are secondary, as well. The 1917 Clinic Cohort utilizes information collected in the UAB EMR for all 1917 Clinic patients as part of their routine medical care, and, thus, informed consent is not obtained. However, patients seeking medical care at the 1917 Clinic allow for their personal health information to be used for the purposes of research when they consent to treatment at the clinic. All patients at the 1917 Clinic (adults, generally over the age of 19, diagnosed with HIV) are eligible for participation in the 1917 Clinic Cohort. Cohort activities, including recruitment, are supervised by the 1917 Clinic Cohort Director, Michael J. Mugavero, M.D.

For individual-level, secondary data, a concept proposal and data request was submitted to the 1917 Clinic Cohort per standard protocol in July 2012.

Eligibility

To be included in the secondary data analysis, participants had to provide informed consent through IRB-approved procedures for CNICS and/or (1) be adults over the age of 19 (the age of consent in Alabama); (2) be diagnosed with HIV and have a Project CONNECT new patient orientation visit at the 1917 Clinic during the study period; (3) not be cognitively impaired at the time of data collection (CNICS eligibility); (4) speak English (CNICS eligibility); and (5) self-report a residence address within the state of Alabama at the time of their

first clinic contact. Additionally, the sample for this research includes all newly-diagnosed patients at the 1917 Clinic presenting for a Project CONNECT visit (baseline) between 7/1/09 and 6/30/11 and who have at least one additional primary care visit within the next 12 months. Manual medical record abstraction was used to further exclude participants if it was determined that they had an HIV primary medical care visit prior to baseline, their baseline viral load resulted in virologic suppression (<200 mL/copies) without evidence of participant's elite control of the virus, and/or the provided residence address was a known residential substance abuse treatment program or other institutionalized setting.

Procedures for Data Collection

Prior to data collection, use of the 1917 Clinic Cohort data was formally obtained in August 2012 (Appendix A), and a formal request was made to The University of Alabama's Institutional Review Board (IRB). Approval was granted to proceed with the study in September 2012 (Appendix B). The study proposal was approved by the Dissertation Committee in October 2012.

Phase 1 of the research involves the analysis of primary individual-level, secondary data. As this study uses secondary data, data collection was not necessary. Following established procedures, a concept proposal of research was submitted to the 1917 Clinic Cohort and orally presented at a regular meeting of the group in August 2012. Simultaneously, a comprehensive data request was developed and submitted to the 1917 Clinic Cohort Informatics Team in September 2012. Requested data was ultimately received in November 2012 in Excel 2007 spreadsheets. Exact measures are described later.

Data measures were obtained through the CNICS study PROs and from the 1917 Clinic New Patient Health Questionnaire and Project CONNECT Interview. 1917 Clinic patients

complete the PRO measures (also referred to as Patient-based metrics, or PBMs) during their clinic orientation visit (1917 Clinic New Patient Health Questionnaire) and during primary medical care visits every four to six months, pending their consent to participate in the CNICS study. The PRO is a component of the national CNICS project. The PRO is an aggregate instrument based on standardized questionnaires that assesses ARV medication adherence (ACTU), quality of life (EuroQOL-5D), HIV symptoms (HIVSI), sexual and substance use risk behaviors (HRAP-R, AUDIT-C, ASSIST), and depression and mental health status (PHQ). The PRO is administered on a touch-screen computer. With improved HIV-related health resultant of ARV adherence, many patients are experiencing fewer HIV-related health complications and are regularly scheduled primary medical care appointments every six months. Hence, healthy patients may complete the PRO at every primary care visit. In addition to PRO data, CNICS provides information in the following nine domains: (1) Disease diagnoses, (2) laboratory data, (3) medication data, (4) demographics, (5) health care utilization, (6) vitals status, (7) ARV drug resistance, (8) biologic specimens, and (9) census block data. The 1917 Clinic Project CONNECT Interview is a semi-structured interview usually completed by a social worker at the Project CONNECT/clinic orientation visit (Appendix C).

Phase 2 of the study consisted of gathering aggregate census data and linking those data to the individual records. Data on community-level poverty, housing, employment, and other structural-level measures (See Measures below) were collected for those counties and census tracts where study participants reside. Aggregate data sources used in the collection of community-level variables included Census 2010 Summary Files, the U.S. Census Bureau's American Community Survey and County Business Patterns surveys, the Bureau of Justice Statistics' Uniform Crime Reports, the Alabama Department of Education Annual Yearly

Progress Reports, and other sources. Individual-level data were linked to these aggregated data via participants' home addresses. Given the highly personal nature of one's home address, each participant was assigned a unique identification number. The data query was stored on a secure network server with password protection and regular system back-up at least every 24 hours. Once home addresses were linked to the community-level data, this field in the data query was deleted.

Measures

Principal Outcomes

The study examines individual and community-level determinants of negative health outcomes among HIV-infected individuals. Specifically, it focuses on linkage and adherence (or retention) to HIV primary medical care.

Linkage to HIV Primary Medical Care. Linkage to HIV primary medical care is determined by the analysis of key milestones in the linkage process. The date of first clinic contact (usually through patient-initiated telephone contact with the Project CONNECT social worker), the date of first scheduled primary medical care appointment, and the date of first arrived primary medical care appointment was reviewed. *Linkage to care* was determined (yes/no) if an individual arrived for their first primary medical care appointment within 183 days (six months) of their first clinic contact. The efficiency of linkage to care was determined by calculating (1) the number of days between first clinic contact and first scheduled primary medical care appointment and (2) the number of days between first clinic contact and first arrived primary medical care appointment. *Efficient linkage to care* was operationalized as an arrived first primary medical care appointment within 60 days of first clinic contact (yes/no).

Effective linkage to care was defined as at least two arrived primary medical care appointments within six months of first clinic contact (yes/no).

Retention in (or Adherence to) HIV Primary Medical Care. Considerable debate has transpired regarding a standard definition of the term, "adherence." For the purposes of this study, the definition of retention purported by the HRSA-HIV/AIDS Bureau (HAB) served as the primary retention outcome. The *HRSA HAB medical visits performance measure* captures whether a patient had two or more completed clinic visits separated by three or more months in time during a 12-month observation period (Mugavero, et al., 2010). This measure was dichotomized (yes retained in care vs. not retained in care) for statistical analyses. Other measures of retention in HIV medical care exist including *missed visits*, *visit adherence*, *visit constancy*, and *gaps in care*. Each measure was modeled in this study. An overview of the remaining four measures of retention in HIV primary medical care follows.

First, the measure of *missed visits* is generally a calculation of "no show" scheduled visits with a primary care provider (Mugavero, Davila, Nevin, & Giordano, 2010). Appointments that were cancelled by the patient or the clinic were not included in this measure. Ultimately, the missed visits measurement is simply a count of qualifying visits that have been missed by the patient during a specified period without regard to the total number of visits scheduled. Initial review of frequency statistics for the number of missed visits in the year following the new patient orientation visit (Project CONNECT) yielded a range of 0-5 with approximately 48% having no missed visits during this time. Just over 32% of the sample missed one visit during the observation period, and less than 20% missed between two and five visits. Given the negatively skewed distribution of the data, this outcome was dichotomized for analyses (yes at least one no-show appointment vs. no no-show appointments) yielding two closely split groups

("Yes at least one no-show"~48% and "No no-shows"~52%). Second, *visit adherence* was calculated by including the number of completed visits divided by the number of scheduled visits or vice versa to determine the related measure, kept visit proportion (KVP) or kept visit rate. (By switching the numerator and denominator in this formula, a missed visit proportion, or MVP, can be calculated, as well.) Besides the measure of missed visits described above, appointment adherence most clearly illustrates if a patient comes to a scheduled appointment or not (Mugavero, Davila, Nevin, & Giordano, 2010). The KVP frequency distribution ranged from 0-1, and the mode of the data was 1 (n=105 with a kept-visit proportion of 100%). Fifty percent of the data fell at approximately KVP=0.90. The median value in the distribution was 0.888. It was believed that either of these values may be too high to determine statistical effects between groups. Almost 40% of the sample had a KVP of ≤80% and 60% had a KVP >80%; hence, for analysis, visit adherence was dichotomized at this value. Third, the concept of *visit constancy* refers to consistent—or, at least one—primary medical care appointment attendance in each of a set number of time periods (e.g., at least one visit per quarter, for instance) (Mugavero, Davila, Nevin, & Giordano, 2010). Again, initial frequency distributions showed a positively skewed distribution with the majority of participants having a visit constancy equal to one (n=136, 60.2%). The remaining visit constancy groups consisted of small numbers (0 attendance in four quarters=10 or 4.4%, visits in one-third of the time periods=26 or 11.5%, and visits in two-thirds of the time periods=54 or 23.9%). Hence, to analyze visit constancy and avoid issues with inadequate cells, the measure was dichotomized by 100% completed visits (i.e., at least one visit in each of the time periods) and <100% completed visits (i.e., at least one time period without a completed visit). Fourth, the *gaps in care* measure accounts for the length of time between completed primary medical care appointments. The gaps in care measure considers a

pre-determined time interval, such as six months, but it does not consider extended elapsed time between arrived appointments that are dictated by good health (Mugavero, Davila, Nevin, & Giordano, 2010). Gaps in care was dichotomized by those who had >183 days between arrived primary medical care visits and those who did not. Table 2 provides an illustration of each outcome and its respective definition and level of measurement.

Table 2

Study Outcomes

Outcome Measure	Definition	Level of Measurement in Study
Linkage to Care (LTC)	Arrived first PC visit ≤183 days of first clinic contact	Nominal
Efficient LTC	Arrived PC visit ≤60 days of first clinic contact	Nominal
Effective LTC	At least 2 PC visits within 6 months of first clinic contact	Nominal
HRSA-HAB RiC	≥2 PC visits separated by ≥3 months during a 12-month period	Nominal
Missed Visits RiC	Calculation of "no show" scheduled PC appointments	Nominal*
Visit Adherence RiC	Completed PC visits/Scheduled PC visits	Nominal*
Visit Constancy RiC	At least 1 PC visit in each time period	Nominal*
Gaps in Care RiC	Length of time between completed PC visits	Nominal*

**Measures are naturally continuous, but were dichotomized into discreet groups for this study.*

Principal Exposures

Research Question 1.

Individual-level demographic, psychological, and biological characteristics were analyzed for H_1, H_2, and H_3. Specific demographic independent variables (IVs) included age at first clinic contact, race, gender, and patient HIV risk factor. Psychosocial IVs included *depression* measured by the Patient Health Questionnaire-9 (PHQ-9) (Spitzer, Williams, Kroenke, Hornyak, & McMurray, 2000), *anxiety* measured by the PHQ Anxiety Module (PHQ-8) (Spitzer, et al., 2000), *alcohol risk* measured by the Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998), *substance abuse* measured by the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) (WHO ASSIST Working Group, 2002), and *quality of life* measured by the European Quality of Life

(EuroQOL) (Wu, et al., 2002). Patients' CD4 counts and viral loads determined through laboratory tests completed closest to first clinic contact were used to investigate the role of biologic influences on the principal outcomes. Additionally, ARV adherence scores were measured using the AIDS Clinical Trials Unit (ACTU) medication adherence instrument (ACTU-4) (Chesney, et al., 2000), and HIV symptomotology was measured using the HIV Symptoms Index (HIVSI) (Justice, et al., 2001)—both of which are captured at the clinic orientation appointment and systematically thereafter through the CNICS study. Each instrument identified above is included in Appendix D. Additionally, a summary scoring guide for all CNICS study PRO instruments is included in Appendix E.

Beyond biological and psychological characteristics, the study examines the effects of individual-level socioeconomic characteristics on suboptimal linkage and adherence to HIV primary medical care appointments. These characteristics were investigated for H_4, H_5, H_6, H_7, and H_8. Specific socioeconomic variables included insurance status as a proxy for socioeconomic status, enrollment in the Federally-funded Ryan What CARE Act as indicative of income level, level of education, employment status, marital status, and presence of children in the home.

Research Question 2.

In addition to individual-level measures, the study investigated a number of variables measured at the census tract and/or county levels. 2010 was used as the referent year for all variables included in the community modeling as the greatest number of study participants had their first contact with the 1917 Clinic during this year (approximately 45%). Most community data were available at the census tract level. However, some variables were included of which the county level was the smallest unit available (number of schools, for example).

Strain associated with family structure (contributors to community socioeconomic well-being) was investigated within H_1. Specific family structure variables analyzed included divorce rate, percentage of children under the age of 18 not living with both parents, percentage of female-headed households, percentage of single parent homes, number of families and individuals whose income in the past 12 months falls below the Federal Poverty Level (FPL), and percentage of unemployed individuals.

Social stressors were analyzed for H_2, H_3, H_4, H_5, and H_6. A measure of economic deprivation (H_2) consisted of median household income, percentage of families living below the poverty level in the past 12 months, and percentage of individuals at or below the age of 25 without a high school diploma. Income inequality (H_3) was defined by the Gini coefficient of income inequality (also known as the Gini Index of Neighborhood Inequality, see Kleiber & Kotz, 2002). This coefficient is an aggregate measure of economic inequality where higher values represent greater inequality. In order to model the effects of racial segregation (H_4), a calculation of the Lieberson's (1981) isolation index was completed. This variable was calculated from census tract-level data and measures the spatial isolation of any given minority group. It represents the likelihood that, based on the residential structure of the county/census tract and group size, African-Americans have the opportunity to interact with whites. To calculate Lieberson's index, the population of racial subgroups (for this research, "white," "black," and "other") within a specified subarea (e.g., a census tract) was each divided by the population of the respective racial subgroups within all subareas (e.g., a county). The age structure of a population represents a community strain when there are greater numbers of youth or elderly relative to the working age population (H_5). Therefore, the study included a youth dependency ratio (calculated as the ratio of those under age 18 to those aged 18 to 64) and an

elderly dependency ratio (the ratio of those over 64 to those aged 18 to 64). For H_6, the analyses included two measures of crime: A violent crime index comprised of murder, aggravated assault, forcible rape, and robbery and a property crime index including burglary, larceny-theft, motor vehicle theft, and arson. The crime data for the study represent aggregate rates of violent and property crime known to police and reported to the Federal Bureau of Investigation (FBI) at the county level and collected from individual agencies at the tract level (where available).

Communities are differentiated not only by the stressors they face, but the resources they can call upon. The study considered community resources as plausible influences on the principal outcomes (H_7, H_8, H_9, H_{10}, H_{11}, and H_{12}). Factors that are considered to be key indicators of the economic structure (H_7) of an area were included to assess the type of employment available in each county and census tract (Manufacturing; low-skill industry services; retail trade; and educational, health, and social services). To measure levels of employment versus types of employment, models included tract unemployment rates and labor force participation rates. As a measure of employment opportunity as well as availability of resources through local businesses (H_8), the presence of local businesses was investigated. This variable was defined as the number of local business establishments at the county level, as reported in the 2009 U.S. Census' ZIP Code Business Patterns, to capture local employment opportunities (versus aggregate occupations of residents in H_7 above). The quality and expense of the available housing stock (H_9) was measured with variables that included the ratio of homeowners to renters, the average age of available housing, the percentage of housing without full bathrooms and kitchens, and the percentage of households with rent or mortgage payments greater than 35% of the household income. Measures were included to analyze access to transportation (H_{10}) such as the percentage of households with access to an automobile (at the

tract and county levels) and a categorical measure indicating whether public bus service, private cab service, and/or unregulated (i.e., jitney) cab service are available in each county as obtained through an internet search of county business records, telephone directories, and local government offices. Local business directories and telephone books were used to record the number of hospitals and health clinic facilities in each county of patient residence including hospitals, private health clinics, substance abuse treatment facilities, public health clinics, mental health clinics, and social service agencies. This measure served as a proxy for social and health service access (H_{11}). Lastly, to assess access to and performance of local schools (H_{12}), local government directories were used to record the number of school systems in each county. State records of school test scores were then used to assess the quality of local schools. Specifically, school performance was measured by the national scale of Adequate Yearly Progress (AYP); school performance was operationalized as the percent of cells (indicators) met for AYP including reading and math.

Research Question 3.

Neighborhood Strain. Inherent in general strain theory is the conceptualization of *strain*. While a standard measurement of *strain* has yet to be established, GST researchers agree that three primary types of strain must be considered. According to Agnew and White (1992), these incidences of "strain, or negative relationships with others, occur when others 1) prevent or threaten to prevent one from achieving positively-valued goals, 2) remove or threaten to remove positively-valued stimuli that one possesses, or 3) present or threaten to present one with noxious or negatively-valued stimuli" (p. 476). Neighborhood-level strain occurs when these relationships are pervasive in a given community, or become community-level. Other GST researchers have followed this conceptualization, as well (Brezina, 1996; Hoffman & Su, 1998;

Agnew, 1999; Hoffman & Miller, 1999; Broidy, 2001; Agnew, Brezina, Wright & Cullen, 2002; Jang & Johnson, 2003; Warner & Fowler, 2003; Hoffman & Ireland, 2004), but each has ultimately operationalized *strain* differently. Previous studies have benefitted from prospective data collection which allows the researcher to incorporate surveys that include specific indices of strain available in the literature. This study—which analyzes retrospective, secondary data—does not have this luxury. Thus, a new measure for strain was necessitated.

Agnew argued that the three major types of strain should have a cumulative effect (Agnew & White, 2002). Hence, for the purposes of this study, available community-level strain, or risk, variables were designated as "Present" or "Not Present" and were scored a "1" or "0", respectively. Similarly, community-level protective variables were reverse coded as "Present" or "Not Present" and were scored "-1" or "0", respectively. Higher scores (>0) were indicative of strained neighborhoods while lower scores ($\leq$0) indicated a lesser degree of neighborhood strain. Since the values for continuous variables lay on a continuum from risk to protective, values greater than or equal to that of the state (mean, median, or mode) were scored as protective ("-1" or "0") and values less than that of the state were scored as strained ("1"). This scoring was inverted as dictated by the definition of particular variables.

Census tracts were assigned a strain score for each of the domains investigated at the community-level (suggested by Research Question #2)—economic deprivation, inequality, segregation, age structure, family structure, crime rate, labor market characteristics, local businesses, housing characteristics, access to transportation, social and health services, and schools. A composite strain score was calculated by adding strain for each of the 12 domains to model the mediating effect of cumulative community-level strain on linkage and adherence to HIV primary medical care appointments. Composite strain proved to be normally distributed as

illustrated in Figure 2 and Table 3 and as indicated in the related measures of central tendency and variability. Measures of central tendency for the Composite Strain outcome included the mean ± SD (15.55 ± 5.70), median (16.00), and mode (20.00). Measures of variability for the Composite Strain outcome included the range (minimum-maximum, 2.00-30.00), and interquartile range (9.00, lower quartile=11.00 and upper quartile=20.00).

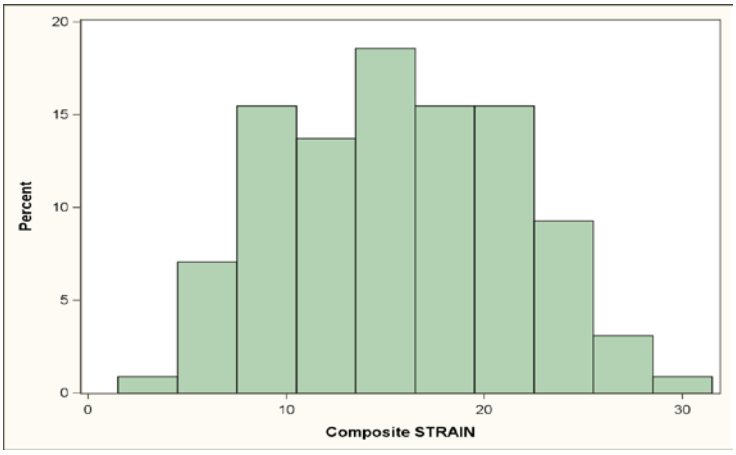
Table 3

Frequency Distribution for Composite Strain

Composite Strain Value	Frequencies	
	N=226	%
2	1	0.44
4	1	0.44
5	3	1.33
6	4	1.77
7	9	3.98
8	13	5.75
9	15	6.64
10	7	3.10
11	8	3.54
12	4	1.77
13	19	8.41
14	9	3.98
15	16	7.08
16	17	7.52
17	18	7.96
18	11	4.87
19	6	2.65
20	21	9.29
21	9	3.98
22	5	2.21
23	10	4.42
24	9	3.98
25	2	0.88
26	4	1.77
27	3	1.33
29	1	0.44
30	1	0.44

Figure 2.

Histogram of Composite Strain Outcome



Data Analysis

Data were analyzed using SAS version 9.3. Initial analyses of frequencies and descriptive statistics were conducted for all individual- and community-level independent variables (factors considered for Research Question #1 and Research Question #2) and for the community-level domains. The purpose of descriptive statistics is to provide a "picture" of the data and to inform subsequent steps in data analysis. A preliminary data query was conducted during the proposal development which yielded a sample size of 531. After review of the descriptive statistics, it was determined that some cases did not meet study inclusion criteria, and every effort was made to omit these cases. For example, cases with a residence address outside of Alabama were excluded (n=10), as well as those cases with a residence address at a known residential substance abuse treatment facility (n=18), cases with an initial first clinic contact date prior to 2009 (n=69) and cases with a suppressed viral load at the CONNECT visit (indicating that the patient was not treatment and/or ARV naïve) (n~180). Medical record abstraction was used to confirm baseline viral load. The final study sample included 226 participants.

Descriptive statistics were also run for all outcome measures and are included in Appendix F. While some of the principal outcomes are naturally dichotomous (e.g., linkage to care and the HRSA-HAB primary care adherence measure), all remaining outcomes were dichotomized, as well (e.g., visit constancy and visit adherence; see reasoning for dichotomizing retention measures above). Then, to model the relationship between individual-level factors and the principal outcome and between community-level strain domains (described below) and the principal outcome, only the use of simple logistic regression was necessary. Simple logistic regression is the common statistical test used when the dependent variable is nominal. The objective of simple logistic regression is to determine the probability of a value of the dependent variable being associated with the independent variable (McDonald, 2009). It is typically expressed with the odds ratio (OR).

For the Mediation Models (Research Question #3), statistically significant individual-level independent variables and independent community-level domains were analyzed within each model. Community-level independent variables within each community-level domain were also modeled. A composite strain measure (the sum of each community-level domain strain = *community-level strain*) was calculated and included as a community-level independent variable; it was modeled for each principal outcome, and its statistical significance in each model was determined. Community-level strain is hypothesized as a mediator between individual-level factors and suboptimal linkage and adherence to HIV primary medical care appointments. A description of how community-level strain is operationalized appears in the *Research Question 3* section above, and an example of calculation follows.

Community-level strain within the Economic Deprivation domain was calculated in the following manner (See Table 4).

Table 4

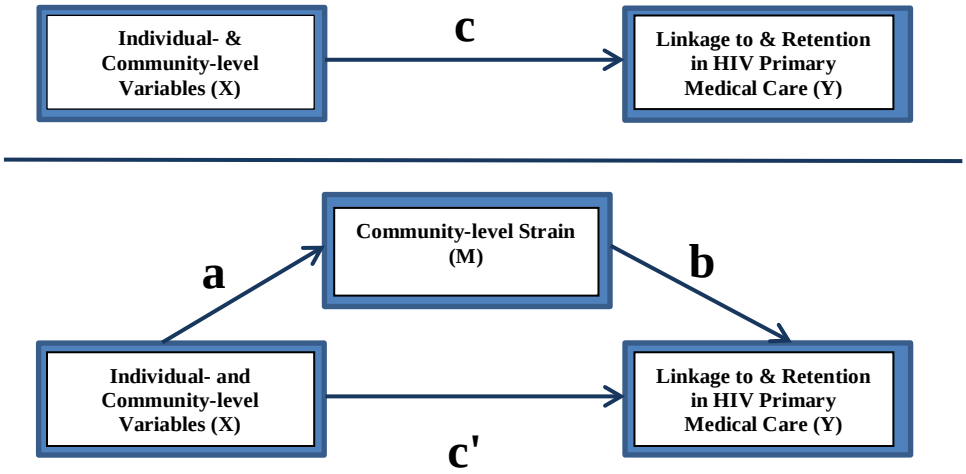
Calculation of Strain for Economic Deprivation Domain

Factor (at Census Tract)	Calculation	Value
A. Median Household Income	If higher than Alabama median ($42,081), Strain = No If lower than Alabama median ($42,081), Strain = Yes	-1 1
B. % Families below 100% of Poverty Level in past 12 months	If higher than Alabama percentage (13%), Strain = Yes If lower than Alabama percentage (13%), Strain = No	1 -1
C. % Individuals ≥ 25 years without High School Diploma	If higher than Alabama percentage (18.6%), Strain = Yes If lower than Alabama percentage (18.6%), Strain = No	1 -1
Economic Deprivation Domain	A + B + C	-3 to 3

Once all strain calculations were obtained, analysis then followed Barron & Kenny's (1986) steps for establishing mediation (Figure 3).

Figure 3

Barron & Kenny's (1986) Mediation Model



Barron and Kenny (1986) suggest four steps in determining mediation: Step 1: Show initial variable (X) is correlated with the outcome (Y); Step 2: Show initial variable (X) is correlated with the mediator (M); Step 3: Show mediator (M) affects the outcome variable (Y); and Step 4: To establish that M completely mediates the X-Y relationship, the effect of X on Y controlling for M (path c^i) should be zero. Figure 3 applies these steps to the study analysis

where X = statistically significant individual-level variables within a single outcome model identified through logistic regression for Research Question #1 and statistically significant community-level variables within a single outcome model identified through logistic regression for Research Question #2; Y = any principal outcome for the study (linkage to care, effective linkage to care, efficient linkage to care, or any of the five measures of HIV primary care appointment adherence); M = statistically significant community strain domains or community-level variables within the same outcome model as X identified through logistic regression for Research Question #2. All statistically significant individual-level and community-level variables ($p<.10$) were included as covariates in the mediation models (Research Question #3).

Protection of Human Subjects

As previously noted, the CNICS study, Project CONNECT, and the 1917 Clinic Cohort have received IRB approval through the UAB Office of Research Compliance. The author of the current study is included as an Investigator or other key personnel on each of these protocols. Additionally, approval to conduct the study was obtained from The University of Alabama (UA) Office for Research Compliance as the doctoral research is based in UA's School of Social Work. As aforementioned, the IRB approval may be reviewed in Appendix B.

CHAPTER 4

RESULTS

Demographic Frequencies

Of 226 patients included in the analysis, 150 were non-white (mostly African-American), and 76 were white. Generally speaking, the sample was male (85%), uninsured or having public insurance (60.6%), single (67.7%), and with no children in the home (93.8%). Mean age was 33.19 years (±11.13) and ranged from 18.17-75.21 years. Participants were more often between the ages of 25 and 49 years (63.7%), although the sample includes individuals under the age of 25 (27.9%) and over the age of 50 (8.4%). In terms of HIV risk factor, 58.9% (n=133) identified as men who have sex with men (MSM) followed by 28.8% (n=65) who identified as heterosexual. The sample was roughly split between individuals who were employed at baseline and those who were not. Sociodemographic characteristics of the study sample can be found in Table 5.

Biological and psychological characteristics were available through laboratory tests and self-report on standardized instruments completed at the clinic orientation visit (Table 6). Participants' CD4 and viral load were included as baseline measures when they occurred -21 days and +14 days from the baseline visit. The mean CD4 was 462.7 (±265.2) and ranged from 1-2,058; the mean viral load was 56,091 (±406,641.2) and ranged from 19-10,000,001. Overall, the study sample exhibited less advanced viremia as 48.7% (n=108) had baseline CD4 counts >350, and 44.6% (n=100) had baseline viral loads of <25,000, including eight individuals with a

suppressed viral load (≤250). Each of the suppressed viral load cases was investigated and confirmed as newly-diagnosed or treatment naïve through medical record abstraction.

Table 5

Sociodemographic Characteristics of Study Sample

Variable	Frequencies	
	N=226	%
Race		
White	76	33.6
Non-White	150	66.4
Gender		
Male	192	85.0
Female	34	15.0
Age*		
<25	63	27.9
25-34	77	34.1
35-49	67	29.6
≥50	19	8.4
Education**		
1st-8th Grade	2	0.9
9th-11th Grade	22	9.8
12th Grade/GED	56	24.9
Any College	145	64.4
Insurance		
Private	89	39.4
Public	19	8.4
None	118	52.2
Present Employment**		
Yes	97	49.5
No	99	50.5
Marital Status		
Married/Partnered	56	24.8
Separated/Divorced/Widowed	17	7.5
Single	153	67.7
Presence of Children in Home		
Yes	14	6.2
No	212	93.8
HIV Risk Factor		
Heterosexual	65	28.8
IVDU	13	5.8
MSM	133	58.9
Other/Unknown	15	6.6

**Age based on year 2010; Age is a continuous variable, but categorized here for descriptive purposes.*
***Excludes missing*

The study sample self-reported problems with depression (on the PHQ-9), anxiety (on the PHQ-A), alcohol use (on the AUDIT-C), and substance use (on the ASSIST). Specifically, 29.3% (n=60) reported moderate to severe depressive symptoms at baseline, and 24.8% (n=51)

reported anxiety symptoms or panic syndrome. Likewise, 21.6% of participants self-reported at-risk alcohol use (n=45), and 12.7% of participants self-reported current substance use (n=27).

Table 6

Biological and Psychological Characteristics of Study Sample

Variable* **	**Frequencies**	
	N=226	**%**
Depression (PHQ-9)*		
None/Mild	145	70.7
Moderate/Severe	60	29.3
Anxiety (PHQ-A)*		
No Anxiety	155	75.2
Anxiety Symptoms	34	16.5
Panic Syndrome	17	8.3
Alcohol Use (AUDIT-C)*		
No Risk	47	22.6
Low Risk	116	55.8
At Risk	45	21.6
Substance Use* (ASSIST)		
Current	27	12.7
Never	143	67.1
Prior	43	20.2
Baseline CD4*/**		
<200	63	28.4
200-350	51	23.0
>350	108	48.7
Baseline VL*/**		
<250	8	3.5
250-25,000	92	41.1
25,001-100,000	63	28.1
>100,000	61	27.2

**Excluded missing*
***CD4 and VL at CONNECT visit, -21 days, +14 days of CONNECT date*
****EuroQOL, HIVSI, and ACTU-4 frequencies not included, but available upon request.*

Frequencies of participants linked to census tracts by residence address (N=161) yielded a range of 1 to 6 participants per tract. The modal number of participants per census tract was one (n=119, 74%). Thus, the majority of census tracts did not demonstrate a clustering effect, and the decision was made by the candidate in consultation with his committee to model the community-level characteristics of each census tract as additional characteristics of the individual residing in the defined area. Community-level characteristics, then, are described in

Table 7 as characteristics of the individuals included in the sample (N=226) rather than as characteristics of the census tracts (N=161).

Table 7

*Select Community Sociodemographic Characteristics (from Census Tract**)*

Domain/Variables	Mean ± SD	(Minimum, Maximum)
Economic Deprivation Domain	**0.51 (2.53)**	**(-3.00-3.00)**
Median Household Income	42044.74 (22238.02)	(11629.00, 154324.00)
% of Families Below 100 percent of the Poverty Level in the Past 12 Months	15.59 (12.46)	(0.00-56.60)
% of Individuals Age >25 Without a High School Diploma Non-White	28.13 (18.25)	(0.00-73.80)
Inequality Domain	**0.26 (0.44)**	**(0.00-1.00)**
Gini Index of Neighborhood Inequality	0.44 (0.07)	(0.29-0.63)
Segregation Domain	**0.82 (0.38)**	**(0.00-1.00)**
Lieberson Isolation Index	0.60 (0.21)	(0.02-0.87)
Age Structure Domain	**0.82 (0.68)**	**(0.00-2.00)**
Youth Dependency Ratio	35.10 (9.83)	(4.69-57.58)
Elder Dependency Ratio	21.12 (8.04)	(3.44-47.07)
Family Structure Domain*	**1.69 (1.09)**	**(0.00-4.00)**
Divorce Rate	13.54 (4.30)	(4.20-29.60)
Total % Households—Both Male and Female Householders with Own Children Under Age 18	12.05 (7.40)	(0.00-31.60)
% Households with children under age 18 who are not living with both parents	27.33 (8.57)	(0.00-55.50)
% Female-Headed Households	19.16 (11.58)	(0.50-45.90)
Crime Rate Domain*/**	**0.22 (0.42)**	**(0.00-1.00)**
Overall Crime Rate per/1,000 for Reported Crimes	22.96 (25.57)	(0.00-128.44)
Labor Market Characteristics Domain	**6.38 (2.53)**	**(1.00-12.00)**
Mean Travel Time to Work in Minutes	23.00 (5.15)	(13.50-42.20)
Rate of Employment by Manufacturing Industry for Civilians Age 16 and Older	11.06 (6.41)	(0.00-32.50)
Rate of Employment by Retail Trade Industry for Civilians Age 16 and Older	11.77 (4.64)	(2.10-24.50)
Rate of Employment by Educational, Health, and Social Services (EHS) Industry	23.76 (7.30)	(2.20-51.10)
Rate of Employment by Low-Skills Industry (Construction, Transportation, and/or Arts)	20.54 (7.96)	(5.30-46.60)
Percent of Households With Earnings	74.62 (10.24)	(42.10-96.50)
Percent of Households With Social Security	31.63 (10.31)	(7.30-56.30)
Percent of Households With Retirement Income	18.09 (6.43)	(1.80-36.70)
Percent of Households With Supplemental Security Income	6.71 (5.82)	(0.00-31.20)
Percent of Households With Cash Public Assistance Income	1.87 (1.96)	(0.00-10.00)
Percent of Households With Food Stamp/SNAP Benefits in the last 12 Months	13.64 (10.73)	(0.00-47.60)
Percent of Unemployed Persons Age 16 and Older	6.09 (3.19)	(0.40-16.80)
Percent of Persons Age 16 and Older Participating in Labor Force	60.55 (9.95)	(33.20-85.50)
Local Businesses Domain**	**-0.39 (0.49)**	**(-1.00-0.00)**
Number of Local Business Establishments (per ZIP Code)	697.37 (682.26)	(0.00-2961.00)
Housing Characteristics Domain*	**3.25 (1.46)**	**(0.00-7.00)**
Ratio of Homeowners to Renters	3.23 (3.76)	(0.08-30.89)
Median Age of Available Housing [in years]	35.67 (15.69)	(5.00-71.00)
Percent of Available Housing Units Lacking Complete Plumbing	0.34 (0.79)	(0.00-6.80)
Percent of Available Housing Units Lacking Complete Kitchens	0.51 (0.92)	(0.00-5.30)
Percent of Available Housing Units Lacking Telephone Service	3.24 (2.92)	(0.00-17.80)
Total % Housing Units (with rent or mortgage payment) > 35% of Household Income	25.22 (10.16)	(6.30-51.12)
Access to Transportation Domain*	**0.35 (0.48)**	**(0.00-1.00)**
Percent of Households with access to an automobile	95.88 (5.21)	(75.60-100.00)
Access to Social and Health Services Domain*/**	**0.40 (0.49)**	**(0.00-1.00)**
Total Number of Social and Health Services	271.84 (144.71)	(11.00-389.00)
Schools Domain**	**1.24 (0.59)**	**(0.00-2.00)**
Number of Schools	7.72 (5.25)	(0.00-23.00)
Percent of Cells Met for Adequate Yearly Progress	89.55 (3.64)	(83.42-100.00)

**Not all variables within these domains shown.*

***Information not available at the census tract level. Smallest unit available was used (no larger than county-level).*

Study participants resided in census tracts with a median household income of $42,044.74 (*SD* ± $22,238.02). On average, 15.59% (*SD* ± 12.46%) of families in the census tracts lived below 100% of the FPL over the past 12 months. Community-level inequality and segregation were both moderate as the average Gini Index was 0.44 (*SD* ± 0.07) and the average Lieberson Isolation Index was 0.60 (*SD* ± 0.21). Communities were also younger on average (Youth Dependency Ratio=35.10, *SD* ± 9.83). Community divorce rates were 13.54 (*SD* ± 4.30), and 19.16% (*SD* ± 11.58%) of households were female-headed. Additionally, overall crime in the areas was low (Crime Rate=22.96, *SD* ± 25.57), and residents primarily generated household financial support through earnings (74.62%, *SD* ± 10.24). People living in these communities, on average, had access to their own transportation, social and health care resources, and schools with reasonably good academic performance. On each of these measures, excluding divorce rate and percent of households with earnings, census tract information included in the study was equal to or worse than statistics for the State of Alabama.

Bivariate Analyses

Bivariate associations investigated in this study are presented as individual-level and community-level in Tables 7 and 8. For all bivariate analyses, linkage to care was modeled as not linked to care within 183 days of baseline; efficient linkage to care was modeled as not efficiently linked to care within 60 days of baseline; effective linkage to care was modeled as not effectively linked to care with two arrived primary care appointments within 183 days of baseline; missed visits was modeled as at least one no-show appointment in the study period; visit adherence was modeled as the kept-visit proportion (KVP) less than or equal to 80%; visit constancy was modeled as four-month constancy less than 100%; gaps in care was modeled as more than 183 days between arrived visits; and the HRSA-HAB measures was modeled as not

being met, or not having two arrived visits in the study year more than 90 days apart. Frequency distributions for all study outcomes are included in Appendix F.

Perhaps the most striking result from this analysis is the inconsistency of results across principal outcomes (discussed further in Chapter 5). Additionally, the bivariate analyses failed to establish an association between the composite measure of strain and any of the study outcomes. However, there are several notable associations worthy of further discussion.

Bivariate Analyses of Individual-Level Factors.

Sixty-six individual-level variables were modeled with the eight principal outcomes (528 combinations). Logistic regression analyses replicated findings in the existing literature that purports associations between race and insurance status and some of the principal outcomes. Table 8 illustrates the results of all logistic regression models for the included individual-level factors. Race (dichotomized as non-white vs. white) was found to have strong associations with less efficient linkage to care (OR=4.13, 95% CI=1.39-12.26), missed visits (OR=2.36, 95% CI=1.34-4.16), and visit adherence (OR=1.94, 95% CI, 1.07-3.51). Participants who were uninsured or had public health insurance were, respectively, 2.66 times (95% CI=1.51-4.68) and 3.68 times (95% CI=1.28-10.60) more likely than participants with private health insurance to have at least one no-show appointment in a 12-month period (missed visits measure). Similarly, when insurance was modeled with the visit adherence (KVP) outcome, uninsured participants were 2.98 times (95% CI=1.61-5.52) more likely than privately insured participants to have a KVP of ≤80%; those with public insurance were 5.66 times (95% CI=1.96-16.29) more likely than privately insured participants to have a lower KVP (≤80%). Current substance use (vs. never using substances) was associated with missed visits (OR=3.97, 95% CI=1.51-10.42) and lower visit adherence (OR=2.34, 95% CI=1.01-5.42).

Across all outcome measures, one of the strongest associations was found between participant's employment status and four of the eight principal outcomes. Being employed (dichotomized as Yes vs. No) was associated with less effective linkage to care (OR=3.11, 95% CI=1.16-8.34), <100% visit constancy (OR=5.26, 95% CI=2.12-13.05), gaps in care (OR=7.43, 95% CI=3.02-18.25), and failure to meet the HRSA-HAB adherence measure (OR=6.81, 95% CI=2.57-18.03).

Additionally, strong associations ($p<0.05$) are also noted for presence of children in the home for less effective (OR=3.65, 95% CI=1.14-11.68) and less efficient (OR=3.81, 95% CI=1.19-12.21) linkage to care, but this association was attenuated in the linkage to care model. Self-reported depression as assessed by the PHQ-9 appears to play a role in effective and efficient linkage to care and missed visits measures. When dichotomized as those reporting severe depression and those reporting no depressive symptoms, participants reporting severe depression were 4.01 times (95% CI=1.10-14.58), 3.67 times (95% CI=1.02-13.25), and 12.65 times (95% CI=1.56-102.32) more likely than participants reporting no depressive symptoms to have less efficient linkage to care, less effective linkage to care, and at least one missed visit, respectively. Finally, participants who reported some skipping of ARV doses were more likely than those who reported never skipping doses to miss visits (OR=3.58, 95% CI=1.32-9.73) and to have lower KVP (OR=3.20, 95% CI=1.21-8.46).

Four items on the HIV Symptom Inventory (HIV-SI) were found to have associations of varying strength with some of the principal outcomes. Not surprisingly, individuals who self-reported trouble remembering were more likely than those who did not report the symptom to have missed visits (OR=3.10, 95% CI=1.47-6.51) and ≤80% visit adherence (OR=2.09, 95% CI=1.03-4.24). The association between self-reported skin problems and the linkage to care

principal outcomes, although the statistical significance of this relationship was variable (i.e., a weaker statistically significant association was found for linkage to care and effective linkage to care than the association found for efficient linkage to care). Self-reported bloating pain or gas was found to be strongly associated with more missed visits ($p<0.05$), but attenuated with visit adherence and gaps in care ($p<0.10$). Participants who self-reported muscle aches and joint pain were strongly associated with missed visits ($p<0.05$), but weaker—although still significantly significant at $p<0.10$—with visit adherence. Beyond the obvious correlation between trouble remembering and measures of adherence, the other HIV symptoms associated with the principal outcomes are more difficult to explain and beyond the scope of this study.

All other individual-level independent variables failed to demonstrate statistically significant associations on more than one of the principal outcomes. The only exception to this finding is HIV risk factor when dichotomized as other risk factor or unknown vs. heterosexual risk. This variable was found to be associated with every principal outcome except the missed visits adherence measure. However, these findings are not practically significant and have been omitted from subsequent steps in the analysis. Results from each hypothesis for Research Question #1 (individual-level question) are further discussed below.

Hypothesis 1. These analyses of individual-level factors tested the hypothesis that individual-level demographic characteristics are associated with suboptimal linkage and adherence to HIV primary medical care appointments. Specifically, H_1 suggests that a) younger age is negatively associated with principal outcomes, b) African-American race is negatively associated with principal outcomes, c) being female is negatively associated with principal outcomes, and d) HIV risk factor can be negatively associated with principal outcomes. These

analyses were accomplished by regressing each individual-level demographic characteristic and each principal outcome.

Findings from these analyses were varied. In this case, there is not ample evidence to reject the null hypothesis that younger age is not adversely associated with the principal outcomes. As described above, the analyses for H_{1b} suggest that race is associated with less efficient linkage to care, increased missed visits, and poorer visit adherence. The null hypothesis cannot be rejected that being African-American is not associated with the principal outcomes because the race variable was dichotomized into two groups (non-white vs. white), and does not reflect a model using African-American race only. The association between gender and the principal outcomes, likewise, could not be established, and the null hypothesis (H_{1c}) could not be rejected. A statistically significant relationship between gender and less efficient linkage to care was demonstrated (OR=2.65, 95% CI=1.10-6.36), but this association was not found for the remaining outcomes. To further investigate possible associations between race and the outcomes, race was categorized into three additional sets—black females, black males, and white females vs. white males as the referent. In this manner, the associations for race were further explained. In comparison to white males, black females were 7.06 times (95% CI=0.98-25.17) more likely to exhibit less efficient linkage to care and 2.36 times (95% CI=1.00-5.56) to have missed visits. In comparison to white males, black males were 3.28 times (95% CI=1.07-10.06) more likely to have less efficient linkage to care, 2.52 times (95% CI=1.38-4.59) more likely to have missed visits, and 1.94 times (95% CI=1.04-3.63) more likely to have poorer visit adherence. Associations could not be established between white females and white males for any outcome. The analyses for H_{1d} suggest that HIV risk factor will predict the principal outcomes. HIV risk factor was categorized as intravenous drug use (IVDU), MSM, and

other/unknown and modeled in comparison to heterosexual risk. Only IVDU was found to be associated with any principal outcome. When compared to individuals with heterosexual risks for HIV, IVDUs were 5.67 times (95% CI=1.16-27.61) more likely to have missed visits and were 5.06 times (95% CI=1.39-18.39) more likely to have poorer visit adherence. As discussed above, statistical significance was observed for the other/unknown HIV risk and several of the principal outcomes, but it is difficult to explain this relationship.

Hypothesis 2. These analyses of individual-level factors tested the hypothesis that individual-level psychosocial characteristics are associated with suboptimal linkage and adherence to HIV primary medical care appointments. Specifically, H_2 suggests that a) higher levels of self-reported depressive symptomotology is negatively associated with principal outcomes, b) higher level of self-reported anxiety is negatively associated with principal outcomes, c) higher rates of self-reported alcohol use is negatively associated with principal outcomes, d) higher rates of self-reported substance use is negatively associated with principal outcomes, and e) lower self-reported quality of life is negatively associated with principal outcomes. These analyses were accomplished by regressing each individual-level psychosocial characteristic and each principal outcome.

The results of the simple logistic regression analyses were varied. For H_{2a}, an association between depression and the principal outcomes was determined for effective linkage to care, efficient linkage to care, and missed visits, as previously described. The association with missed visits was maintained (OR=2.10, 95% CI=1.13-3.92) when the depression variable was categorized differently (moderate/severe depression vs. mild/no depression). For these models, the null hypotheses were rejected; however, the null hypotheses could not be rejected for the remaining five principal outcomes. Likewise, the association between anxiety and the principal

outcomes (H_{2b}) could not be established for any model, and the null hypotheses are not rejected. For H_{2c}, a weak association ($p<0.10$) between self-reported alcohol use and visit constancy was identified. The dichotomized alcohol use variable used in the model comparing participants scoring at risk for alcohol use and participants scoring no risk yielded the association (OR=2.04, 95% CI=0.87-4.76) with <100% visit constancy. All remaining hypotheses could not be rejected. Self-reported substance (H_{2d}) use was found to be associated with both missed visits (OR=3.97, 95% CI= 1.51-10.42) and visit adherence (OR=2.34, 95% CI=1.01-5.42) when self-reported current substance use was compared to no history of substance use. The associations could not be achieved when investigating self-reported prior substance use vs. no substance use history. Hence, the null hypothesis is rejected that self-reported substance use is not associated with the aforementioned outcomes as current substance use is strongly associated with both. The remaining null hypotheses could not be rejected. Lastly, EuroQOL responses were treated as individual variables instead of obtaining an aggregate score for the instrument. This allowed for the independent investigation of very different domains within the EuroQOL. When modeling each EuroQOL item with the principal outcomes, the strongest association ($p=0.0107$) was found for pain/discomfort. Participants reporting pain/discomfort at baseline (the clinic orientation visit) were 2.14 times (95% CI=1.19-3.85) more than those who did not report pain/discomfort to have at least one no-show appointment during the study period (missed visits outcome). Weaker associations were found for mobility ($p=0.0720$) and self-care issues ($p=0.0758$) and the missed visits outcome. No other EuroQOL questions achieved a statistically significant association with the remaining outcomes, and the null hypotheses could not be rejected.

Hypothesis 3. These analyses of individual-level factors tested the hypothesis that individual-level biologic markers/characteristics are associated with suboptimal linkage and

adherence to HIV primary medical care appointments. Specifically, H_3 suggests that a) higher CD4 counts at baseline are negatively associated with principal outcomes, b) higher viral load at baseline is negatively associated with principal outcomes, c) lower adherence scores are negatively associated with principal outcomes, and d) higher self-reports of HIV symptomotology are negatively associated with principal outcomes. These analyses were accomplished by regressing each individual-level biologic marker/characteristic and each principal outcome.

Results from these analyses varied. For H_{3a}, the null hypotheses could not be rejected. However, upon further investigation of baseline CD4 count, a weak association was achieved when the variable was dichotomized into CD4 counts of 200-350 and CD4 counts of >350, effectively omitting the sickest cases. This model found that participants with baseline CD4 counts between 200-350 were 0.37 times (95% CI=0.12-1.16) less likely to have less efficient linkage to care than participants with baseline CD4 counts of >350. Similarly, baseline viral load results (H_{3b}) could not be associated with the principal outcomes, and all but one of the models using this variable could not reject the null hypotheses. A weak association was found between baseline viral load and effective linkage to care; for every one unit increase in the log10(vL), participants were 0.74 times (95% CI=0.52-1.05) less likely to not effectively link to care. The results for H_{3c} have been provided previously. In addition to the associations between missing doses of ARVs and missed visits and between missing doses of ARVs and visit adherence, other associations were found between ACTU-4 items and the study outcomes. Also associated with missed visits, differences between participants who reported that their ability to take their ARVs in the past four weeks was excellent and those whose ability was not excellent was observed (OR=2.69, 95% CI=1.02-7.08); also, differences between participants who

reported zero missed doses of ARVs in the past four days and those who reported missing more than zero doses was observed (OR=8.41, 95%CI=1.78-39.81). Individuals who reported currently taking ARVs were also found to be 0.39 times (95% CI=0.17-0.92) less likely to have gaps in primary care visits than individuals who reported not currently taking ARVs. As described previously, considerable variability was observed for each of HIV Symptom Inventory items when modeled with the principal outcomes. In all, 14 of the 120 models found statistical significance (and, hence, an association) between the independent variables (specific HIV-SI item) and the dependent variable (specific outcome). The remaining 106 models were unable to reject the null hypotheses. The majority of associations were found between the respective HIV-SI symptom and the missed visits outcome, although associations were also seen for HIV-SI symptoms and all three linkage to care outcomes and visit adherence.

Hypothesis 4. These analyses of individual-level factors tested the hypothesis that individual-level economic status is associated with suboptimal linkage and adherence to HIV primary medical care appointments. Specifically, H_4 suggests that a) insurance status is associated with principal outcomes and/or b) enrollment in the Ryan White C.A.R.E. Act program is associated with principal outcomes. These analyses were accomplished by regressing each individual-level economic characteristic and each principal outcome.

Modeling of insurance and principal outcomes has been discussed above and resulted in rejecting the null hypotheses which included uninsured vs. private insurance and missed visits, uninsured vs. private insurance and visit adherence, public insurance vs. private insurance and missed visits, and public insurance vs. private insurance and visit adherence. A weaker association was also found for public insurance vs. private insurance and efficient linkage to care. This means that participants who were publicly insured were 2.82 times (95% CI=0.84-

9.51) more likely than participants who were privately insured to have less efficient linkage to care. In all other related models, the null hypotheses could not be rejected. Additionally, the analysis could not demonstrate a relationship between being enrolled in the Ryan White C.A.R.E. Act and any of the principal outcomes.

Hypothesis 5. These analyses of individual-level factors tested the hypothesis that individual-level educational characteristics are associated with suboptimal linkage and adherence to HIV primary medical care appointments. Specifically, H_5 suggests that lower educational attainment is negatively associated with principal outcomes. This was investigated by regressing each individual-level educational characteristic and each principal outcome.

The education variable was analyzed in a number of ways, each splitting the participants into roughly equal groups while maintaining meaningful categories. The null hypotheses could not be rejected for any of the models when education was categorized with 12th grade/GED as the referent (1st-8th vs. 12th grade/GED, 9th-11th vs. 12th grade/GED, and any college vs. 12th grade/GED). When the variable was dichotomized into a group for any college and a group for ≤12th grade, statistical significance was achieved for the missed visits and visit adherence outcomes. As such, these models determined that participants with a 12th grade education or less are 1.65 times (95% CI=0.95-2.87) more likely than participants with any college training (including post-high school vocational training) to miss visits, and they are 1.64 times (95% CI=0.94-2.87) more likely than participants with any college to have poorer visit adherence.

Hypothesis 6. These analyses of individual-level factors tested the hypothesis that individual-level employment characteristics are associated with suboptimal linkage and adherence to HIV primary medical care appointments. Specifically, H_6 suggests that lack of

stable employment is negatively associated with principal outcomes. This was investigated by regressing the individual-level employment characteristic and each principal outcome.

H_6 has been adequately described above. Employment proved to perform most consistently across the study outcomes. The null hypotheses were rejected for models including effective linkage to care, visit constancy, gaps in care, and the HRSA-HAB adherence measure. In the remaining four models, the null hypotheses could not be rejected.

Hypothesis 7. These analyses of individual-level factors tested the hypothesis that individual-level family characteristics are associated with suboptimal linkage and adherence to HIV primary medical care appointments. Specifically, H_7 suggests that a) marital status is associated with principal outcomes and b) absence of children in the home is associated with principal outcomes. These analyses were accomplished by regressing each individual-level family characteristic and each principal outcome.

All null hypotheses for H_{7a} could not be rejected. No associations were found between marital status and any of the principal outcomes. For H_{7b}, the associations between presence of children in the home and less efficient and less effective linkage to care have previously been described. All other null hypotheses could not be rejected.

Table 8

Individual-Level Independent Variables Modeled for Each Principal Outcome with Odds Ratios and 95% Confidence Interval

		Linkage to Care (LTC) Measures			Retention in Care (RIC) Measures				
	Independent Variables	**LTC OR (95% CI)**	**Efficient LTC OR (95% CI)**	**Effective LTC OR (95% CI)**	**Missed Visits OR (95% CI)**	**Visit Adherence OR (95% CI)**	**Visit Constancy OR (95% CI)**	**Gaps in Care OR (95% CI)**	**HRSA-HAB OR (95% CI)**
Sociodemographic Independent Variables	*Age at orientation (Unit=10)*	1.13 (0.68- 1.89)	0.81 (0.56-1.18)	0.84 (0.59-1.21)	0.91 (0.72-1.15)	**0.68 (0.52-0.90)****	0.94 (0.74-1.20)	0.92 (0.70-1.20)	1.01 (0.73-1.39)
	CD4 at orientation (Unit=50)	0.98 (0.87-1.11)	1.04 (0.97-1.11)	1.02 (0.95-1.10)	0.99 (0.94-1.04)	1.05 (0.99-1.10)	1.04 (0.99-1.09)	1.03 (0.97-1.09)	1.02 (0.95-1.09)
	<200 vs. >350	1.76 (0.43-7.31)	0.55 (0.22-1.39)	0.83 (0.35-1.99)	1.59 (0.85-2.98)	0.70 (0.36-1.35)	0.73 (0.38-1.39)	0.74 (0.36-1.51)	0.78 (0.33-1.85)
	200-350 vs. >350	1.62 (0.19-2.54)	**0.37 (0.12-1.16)***	0.54 (0.19-1.56)	1.36 (0.70-2.66)	1.09 (0.55-2.13)	1.10 (0.56-2.17)	1.19 (0.58-2.42)	0.87 (0.35-2.15)
	Log10(VL) at orientation (Unit=1)	0.81 (0.45-1.44)	0.75 (0.52-1.07)	**0.74 (0.52-1.05)***	1.14 (0.88-1.48)	0.94 (0.71-1.22)	0.95 (0.73-1.23)	0.97 (0.73-1.29)	0.92 (0.65-1.30)
	Race (Non-White vs. White)	2.36 (0.50-11.21)	**4.13 (1.39-12.26)****	1.70 (0.73-3.97)	**2.36 (1.34-4.16)****	**1.94 (1.07-3.51)****	1.02 (0.58-1.80)	1.47 (0.78-2.76)	1.63 (0.73-3.68)
	BF vs. WM	1.18 (0.10-13.55)	**7.06 (1.98-25.17)****	1.95 (0.61-6.19)	**2.36 (1.00-5.56)****	2.00 (0.84-4.78)	0.88 (0.37-2.12)	1.57 (0.62-3.97)	1.37 (0.42-4.47)
	BM vs. WM	2.56 (0.53-12.40)	**3.28 (1.07-10.06)****	1.54 (0.64-3.73)	**2.52 (1.38-4.59)****	**1.94 (1.04-3.63)****	1.12 (0.62-2.04)	1.49 (0.76-2.90)	1.61 (0.70-3.73)
	WF vs. WM	0.00 (0.00-I)	0.00 (0.00-I)	0.00 (0.00-I)	3.41 (0.29-39.36)	1.21 (0.10-14.12)	3.21 (0.28-37.11)	1.65 (0.14-19.30)	0.00 (0.00-I)
	Gender (Female vs. Male)	0.55 (0.07-4.45)	**2.65 (1.10-6.36)****	1.31 (0.50-3.46)	1.37 (0.65-2.87)	1.25 (0.60-2.62)	0.92 (0.44-1.96)	1.22 (0.56-2.68)	0.90 (0.32-2.49)
	HIV Risk Factor								
	IVDU vs. Heterosexual	0.00 (0.00-1.00)	1.30 (0.24-6.94)	2.49 (0.55-11.25)	**5.67 (1.16-27.61)****	**5.06 (1.39-18.39)****	2.44 (0.73-8.18)	2.63 (0.77-8.96)	1.30 (0.24-6.94)
	MSM vs. Heterosexual	0.98 (0.009-10.98)	0.77 (0.30-1.97)	0.97 (0.37-2.55)	0.99 (0.54-1.78)	1.40 (0.74-2.63)	1.22 (0.65-2.29)	0.97 (0.49-1.94)	0.97 (0.39-2.41)
	Other/Unknown vs. Heterosexual	**73.14 (7.94-673.76)****	**10.69 (3.00-38.08)****	**12.43 (3.40-45.46)****	2.06 (0.63-6.70)	**4.50 (1.21-16.69)****	**13.61 (2.81-65.87)****	**8.42 (2.35-30.17)****	**14.25 (3.87-52.49)****
	Insurance								
	None vs. Private	0.74 (0.21-2.65)	1.33 (0.58-3.06)	1.61 (0.71-3.64)	**2.66 (1.51-4.68)****	**2.98 (1.61-5.52)****	1.11 (0.63-1.95)	0.99 (0.54-1.83)	1.12 (0.52-2.41)
	Public vs. Private	0.93 (0.10-8.48)	**2.82 (0.84-9.51)***	1.48 (0.37-5.99)	**3.68 (1.28-10.60)****	**5.66 (1.96-16.29)****	1.18 (0.43-3.22)	1.49 (0.53-4.23)	1.56 (0.45-5.44)
	Enrolled in Ryan White (Yes vs. No)	0.34 (0.07-1.70)	0.50 (0.15-1.65)	0.78 (0.21-2.89)	1.62 (0.59-4.41)	1.47 (0.49-4.39)	0.56 (0.21-1.52)	0.72 (0.26-2.04)	0.59 (0.18-1.92)
	Education								
	1st-8th vs. 12th Grade/GED	13.00	5.22	7.00	1279925	1.29	1.95	2.50	3.67

		(0.68-248.99)	(0.30-91.38)	(0.39-125.04)	(0.00-1.00)	(0.08-21.73)	(0.12-32.88)	(0.15-42.42)	(0.21-63.05)
	9th-11th vs. 12th Grade/GED	0.62 (0.07-5.87)	1.16 (0.32-4.25)	1.11 (0.26-4.72)	2.31 (0.79-6.77)	1.55 (0.57-4.19)	1.62 (0.59-4.43)	1.43 (0.50-4.06)	0.81 (0.23-2.87)
	Any College vs. 12th Grade/GED	0.46 (0.12-1.80)	0.74 (0.31-1.76)	1.25 (0.50-3.12)	0.79 (0.42-1.46)	0.69 (0.37-1.31)	1.34 (0.70-2.55)	0.92 (0.46-1.83)	0.55 (0.25-1.23)
	≤High School Grad vs. Any College	2.27 (0.67-7.69)	1.50 (0.70-3.20)	0.89 (0.41-1.95)	**1.65 (0.95-2.87)***	**1.64 (0.94-2.87)***	0.87 (0.50-1.53)	1.24 (0.68-2.25)	1.79 (0.87-3.68)
	Employed								
	Missing/Unknown vs. No	2.29 (0.36-14.36)	1.70 (0.62-4.64)	**3.11 (1.16-8.34)****	0.81 (0.36-1.86)	1.74 (0.74-4.05)	**5.26 (2.12-13.05)****	**7.43 (3.02-18.25)****	**6.81 (2.57-18.03)****
	Yes vs. No	2.11 (0.51-8.69)	0.64 (0.27-1.51)	1.02 (0.44-2.40)	**0.44 (0.25-0.77)****	**0.56 (0.31-1.02)***	1.03 (0.57-1.86)	1.22 (0.63-2.38)	1.38 (0.57-3.31)
	Marital Status								
	Separated/Divorced/Widow vs. Married/Partnered	0.00 (0.00-487E225)	0.64 (0.07-5.87)	0.80 (0.15-4.18)	1.77 (0.59-5.32)	0.86 (0.26-2.80)	1.08 (0.36-3.27)	1.13 (0.31-4.10)	2.56 (0.63-10.45)
	Single vs. Married/Partnered	1.69 (0.35-8.06)	2.09 0.76-5.74)	1.06 (0.44-2.53)	1.47 (0.79-2.72)	1.55 (0.81-2.97)	1.02 (0.55-1.92)	1.73 (0.84-3.56)	1.71 (0.66-4.39)
	Children in the Home (Yes vs. No)	3.76 (0.73-19.36)	**3.81 (1.19-12.21)****	**3.65 (1.14-11.68)****	0.49 (0.16-1.50)	0.67 (0.20-2.24)	1.14 (0.38-3.41)	0.99 (0.30-3.28)	2.25 (0.66-7.61)
Biological-Psychological Independent Variables	*PHQ-9 (Depression)*								
	Mild vs. No Depressive Symptoms	0.47 (0.009-2.40)	0.88 (0.34-2.28)	0.93 (0.37-2.30)	1.04 (0.53-2.02)	0.74 (0.37-1.47)	0.81 (0.41-1.58)	0.60 (0.29-1.26)	0.68 (0.28-1.64)
	Moderate vs. No Depressive Symptoms	0.89 (0.17-4.65)	0.58 (0.15-2.19)	0.34 (0.07-1.60)	1.48 (0.65-3.35)	0.84 (0.36-1.94)	0.49 (0.21-1.19)	0.69 (0.29-1.69)	0.54 (0.17-1.74)
	Moderately Severe vs. No Depressive Symptoms	0.00 (0.00-339E221)	0.37 (0.05-3.08)	0.73 (0.15-3.60)	1.92 (0.64-5.74)	1.09 (0.37-3.20)	0.76 (0.25-2.27)	**0.25 (0.05-1.19)***	0.25 (0.03-2.04)
	Severe vs. No Depressive Symptoms	1.21 (0.13-11.04)	**4.01 (1.10-14.58)****	**3.67 (1.02-13.25)****	**12.65 (1.56-102.32)****	2.80 (0.78-10.03)	1.77 (0.52-6.01)	1.27 (0.37-4.33)	1.89 (0.51-6.99)
	Moderately Severe/Severe vs. None/Mild	0.90 (0.23-3.52)	1.04 (0.45-2.43)	0.94 (0.41-2.13)	**2.10 (1.13-3.92)****	1.29 (0.70-2.38)	0.80 (0.43-1.48)	0.78 (0.40-1.53)	0.77 (0.34-1.76)
	PHQ-A (Anxiety)								
	Anxiety Symptoms vs. No Anxiety	0.64 (0.08-0.5.39)	0.48 (0.14-1.69)	0.50 (0.14-1.77)	1.45 (0.68-3.07)	1.33 (0.63-2.80)	1.12 (0.53-2.37)	1.07 (0.48-2.36)	0.82 (0.29-2.30)
	Panic Syndrome vs. No Anxiety	2.82 (0.54-14.81)	0.66 (0.14-3.07)	1.11 (0.30-4.16)	2.43 (0.82-7.22)	0.81 (0.29-2.32)	0.59 (0.20-1.76)	0.30 (0.07-1.35)	0.63 (0.14-2.93)
	AUDIT-C (Alcohol Use)								
	Low Risk vs. No Risk	0.80 (0.14-4.54)	0.58 (0.23-1.45)	1.09 (0.40-2.99)	1.20 (0.61-2.36)	1.02 (0.51-2.06)	1.56 (0.76-3.19)	1.41 (0.65-3.09)	1.60 (0.60-4.24)
	At Risk vs. No Risk	2.81 (0.52-15.31)	1.06 (0.38-2.96)	1.95 (0.64-5.91)	1.19 (0.53-2.70)	1.23 (0.53-2.86)	**2.04 (0.87-4.76)***	1.64 (0.65-4.09)	1.26 (0.39-4.08)
	ASSIST (Substance Use)								
	Current Use vs. Never	0.88 (0.10-7.60)	1.01 (0.32-3.22)	0.69 (0.19-2.48)	**3.97 (1.51-10.42)****	**2.34 (1.01-5.42)****	0.95 (0.41-2.20)	1.41 (0.60-3.34)	0.56 (0.16-2.01)
	Prior Use vs. Never	2.34 (0.63-8.72)	1.13 (0.44-2.87)	1.07 (0.42-2.71)	1.43 (0.72-2.84)	0.90 (0.44-1.83)	0.82 (0.41-1.65)	0.83 (0.38-1.79)	0.87 (0.35-2.18)
	EuroQOL (Quality of Life)								
	Mobility (Yes vs. No)	0.75	0.73	0.73	**2.25**	1.33	1.08	1.08	1.28

		(0.09-6.18)	(0.20-2.60)	(0.20-2.60)	**(0.93-5.44)***	(0.58-3.04)	(0.47-2.49)	(0.44-2.63)	(0.44-3.67)
	Self-care (Yes vs. No)	0.00 (0.00-1.00)	0.85 (0.10-7.19)	0.85 (0.10-7.19)	**6.79 (0.82-56.21)***	0.90 (0.21-3.89)	0.20 (0.02-1.67)	0.34 (0.04-2.80)	0.00 (0.00-I)
	Usual Activities (Yes vs. No)	1.19 (0.24-5.86)	0.69 (0.23-2.12)	1.47 (0.58-3.73)	1.69 (0.80-3.55)	1.32 (0.64-2.71)	1.00 (0.48-2.07)	1.40 (0.65-2.97)	1.85 (0.78-4.37)
	Pain/Discomfort (Yes vs. No)	0.50 (1.10-2.49)	0.65 (0.27-1.56)	0.75 (0.32-1.72)	**2.14 (1.19-3.85)****	1.21 (0.68-2.16)	0.90 (0.50-1.60)	1.39 (0.75-2.57)	1.33 (0.63-2.82)
	Anxiety/Depression (Yes vs. No)	0.69 (0.19-2.54)	0.84 (0.38-1.85)	0.84 (0.38-1.85)	1.43 (0.83-2.48)	0.98 (0.56-1.71)	0.87 (0.50-1.51)	0.82 (0.45-1.50)	0.86 (0.41-1.82)
	ACTU-4 (ARV Adherence)								
	Currently taking meds (Yes vs. No)	-	0.47 (0.16-1.44)	0.66 (0.18-2.38)	1.12 (0.59-2.13)	0.75 (0.38-1.48)	1.14 (0.55-2.36)	**0.39 (0.17-0.92)****	0.66 (0.16-2.75)
	Past 4 weeks ability to take ARVs(<Excellent vs. Excellent)	-	2.95 (0.56-15.72)	0.67 (0.07-6.27)	**2.69 (1.02-7.08)****	1.45 (0.55-3.84)	0.76 (0.26-2.18)	0.57 (0.11-2.84)	0.90 (0.009-9.10)
	Doses missed last 4 days (>0 vs. 0)	-	1.04 (0.11-9.62)	1.32 (0.14-12.72)	**8.41 (1.78-39.81)****	2.38 (0.77-7.36)	0.60 (0.15-2.32)	2.19 (0.51-9.43)	0.00 (0.00-619E255)
	Missed any meds last weekend (Yes vs. No)	-	2.29 (0.23-22.39)	2.89 (0.28-29.54)	3.22 (0.61-16.86)	2.54 (0.59-10.99)	0.34 (0.04-2.93)	2.82 (0.49-16.09)	0.00 (0.00-56E212)
	Last time missed any meds (Some skips vs. Never skips)	-	4.43 (0.69-28.28)	1.86 (0.29-11.82)	**3.58 (1.32-9.73)****	**3.20 (1.21-8.46)****	1.79 (0.67-4.83)	2.54 (0.70-9.23)	0.89 (0.09-8.97)
	HIV-SI (HIV Symptoms)								
	Fatigue or loss of energy (Yes vs. No)	1.16 (0.22-6.25)	0.67 (0.26-1.69)	0.71 (0.27-1.87)	1.46 (0.70-3.04)	1.44 (0.68-3.02)	1.39 (0.66-2.94)	1.32 (0.58-2.98)	1.70 (0.58-4.97)
	Fever, chills or sweats (Yes vs. No)	**6.93 (0.81-59.26)***	0.97 (0.39-2.38)	1.36 (0.52-3.54)	**2.15 (1.06-4.33)****	1.34 (0.67-2.69)	1.34 (0.67-2.67)	1.82 (0.85-3.89)	1.51 (0.59-3.88)
	Dizzy or lightheaded (Yes vs. No)	1.62 (0.35-7.54)	0.72 (0.29-1.80)	1.37 (0.54-3.49)	1.78 (0.88-3.58)	1.00 (0.50-2.01)	1.44 (0.72-2.88)	1.02 (0.48-2.16)	1.22 (0.49-3.06)
	Pain/Numbness/Tingling in Hands or feet (Yes vs. No)	1.00 (0.22-4.68)	0.83 (0.33-2.09)	1.59 (0.62-4.06)	1.32 (0.66-2.66)	1.04 (0.51-2.09)	0.84 (0.42-1.69)	1.05 (0.49-2.24)	1.14 (0.45-2.87)
	Trouble remembering (Yes vs.No)	0.59 (0.11-3.15)	1.20 (0.48-2.97)	1.83 (0.72-4.68)	**3.10 (1.47-6.51)****	**2.09 (1.03-4.24)****	1.34 (0.66-2.70)	1.17 (0.55-2.49)	1.64 (0.66-4.12)
	Nausea or vomiting (Yes vs. No)	1.39 (0.26-7.53)	1.25 (0.44-3.52)	1.91 (0.69-5.29)	**2.75 (1.12-6.75)****	1.51 (0.67-3.44)	1.05 (0.46-2.39)	1.03 (0.42-2.50)	1.00 (0.34-2.98)
	Diarrhea (Yes vs. No)	0.89 (0.19-4.14)	1.01 (0.42-2.45)	0.70 (0.27-1.80)	0.82 (0.42-1.62)	0.60 (0.30-1.19)	0.70 (0.35-1.40)	0.59 (0.28-1.25)	0.80 (0.32-2.01)
	Felt depressed (Yes vs. No)	2.02 (0.23-17.43)	1.21 (0.41-3.57)	2.17 (0.60-7.89)	1.49 (0.68-3.29)	1.35 (0.60-3.02)	1.29 (0.58-2.87)	1.52 (0.62-3.72)	1.57 (0.49-5.03)
	Felt nervous or anxious (Yes vs. No)	3.82 (0.45-32.68)	1.89 (0.69-5.16)	**2.75 (0.86-8.74)***	1.27 (0.63-2.56)	0.99 (0.49-2.00)	1.38 (0.67-2.82)	0.81 (0.38-1.75)	1.25 (0.47-3.33)
	Difficulty with sleep (Yes vs. No)	1.41 (0.26-7.54)	1.04 (0.41-2.68)	1.46 (0.53-4.07)	1.57 (0.76-3.21)	1.10 (0.53-2.25)	1.37 (0.66-2.82)	1.22 (0.56-2.67)	1.22 (0.46-3.25)
	Skin Problems (Yes vs. No)	**0.12 (0.01-1.04)***	**0.33 (0.13-0.83)****	**0.43 (0.17-1.12)***	1.24 (0.63-2.46)	0.89 (0.45-1.77)	1.03 (0.52-2.04)	0.78 (0.37-1.62)	0.49 (0.19-1.25)
	Cough (Yes vs. No)	0.27 (0.03-2.32)	0.77 (0.29-2.03)	0.70 (0.25-1.95)	1.20 (0.59-2.45)	0.90 (0.44-1.83)	0.67 (0.33-1.38)	0.76 (0.35-1.67)	0.59 (0.22-1.63)
	Headache (Yes vs. No)	0.36 (0.07-1.91)	0.84 (0.34-2.06)	1.31 (0.51-3.36)	**1.83 (0.91-3.67)***	1.38 (0.69-2.77)	1.39 (0.69-2.77)	1.53 (0.72-3.27)	1.81 (0.70-4.67)

	Loss of appetite (Yes vs. No)	1.59 (0.34-7.38)	1.20 (0.50-2.90)	1.34 (0.53-3.40)	**1.79 (0.90-3.58)***	1.03 (0.52-2.06)	0.96 (0.48-1.90)	1.07 (0.51-2.25)	1.49 (0.59-3.73)
	Bloating pain or gas (Yes vs. No)	1.45 (0.28-7.48)	2.12 (0.85-5.29)	1.52 (0.59-3.96)	**3.29 (1.56-6.94)****	**2.03 (1.00-4.12)***	1.54 (0.76-3.11)	**1.93 (0.90-4.14)***	2.16 (0.84-5.56)
	Muscle aches or joint pain (Yes vs. No)	0.46 (0.09-2.47)	0.91 (0.37-2.25)	1.39 (0.55-3.54)	**2.36 (1.16-4.80)****	**1.82 (0.90-3.66)***	0.94 (0.47-1.89)	1.20 (0.57-2.55)	1.00 (0.40-2.51)
	Problems with having sex (Yes vs. No)	1.04 (0.22-4.84)	1.33 (0.54-3.29)	1.31 (0.51-3.35)	1.66 (0.82-3.38)	1.45 (0.72-2.92)	1.48 (0.73-2.98)	1.71 (0.81-3.65)	1.84 (0.73-4.64)
	Changes in the way body looks (Yes vs. No)	0.63 (0.07-5.51)	1.48 (0.52-4.21)	1.71 (0.59-4.94)	1.75 (0.72-4.25)	1.33 (0.57-3.12)	**2.27 (0.96-5.38)***	**2.82 (1.18-6.77)****	2.10 (0.76-5.82)
	Problems with weight loss/wasting (Yes vs. No)	2.24 (0.448-10.45)	1.46 (0.60-3.56)	1.25 (0.49-3.22)	1.34 (0.66-2.72)	0.90 (0.44-1.83)	1.10 (0.55-2.23)	**2.32 (1.09-4.95)****	**2.22 (0.88-5.59)***
	Hair loss or changes (Yes vs. No)	0.00 (0.00-102E180)	0.62 (0.17-2.29)	0.71 (0.19-2.62)	1.75 (0.69-4.45)	1.19 (0.49-2.88)	1.12 (0.46-2.73)	0.97 (0.36-2.55)	0.66 (0.18-2.45)

**p<0.10, **p<0.05*
*The model including ACTU-4*Linkage to Care is not provided as it naturally results in a structural zero.*
All results are from bivariate logistic regression models.
Units are included for continuous variables.

Community-Level Variables

As previously noted, community-level variables were treated as individual-level due to an inability to demonstrate a clustering effect with the data. Community-level variables were modeled individually and also as aggregate domain variables with each principal outcome using bivariate logistic regression. The results of all logistic regression models for community-level variables are included in Table 9. A composite strain variable was calculated, as well. Fifty-five community-level variables were modeled for each of the eight principal outcomes (440 combinations).

Some community-level variables modeled individually are noteworthy here. First, the variables that demonstrated more statistically significant relationships were violent crime index and number of local businesses. For violent crime index, as the rate of violent crime increases by five percentage points, one's likelihood of more efficient linkage to care increases (OR=0.41, 95% CI=0.15-1.17); although a weak statistically significant relationship, the association also was found for missed visits (OR=0.65, 95% CI= 0.40-1.06) and visit constancy (OR=0.59, 95% CI=0.35-1.02). A stronger association between violent crime index and the visit adherence measure was observed (OR=0.54, 95% CI=0.31-0.94). Weak associations were noted for number of local businesses and linkage to care, effective linkage to care, and the HRSA-HAB adherence outcomes. As the number of businesses increases by 150, one's likelihood of being linked to care increases by 0.77 (95% CI=0.58-1.03); one's likelihood of being effectively linked to care increases by 0.90 (95% CI=0.81-1.01); and one's likelihood of not meeting the HRSA-HAB measure for adherence decreases by 0.90 (95% CI=0.81-1.00).

Weaker associations were found among several variables. For example, property crime index (increases of five percentage points) was associated with both more efficient linkage to

care (OR=0.90, 95% CI=0.81-1.01) and better visit adherence (OR=0.95, 95% CI=0.89-1.01). Similarly, overall crime rate (increases of five percentage points) was associated with more efficient linkage to care (OR=0.91, 95% CI=0.82-1.01) and better visit adherence (OR=0.95, 95% CI=0.90-1.01). These relationships are unexpected given the study's conceptual framework based on General Strain Theory, and they are counterintuitive to assumptions made by Agnew (1999). Also driven by GST, indicators of low socio-economic status (SES) were associated with some of the principal outcomes. As the percentage of households with Social Security Income (SSI) increases by five percent, participants were 1.33 times (95% CI=1.05-1.69) more likely to have missed visits and were 1.22 times (95% CI=0.97-1.54) more likely to have ≤80% visit adherence (KVP). The ratio of renters to homeowners (increases of five percentage points) was associated with failure to link to care (OR=1.57, 95% CI=0.93-2.66) and the failure to meet the HRSA-HAB adherence measure (OR=1.44, 95% CI=0.96-2.14). The percent of housing with lack of telephone service was associated with gaps in care and the HRSA-HAB adherence measure; as this percentage increases by five percentage points, participants are 1.68 times (95% CI=1.04-2.72) more likely to have more than 183 days between arrived visits (gaps in care) and 1.67 times (95% CI=0.96-2.89) more likely to not meet the HRSA-HAB requirements. Finally, access to an automobile was associated with missed visits and visit adherence. As the percent of households with access to an automobile increases by five percentage points, participants are less likely to miss visits (OR=0.75, 95% CI=0.58-0.99) and have higher (≥80%) KVP (OR=0.77, 95% CI=0.59-0.99).

Stronger associations were also found among some of the community-level variables. Of these, most were variables within the family structure strain domain. Five percent increases in percent of households with male householder, no wife present, with own children aged 18 or

younger was associated with not linking to care (OR=4.26, 95% CI=1.39-13.06) and poorer visit adherence (OR=1.80, 95% CI=0.9203.55). There was a stronger relationship established for five percent increases in percent of households with female householder, no husband present, with own children ≤18 years; however, the relationships were for adherence measures only: Missed visits (OR=1.31, 95% CI=1.07-1.59) and visit adherence (OR=1.28, 95% CI=1.05-1.56). Similarly, percent of households, both male and female householders, with own children ages 18 and younger was found to be associated with missed visits (OR=1.32, 95% CI=1.10-1.59) and visit adherence (OR=1.30, 95% CI=1.08-1.56). Additionally, as the percent of female-headed households increases by five, participants were 1.21 times (95% CI=1.07-1.36) more likely to have missed visits and 1.17 times (95% CI=1.04-1.32) more likely to have poorer visit adherence. The ratio of youth to the working age population, represented by the youth dependency ratio, when increased by five percent, was also found to be associated with missed visits (OR=1.15, 95% CI=1.01-1.32) and visit adherence (OR=1.18, 95% CI=1.02-1.37).

Domain variables that achieved statistically significant associations include age structure strain, family structure strain, crime rate strain, social and health services access strain, and school strain. The remaining seven domains failed to establish statistically significant relationships with any of the principal outcomes. The family structure strain domain was found to be associated with four of the five measures of HIV primary care visit adherence, and all relationships were strong except for the visit constancy model. For every one unit increase in family structure strain, participants were 1.58 times (95% CI=1.22-2.03) more likely to have missed visits, 1.44 times (95% CI=1.11-1.86) more likely to have poorer visit adherence, 1.23 times (95% CI=0.96-1.58) more likely to have visit constancy <100%, and 1.41 times (95% CI=1.07-1.86) more likely to have gaps in care. Age structure strain was also found to be

associated with visit adherence and gaps in care. For every one unit increase in age structure strain, participants were 1.45 times (95% CI=0.98-2.16) more likely to have visit adherence ≤80% and 1.67 times (95% CI= 1.08-2.57) more likely to have gaps in care. A strong association was observed for crime rate strain and visit adherence as, for every one unit increase, participants were 0.46 times (95% CI=0.23-0.92) less likely to have poorer visit adherence. Finally, a weak statistically significant association was seen for school strain and linkage to care (OR=2.73, 95% CI=0.88-8.46); a stronger association was identified for social and health services access strain and missed visits (OR=1.58, 95% CI=0.27-0.79). Neither of these latter domains, however, achieved statistical significance for more than one principal outcome.

As indicated previously, associations between the composite strain measure and principal outcomes were not achieved. This finding limits the remaining mediation analysis substantially, and will be further discussed below. Results from each hypothesis for Research Question #2 (community-level question) are further discussed below.

Hypothesis 1. These analyses of community-level factors tested the hypothesis that community-level socioeconomic factors are associated with suboptimal linkage and adherence to HIV primary medical care appointments. Specifically, H_1 suggests that a) higher divorce rates are negatively associated with principal outcomes, b) higher percentage of children not living with both parents is negatively associated with principal outcomes, c) higher percentage of female-headed households is negatively associated with principal outcomes, d) higher percentage of single-parent homes is negatively associated with principal outcomes, e) increased community poverty is negatively associated with principal outcomes, and f) higher percentage of unemployment is negatively associated with principal outcomes. These analyses were

accomplished by regressing each community-level socioeconomic factor and each principal outcome.

Results varied for these models. First, a relationship could not be established between community-level divorce rates and any of the principal outcomes except for linkage to care. The results suggest that as the community-level divorce rate increases by five percentage points, participants' likelihood of failing to link to care is decreased by 0.44 times (95% CI=0.19-1.01). Hence, all null hypotheses included in H_{1a} except the one modeled above could not be rejected. For H_{1b}, the percentage of children not living with both parents was defined by census variables, *male householder, no wife present, with own children ≤18 years* and *female householder, no husband present, with own children ≤18 years*. Both variables, when increased by increments of five percent, were found to be associated with the linkage to care or missed visits and visit adherence outcomes. Specifically, as the percentage of households with male householder, no wife present, with own children ≤18 years increases by five percent, participants are 4.26 times (95% CI=1.39-13.06) more likely to fail to link to primary medical care. Participants residing in these communities are also 1.80 times (95% CI=0.92-3.55) more likely to have poorer visit adherence. The percentage of households with female householder, no husband present, with own children ≤18 years was found to be associated with poorer visit adherence (OR=1.28, 95% CI=1.05-1.56) and missed visits (OR=1.31, 95% CI=1.07-1.59). It is only for these models that the null hypotheses can be rejected; all others related to H_{1b} could not be rejected. For H_{1c}, an association between a five percent increase in the percentage of female-headed households in the community and participants' likelihood to miss appointment visits was established (OR=1.21, 95% CI=0.40-1.06). Remaining null hypotheses could not be rejected. Statistically significant relationships could not be established for either percentage of single-parent homes, community

poverty (defined as percentage of households whose income fell below 100% poverty in the past 12 months) or unemployment. Therefore, null hypotheses for H_{1d}, H_{1e} and H_{1f} could not be rejected.

Hypothesis 2. These analyses of community-level factors tested the hypothesis that community-level economic deprivation is associated with suboptimal linkage and adherence to HIV primary medical care appointments. Specifically, H_2 suggests that a) lower median household income is negatively associated with principal outcomes, b) higher percentage of families living at or below 100% of the Federal poverty level is negatively associated with principal outcomes, and c) lower percentage of individuals aged 25 years or older without a high school diploma is associated with principal outcomes. These analyses were accomplished by regressing each community-level socioeconomic factor and each principal outcome.

The analyses failed to establish any associations between these community-level variables and the principal outcomes. Therefore, the null hypotheses could not be rejected for H_{2a}, H_{2b}, nor H_{2c}.

Hypothesis 3. These analyses of community-level factors tested the hypothesis that higher community-level income inequality is associated with suboptimal linkage and adherence to HIV primary medical care appointments. Specifically, H_3 suggests that the Gini Index of Neighborhood Inequality will proxy community-level income inequality. This was further investigated by regressing each community-level Gini coefficient and each principal outcome.

As all models failed to reach statistical significance, the null hypothesis for H_3 could not be rejected.

Hypothesis 4. These analyses of community-level factors tested the hypothesis that higher community-level racial segregation is associated with suboptimal linkage and adherence

to HIV primary medical care appointments. Specifically, H_4 suggests that the community-level measure of the Lieberson Isolation Index will influence the principal outcomes. This was accomplished by regressing the community-level Lieberson Isolation Index score and each principal outcome. With each 0.1 unit increase in the Lieberson Isolation Index score, participants residing in that community were found to be 1.14 times (95% CI=1.00-1.29) more likely to have missed visits. All remaining models failed to reach statistical significance, and the null hypotheses could not be rejected.

Hypothesis 5. These analyses of community-level factors tested the hypothesis that community-level age structure discrepancies are associated with suboptimal linkage and adherence to HIV primary medical care appointments. Specifically, H_5 suggests that a higher disproportion of younger people or of older people to those in the working ages is negatively associated with principal outcomes. To model this, both a Youth Dependency Ratio and an Elder Dependency Ratio was calculated for each census tract. Then, the analyses were accomplished by regressing each community-level age structure discrepancy and each principal outcome.

The analyses suggest that there is an association between five percent increases in the community Youth Dependency Ratio and community resident's likelihood of missing visits and having poorer visit adherence. For every five unit incremental increase in the community Youth Dependency Ratio, participants who reside in these communities are 1.15 times (95% CI=1.01-1.32) more likely to miss visits and are 1.18 times (95% CI=1.02-1.37) more likely to fail to achieve >80% visit adherence. No further associations between Youth Dependency Ratio could be established. Further, no associations between Elder Dependency Ratio could be achieved for any principal outcome. For these, the null hypotheses could not be rejected.

Hypothesis 6. These analyses of community-level factors tested the hypothesis that community-level crime is associated with suboptimal linkage and adherence to HIV primary medical care appointments. This hypothesis was modeled for a community's Violent Crime Index, Property Crime Index, and Overall Crime Rate. These analyses were accomplished by regressing each crime measure and each principal outcome.

All associations between crime variables and the principal outcomes have already been discussed as notable findings from the community-level analysis. The remaining models failed to achieve statistical significance, and, thus, these null hypotheses could not be rejected.

Hypothesis 7. These analyses of community-level factors tested the hypothesis that community-level labor market viability is associated with suboptimal linkage and adherence to HIV primary medical care appointments. For H_7, labor market viability was defined by several community-level variables including mean travel time to work, percentage of manufacturing employment available, percentage of retail employment available, percentage of education-health-services (EHS) employment available, percentage of low-skills industry employment available, percent of households with earnings, Social Security, retirement income, SSI, cash public assistance income, and food stamp benefits, percent of unemployed persons aged 16 years and older, and percent of persons 16 years and older participating in the labor force. These analyses were accomplished by regressing each community-level labor market viability factor and each principal outcome.

For H_7, 13 independent variables were modeled with each principal outcome. One-hundred four (104) models were performed. Of these, only six achieved statistical significance and suggested an association. All other null hypotheses could not be rejected.

Of the remaining models, labor market viability factors were most related to the missed visits outcome. Specifically, associations were identified between some of the types of earnings in community-households and missed visits. As the percentage of households with SSI increased by five percent, one's likelihood of having missed visits (OR=1.03, 95% 1.05=1.69) and poorer visit adherence (OR=1.22, 95% CI=0.97-1.54) also increased. Likewise, increases in the percentage of households with cash public assistance income increased a participant's likelihood of missing visits by 1.89 times (95% CI=0.94-3.79), and increases in the percentage of households with food stamp benefits was associated with missed visits (OR=1.16, 95% CI=1.02-1.31). The type of employment available in the community was found to be associated with gaps in care. As the percentage of manufacturing employment available increases by five percentage points, one's likelihood of having more than 183 days between arrived visits is decreased (OR=0.78, 95% CI=0.61-1.00). A similar association was found for decreases in the percentage of low-skills industry employment (OR=0.84, 95% CI=0.69-1.02).

Hypothesis 8. These analyses of community-level factors tested the hypothesis that community-level availability of local businesses is associated with suboptimal linkage and adherence to HIV primary medical care appointments. Specifically, H_8 uses business patterns captured at the ZIP Code level to model the hypothesis. The analysis was further investigated by regressing each community-level number of local businesses and each principal outcome.

Results from this analysis are previously described. All other null hypotheses could not be rejected.

Hypothesis 9. These analyses of community-level factors tested the hypothesis that community-level housing characteristics are associated with suboptimal linkage and adherence to HIV primary medical care appointments. Specifically, H_9 suggests that a) lower rates of renters

to homeowners are associated with principal outcomes, b) higher age of housing is negatively associated with principal outcomes, c) higher percentage of households without bathrooms, kitchens and/or telephones is negatively associated with principal outcomes, and d) higher percentage of households with rent or mortgage payments higher than 35% of household income is negatively associated with principal outcomes. These analyses were accomplished by regressing each community-level housing characteristic and each principal outcome.

The analyses failed to yield many associations between community-level housing and the principal outcomes. Of the six models that found associations, four of them have been described as notable community-level results above (H_{9a} and H_{9c}-telephones). In addition, it was found that a five percent increase in the percentage of housing units lacking complete kitchen is associated with efficient linkage to care (OR=4.73, 95% CI=0.89-25.21). All other null hypotheses could not be rejected for H_{9a}, H_{9b}, and H_{9c}. For H_{9d}, an association between a five unit increase in percentage of households with mortgages >35% of the household income and missed visits was found (OR=1.11, 95% CI=1.00-1.25). No other research hypotheses related to mortgages could be supported.

Hypothesis 10. These analyses of community-level factors tested the hypothesis that community-level access to transportation is associated with suboptimal linkage and adherence to HIV primary medical care appointments. The analysis was further investigated by regressing each of the percentage of households with automobiles and each principal outcome.

For H_{10}, a five percentage point increase in the percentage of households with automobiles was found to be associated with fewer missed visits (OR=0.75, 95% CI=0.58-0.99) and better visit adherence (OR=0.77, 95% CI=0.59-0.99). All remaining null hypotheses could not be rejected.

Table 9

Community-Level Independent Variables Modeled for Each Principal Outcome with Odds Ratios and 95% Confidence Intervals

		Linkage to Care (LTC) Measures			Retention in Care (RIC) Measures				
	Independent Variables (Strain Domains + Domain Variables)	**LTC OR (95% CI)**	**Efficient LTC OR (95% CI)**	**Effective LTC OR (95% CI)**	**Missed Visits OR (95% CI)**	**Visit Adherence OR (95% CI)**	**Visit Constancy OR (95% CI)**	**Gaps in Care OR (95% CI)**	**HRSA-HAB OR (95% CI)**
	Composite Strain (Unit=1)	0.99 (0.89-1.10)	1.00 (0.84-1.18)	1.02 (0.96-1.09)	1.03 (0.98-1.08)	1.01 (0.96-1.06)	1.00 (0.95-1.04)	1.02 (0.89-1.16)	1.02 (0.96-1.09)
Strain Independent Variables	***Economic Deprivation Strain Domain (Unit=1)***	0.62 (0.13-2.94)	0.99 (0.85-1.14)	1.05 (0.90-1.21)	0.96 (0.87-1.07)	0.93 (0.83-1.03)	0.93 (0.84-1.04)	0.97 (0.87-1.09)	0.96 (0.83-1.10)
	Median Household Income (Unit=10,000)	1.12 (0.90-1.40)	1.00 (0.84-1.18)	0.99 (0.83-1.17)	1.04 (0.93-1.17)	1.03 (0.91-1.16)	1.05 (0.93-1.18)	1.02 (0.89-1.16)	1.06 (0.91-1.23)
	% Families Below 100% of Poverty Level (Unit=5)	0.98 (0.76-1.26)	0.97 (0.83-1.13)	1.12 (0.97-1.28)	0.97 (0.88-1.08)	0.98 (0.88-1.09)	0.97 (0.88-1.09)	1.06 (0.95-1.19)	1.06 (0.92-1.21)
	% Age >25 without High School Diploma (Unit=5)	0.94 (0.79-1.12)	0.96 (0.87-1.07)	1.06 (0.96-1.17)	0.99 (0.93-1.07)	0.98 (0.91-1.05)	0.98 (0.91-1.06)	0.99 (0.91-1.07)	0.96 (0.87-1.06)
	Inequality Strain Domain (Unit=1)	0.62 (0.13-2.94)	0.76 (0.31-1.87)	0.73 (0.30-1.78)	0.85 (0.47-1.53)	0.61 (0.32-1.15)	0.78 (0.42-1.45)	1.12 (0.59-2.14)	0.78 (0.33-1.82)
	Gini Index of Neighborhood Inequality (Unit=0.1)	0.81 (0.32-2.05)	0.80 (0.45-1.41)	0.85 (0.49-1.48)	0.84 (0.58-1.23)	0.74 (0.49-1.10)	0.89 (0.60-1.31)	1.03 (0.68-1.56)	0.69 (0.40-1.22)
	Segregation Strain Domain (Unit=1)	0.97 (0.20-4.65)	2.28 (0.66-7.88)	0.77 (0.31-1.91)	1.61 (0.81-3.21)	1.38 (0.66-2.85)	1.28 (0.63-2.62)	1.08 (0.50-2.31)	0.71 (0.30-1.70)
	Lieberson Isolation Index (Unit=0.1)	0.98 (0.74-1.28)	1.19 (0.95-1.49)	0.94 (0.80-1.11)	**1.14 (1.00-1.29)****	1.09 (0.95-1.24)	1.04 (0.92-1.18)	0.99 (0.87-1.14)	0.94 (0.80-1.09)
	Age Structure Strain Domain (Unit=1)	0.65 (0.25-1.66)	0.91 (0.52-1.58)	0.92 (0.53-1.60)	1.28 (0.87-1.89)	**1.45 (0.98-2.16)***	1.19 (0.80-1.76)	**1.67 (1.08-2.57)****	1.12 (0.66-1.88)
	Youth Dependency Ratio (Unit=5)	0.90 (0.67-1.20)	0.99 (0.82-1.19)	1.02 (0.84-1.23)	**1.15 (1.01-1.32)****	**1.18 (1.02-1.37)****	0.98 (0.86-1.12)	1.08 (0.93-1.26)	1.00 (0.84-1.20)
	Elderly Dependency Ratio (Unit=5)	1.12 (0.78-1.61)	1.02 (0.81-1.28)	1.11 (0.88-1.38)	0.91 (0.77-1.07)	0.97 (0.82-1.15)	0.98 (0.83-1.16)	1.04 (0.87-1.24)	0.97 (0.78-1.22)
	Family Structure Strain Domain (Unit=1)	0.96 (0.55-1.67)	1.00 (0.71-1.41)	1.04 (0.74-1.46)	**1.58 (1.22-2.03)****	**1.44 (1.11-1.86)****	**1.23 (0.96-1.58)***	**1.41 (1.07-1.86)****	1.20 (0.86-1.67)
	Divorce Rate (Unit=5)	**0.44 (0.19-1.01)***	0.84 (0.54-1.32)	0.87 (0.56-1.35)	1.17 (0.86-1.59)	1.00 (0.73-1.36)	1.19 (0.87-1.62)	0.94 (0.67-1.32)	0.88 (0.57-1.34)
	Male Householder, No Wife with Children <18 (Unit=5)	**4.26 (1.39-13.06)****	1.18 (0.48-2.90)	1.76 (0.76-4.04)	1.77 (0.89-3.49)	**1.80 (0.92-3.55)***	1.42 (0.74-2.75)	1.60 (0.80-3.21)	1.48 (0.65-3.38)
	Female Householder, No Husband with Children <18 (Unit=5)	0.97 (0.62-1.51)	1.10 (0.84-1.44)	1.07 (0.82-1.40)	**1.31 (1.07-1.59)****	**1.28 (1.05-1.56)****	1.05 (0.87-1.28)	1.15 (0.94-1.42)	1.06 (0.82-1.37)
	Both Male & Female Householders with Children <18 (Unit=5)	1.13 (0.76-1.69)	1.10 (0.86-1.42)	1.11 (0.87-1.42)	**1.32 (1.10-1.59)****	**1.30 (1.08-1.56)****	1.07 (0.90-1.29)	1.17 (0.97-1.43)	1.09 (0.86-1.38)
	Children <18 not living with both parents (Unit=5)	1.14 (0.80-1.62)	1.02 (0.82-1.26)	1.02 (0.82-1.26)	1.07 (0.92-1.25)	1.08 (0.92-1.27)	1.03 (0.88-1.21)	1.10 (0.92-1.30)	1.15 (0.93-1.42)
	% Female-headed Households (Unit=5)	0.97 (0.74-1.27)	1.06 (0.91-1.25)	1.00 (0.85-1.17)	**1.21 (1.07-1.36)****	**1.17 (1.04-1.32)****	1.02 (0.90-1.14)	1.11 (0.98-1.26)	1.09 (0.94-1.27)

Crime Rate Strain Domain (Unit=1)	0.34	0.46	0.75	0.59	**0.46**	0.73	0.55	0.52
	(0.04-2.71)	(0.15-1.38)	(0.29-1.94)	(0.31-1.11)	**(0.23-0.92)****	(0.38-1.40)	(0.26-1.18)	(0.19-1.42)
Violent Crime Index (Unit=5)	0.23	**0.41**	0.79	0.65	**0.54**	**0.59**	0.68	0.55
	(0.02-2.64)	**(0.15-1.17)***	(0.38-1.66)	(0.40-1.06)*	**(0.31-0.94)****	**(0.35-1.02)***	(0.38-1.22)	(0.24-1.28)
Property Crime Index (Unit=5)	0.86	**0.90**	0.97	0.97	**0.95**	0.97	0.95	0.93
	(0.68-1.08)	**(0.81-1.01)***	(0.89-1.06)	(0.92-1.03)	**(0.89-1.01)***	(0.91-1.03)	(0.89-1.02)	(0.85-1.02)
Overall Crime Rate (Unit=5)	0.87	**0.91**	0.97	0.97	**0.95**	0.97	0.96	0.94
	(0.70-1.08)	**(0.82-1.01)***	(0.90-1.05)	(0.92-1.02)	**(0.90-1.01)***	(0.92-1.02)	(0.90-1.02)	(0.86-1.02)
Labor Market Characteristics Strain Domain (Unit=1)	1.01	1.00	1.02	1.08	1.06	1.02	1.07	1.09
	(0.80-1.28)	(0.86-1.16)	(0.89-1.18)	(0.97-1.20)	(0.95-1.17)	(0.92-1.13)	(0.95-1.19)	(0.94-1.25)
Mean Travel Time to Work (Unit=5)	1.23	0.99	1.33	1.05	1.19	1.08	1.15	1.22
	(0.70-2.15)	(0.68-1.42)	(0.94-1.88)	(0.81-1.35)	(0.91-1.54)	(0.84-1.40)	(0.87-1.52)	(0.87-1.71)
Manufacturing Employment (Unit=5)	0.72	0.88	1.08	0.98	0.96	0.90	**0.78**	0.87
	(0.41-1.27)	(0.65-1.20)	(0.81-1.43)	(0.80-1.20)	(0.77-1.19)	(0.72-1.11)	**(0.61-1.00)***	(0.65-1.17)
Retail Employment (Unit=5)	1.11	1.30	1.21	1.13	1.05	0.94	1.05	1.04
	(0.58-2.11)	(0.87-1.92)	(0.82-1.80)	(0.85-1.49)	(0.79-1.41)	(0.71-1.26)	(0.77-1.43)	(0.71-1.52)
EHS Employment (Unit=5)	1.10	1.18	1.00	1.06	1.08	1.08	1.10	1.20
	(0.74-1.63)	(0.92-1.50)	(0.77-1.28)	(0.89-1.27)	(0.90-1.30)	(0.90-1.30)	(0.91-1.34)	(0.95-1.52)
Low-skills Industry Employment (Unit=5)	0.81	0.92	0.93	0.97	0.89	0.92	**0.84**	0.84
	(0.52-1.26)	(0.71-1.17)	(0.73-1.19)	(0.83-1.15)	(0.74-1.05)	(0.77-1.09)	**(0.69-1.02)***	(0.65-1.08)
% Household with Earnings (Unit=5)	0.99	1.00	0.97	0.92	0.97	0.96	0.92	0.91
	(0.74-1.33)	(0.83-1.20)	(0.81-1.16)	(0.81-1.05)	(0.85-1.10)	(0.85-1.10)	(0.80-1.05)	(0.77-1.08)
% Household with Social Security (Unit=5)	1.05	0.96	1.10	1.04	1.05	1.00	1.09	1.15
	(0.78-1.41)	(0.80-1.15)	(0.92-1.32)	(0.92-1.18)	(0.92-1.19)	(0.88-1.14)	(0.95-1.26)	(0.96-1.37)
% Household with Retirement Income (Unit=5)	1.25	0.93	1.04	0.93	0.86	0.84	0.98	1.00
	(0.79-1.99)	(0.69-1.25)	(0.78-1.38)	(0.76-1.14)	(0.69-1.06)	(0.68-1.04)	(0.78-1.23)	(0.76-1.32)
% Households with SSI (Unit=5)	0.87	1.02	0.99	**1.33**	**1.22**	1.20	1.16	1.17
	(0.49-1.55)	(0.74-1.40)	(0.72-1.36)	**(1.05-1.69)****	**(0.97-1.54)***	(0.96-1.51)	(0.91-1.48)	(0.88-1.56)
% Households with Cash Public Assistance Income (Unit=5)	1.44	1.22	0.84	**1.89**	1.44	1.21	1.11	1.09
	(0.35-5.99)	(0.48-3.06)	(0.31-2.22)	**(0.94-3.79)***	(0.73-2.85)	(0.61-2.37)	(0.53-2.30)	(0.44-2.67)
% Households with Food Stamp Benefits (Unit=5)	0.92	1.01	1.03	**1.16**	1.11	1.04	1.07	1.07
	(0.68-1.24)	(0.85-1.20)	(0.86-1.22)	**(1.02-1.31)****	(0.98-1.26)	(0.92-1.17)	(0.94-1.22)	(0.91-1.26)
% Unemployed Persons ≥16 (Unit=5)	0.92	1.24	1.37	0.97	1.04	1.10	1.39	0.99
	(0.68-1.24)	(0.70-2.17)	(0.79-2.37)	(0.64-1.45)	(0.68-1.59)	(0.73-1.67)	(0.89-2.16)	(0.57-1.74)
% Persons ≥16 Participating in Labor Force (Unit=5)	1.07	1.10	0.95	0.92	1.00	1.01	0.98	1.00
	(0.78-1.46)	(0.91-1.33)	(0.79-1.14)	(0.81-1.06)	(0.88-1.15)	(0.89-1.16)	(0.85-1.13)	(0.83-1.19)
Local Businesses Strain Domain (Unit=1)	3.06	0.81	1.00	1.20	1.01	0.89	0.81	1.02
	(0.65-14.49)	(0.38-1.73)	(0.47-2.13)	(0.70-2.05)	(0.58-1.75)	(0.51-1.53)	(0.45-1.45)	(0.49-2.13)
Number of Local Business Establishments (Unit=150)	**0.77**	1.00	**0.90**	0.98	0.97	0.96	0.96	**0.90**
	(0.58-1.03)*	(0.92-1.09)	**(0.81-1.01)***	(0.93-1.04)	(0.92-1.04)	(0.90-1.02)	(0.90-1.03)	**(0.81-1.00)***
Housing Characteristics Strain Domain (Unit=1)	0.97	1.14	1.06	1.02	0.97	0.92	0.95	1.01
	(0.66-1.43)	(0.90-1.45)	(0.83-1.34)	(0.87-1.21)	(0.81-1.15)	(0.78-1.09)	(0.79-1.15)	(0.81-1.27)
Ratio of Renters to Homeowners (Unit=5)	**1.57**	1.12	1.17	1.03	1.11	1.13	1.32	**1.44**
	(0.93-2.66)*	(0.71-1.76)	(0.75-1.81)	(0.73-1.46)	(0.78-1.57)	(0.79-1.60)	(0.92-1.90)	**(0.96-2.14)***
Median Age of Available Housing (Unit=5)	1.02	0.97	0.92	1.03	1.00	0.95	1.00	1.03
	(0.84-1.23)	(0.86-1.09)	(0.82-1.04)	(0.94-1.12)	(0.92-1.09)	(0.87-1.03)	(0.91-1.09)	(0.92-1.16)
% Housing Units Lacking Complete Plumbing (Unit=5)	0.37	2.23	0.45	1.29	1.88	0.52	0.52	0.69
	(0.00-54.51)	(0.29-17.17)	(0.03-7.51)	(0.24-6.90)	(0.35-10.16)	(0.09-3.23)	(0.07-4.02)	(0.06-8.12)
% Housing Units Lacking Complete Kitchens (Unit=5)	0.07	**4.73**	0.37	1.05	1.76	1.20	0.39	0.69
	(0.00-18.78)	**(0.89-25.21)***	(0.03-4.16)	(0.25-4.36)	(0.42-7.39)	(0.28-5.06)	(0.06-2.30)	(0.09-5.48)

% Housing Units Lacking Telephone Service (Unit=5)	1.66 (0.70-3.92)	1.08 (0.57-2.02)	1.33 (0.74-2.39)	1.16 (0.74-1.82)	1.27 (0.79-2.03)	1.27 (0.81-2.01)	**1.68 (1.04-2.72)****	**1.67 (0.96-2.89)***
% Housing Units with Mortgage >35% of HH Income (Unit=5)	1.05 (0.85-1.30)	1.03 (0.90-1.18)	1.06 (0.93-1.20)	0.98 (0.90-1.08)	0.99 (0.89-1.09)	0.98 (0.89-1.08)	1.04 (0.94-1.15)	1.05 (0.93-1.19)
% Housing Units without Mortgage >35% of HH Income (Unit=5)	0.94 (0.72-1.24)	0.89 (0.75-1.07)	0.98 (0.83-1.14)	**1.11 (0.85-1.10)***	1.04 (0.93-1.15)	1.05 (0.95-1.17)	0.99 (0.88-1.12)	1.01 (0.88-1.17)
% Housing Units with Rent/Mortgage >35% of HH Income (Unit=5)	1.01 (0.75-1.36)	0.96 (0.80-1.16)	1.04 (0.87-1.24)	0.97 (0.85-1.10)	0.93 (0.81-1.07)	0.97 (0.85-1.11)	1.06 (0.92-1.22)	1.11 (0.93-1.31)
Access to Transportation Strain Domain (Unit=1)	0.40 (0.08-1.89)	1.14 (0.52-2.47)	1.25 (0.59-2.67)	1.57 (0.90-2.73)	1.48 (0.85-2.59)	1.23 (0.70-2.14)	1.24 (0.68-2.25)	1.41 (0.68-2.91)
% Households with an Automobile (Unit=5)	1.54 (0.66-3.56)	1.03 (0.71-1.48)	1.04 (0.72-1.50)	**0.75 (0.58-0.99)***	**0.77 (0.59-0.99)***	0.85 (0.66-1.09)	0.82 (0.63-1.07)	0.81 (0.59-1.10)
Social and Health Services Strain Domain (Unit=1)	0.84 (0.24-2.96)	0.75 (0.34-1.63)	1.48 (0.71-3.11)	**0.46 (0.27-0.79)****	0.72 (0.41-1.26)	0.98 (0.57-1.69)	0.98 (0.55-1.77)	1.23 (0.60-2.52)
Number of Social and Health Services (Unit=50)	0.97 (0.79-1.19)	1.09 (0.95-1.25)	0.94 (0.83-1.06)	**1.16 (1.06-1.28)***	1.08 (0.98-1.19)	1.01 (0.92-1.11)	1.00 (0.91-1.11)	0.95 (0.84-1.07)
Schools Strain Domain (Unit=1)	**2.73 (0.88-8.46)***	1.16 (0.61-2.20)	1.39 (0.73-2.63)	1.10 (0.70-1.72)	1.44 (0.90-2.29)	1.28 (0.81-2.02)	1.25 (0.76-2.05)	1.54 (0.83-2.88)
Number of Schools (Unit=5)	**0.42 (0.18-1.00)***	1.17 (0.83-1.65)	0.87 (0.60-1.26)	1.00 (0.78-1.28)	0.93 (0.72-1.20)	0.96 (0.74-1.24)	0.88 (0.66-1.17)	0.91 (0.64-1.29)
% Schools meeting AYP (Unit=5)	0.52 (0.19-1.46)	0.92 (0.54-1.56)	0.98 (0.59-1.64)	0.74 (0.51-1.06)	0.81 (0.56-1.18)	1.03 (0.72-1.49)	0.92 (0.61-1.37)	0.76 (0.45-1.29)

NOTE: Bolded Independent Variables indicate aggregate "Domain" model; all others reflect models for specific variable.
**p<0.10, **p<0.05*
All results are from bivariate logistic regression models.
Units are included for continuous variables.

Hypothesis 11. These analyses of community-level factors tested the hypothesis that community-level social and health services access is associated with suboptimal linkage and adherence to HIV primary medical care appointments. The analysis was investigated by regressing the number of community-level social and health services and each principal outcome.

For H_{11}, a 50 unit increase in the number of social and health services in the community was found to be associated with more missed visits (OR=1.16, 95% CI=1.06-1.28). All remaining null hypotheses could not be rejected.

Hypothesis 12. These analyses of community-level factors tested the hypothesis that community-level school factors are associated with suboptimal linkage and adherence to HIV primary medical care appointments. Specifically, H_{12} suggests that a) number of schools in the community is associated with principal outcomes and b) the performance of community schools is associated with principal outcomes. These analyses were accomplished by regressing each community-level school factor and each principal outcome.

For H_{12a}, a weak association was found between the numbers of schools and linkage to care; however, this finding was unexpected. For every five unit increase in the number of schools in a community, the likelihood that a resident will not link to care is also decreased (OR=0.42, 95% CI=0.18-1.00). All other null hypotheses could not be rejected. Likewise, no associations between school performance (as measured by Adequate Yearly Progress) and the principal outcomes could be established.

Table 10 provides a summary of all statistically significant results for the individual- and community-level bivariate analyses corresponding to Research Questions #1 and #2.

Table 10

Statistically Significant (p<0.10) Results of Bivariate Analyses, Individual- and Community-level Independent Variables

	Hypothesis	Statistically Significant Independent Variable (p<0.10)	Principal Outcome	OR (95% CI)
Research Question #1	*Individual-level demographic characteristics are associated with suboptimal linkage and adherence to HIV primary medical care appointments*	Age (Unit=10)	Visit Adherence	0.68 (0.52-0.90)
		Race	Efficient LTC	4.13 (1.39-12.26)
			Missed Visits	2.36 (1.34-4.16)
			Visit Adherence	1.94 (1.07-3.51)
		Gender	Efficient LTC	2.65 (1.10-6.36)
		BF vs. WM	Efficient LTC	7.06 (0.98-25.17)
			Missed Visits	2.36 (1.00-5.56)
		BM vs. WM	Efficient LTC	3.28 (1.07-10.06)
			Missed Visits	\2.52 (1.38-4.59)
			Visit Adherence	1.94 (1.04-3.63)
		HIV Risk Factor		
		IVDU vs. Heterosexual	Missed Visits	5.67 (1.16-27.61)
			Visit Adherence	5.06 (1.39-18.39)
	Individual-level psychosocial characteristics are associated with suboptimal linkage and adherence to HIV primary medical care appointments	Depression		
		Severe vs. None	Efficient LTC	4.01 (1.10-14.58)
			Effective LTC	3.67 (1.02-13.25)
			Missed Visits	12.65 (1.56-102.32)
		Mod Severe/Severe vs. None/Mild	Missed Visits	2.10 (1.13-3.92)
			Gaps in Care	0.25 (0.05-1.19)
		Alcohol Use		
		At Risk vs. None	Visit Constancy	2.04 (0.87-4.76)
		Substance Use		
		Current vs. Never	Missed Visits	3.97 (1.51-10.42)
			Visit Adherence	2.34 (1.01-5.42)
		Quality of Life		
		Mobility	Missed Visits	2.25 (0.93-5.44)
		Self-care	Missed Visits	6.79 (0.82-56.21)
		Pain/Discomfort	Missed Visits	2.14 (1.19-3.85)
	Individual-level biologic markers/characteristics are associated with suboptimal linkage and adherence to HIV primary medical care appointments	CD4		
		200-300 vs. >350	Efficient LTC	0.37 (0.12-1.16)
		Viral load [log10(VL)] (Unit=1)	Effective LTC	0.74 (0.52-1.05)
		ARV Adherence		
		Currently Taking Meds	Gaps in Care	0.39 (0.17-0.92)
		Past 4 weeks ability to take ARTs	Missed Visits	2.69 (1.02-7.08)
		Doses missed in the last 4 days	Missed Visits	8.41 (1.78-39.81)
		Last time missed any meds	Missed Visits	3.58 (1.32-9.73)
			Visit Adherence	3.20 (1.21-8.46)
		HIV Symptoms		
		Fever, chills or sweats	LTC	6.93 (0.81-59.26)
			Missed Visits	2.15 (1.06-4.33)
		Trouble remembering	Missed Visits	3.10 (1.47-6.51)
			Visit Adherence	2.09 (1.03-4.24)
		Nausea or vomiting	Missed Visits	2.75 (1.12-6.75)

		Felt nervous or anxious	Effective LTC	2.75 (0.86-8.74)
		Skin problems	LTC	0.12 (0.01-1.04)
			Efficient LTC	0.33 (0.13-0.83)
			Effective LTC	0.43 (0.17-1.12)
		Headache	Missed Visits	1.83 (0.91-3.67)
		Loss of appetite	Missed Visits	1.79 (0.90-3.58)
		Bloating pain or gas	Missed Visits	3.29 (1.56-6.94)
			Visit Adherence	2.03 (1.00-4.12)
			Gaps in Care	1.93 (0.90-4.14)
		Muscle aches or joint pain	Missed Visits	2.36 (1.16-4.80)
			Visit Adherence	1.82 (0.90-3.66)
		Changes in the way body looks	Visit Constancy	2.27 (0.96-5.38)
			Gaps in Care	2.82 (1.18-6.77)
		Problems with weight loss/wasting	Gaps in Care	2.32 (1.09-4.95)
			HRSA-HAB	2.22 (0.88-5.59)
	Lower individual-level economic status (operationalized by insurance status and/or enrollment in the Ryan White C.A.R.E. Act program) will predict suboptimal linkage and adherence to HIV primary medical care appointments	Insurance Status		
		None vs. Private	Missed Visits	2.66 (1.51-4.68)
			Visit Adherence	2.98 (1.61-5.52)
		Public vs. Private	Efficient LTC	2.82 (0.84-9.51)
			Missed Visits	3.68 (1.28-10.60)
			Visit Adherence	5.66 (1.96-16.29)
	Lower educational attainment will predict suboptimal linkage and adherence to HIV primary medical care appointments	Education		
		≤High School Grad vs. Any College	Missed Visits	1.65 (0.95-2.87)
			Visit Adherence	1.64 (0.94-2.87)
	Lack of stable employment (unemployed, part-time work, and/or low-skilled employment) will predict suboptimal linkage and adherence to HIV primary medical care appointments	Employed	Missed Visits	0.44 (0.25-0.77)
	Family status is associated with suboptimal linkage and adherence to HIV primary medical care appointments	Presence of Children in the Home	Efficient LTC	3.81 (1.19-12.21)
			Effective LTC	3.65 (1.14-11.68)
Research Question #2	*Community socioeconomic factors are associated with suboptimal linkage and adherence to HIV primary medical care appointments*	Divorce Rate (Unit=5)	LTC	0.44 (0.19-1.01)
		% Female-Headed Households (Unit=5)	Missed Visits	1.21 (1.07-1.36)
			Visit Adherence	1.17 (1.04-1.32)
		% Single-Parent Homes (Unit=5)		
		Male HH, no wife with children	LTC	4.26 (1.39-13.06)
			Visit Adherence	1.80 (0.92-3.55)
		Female HH, no husband with children	Missed Visits	1.31 (1.07-1.59)
			Visit Adherence	1.28 (1.05-1.56)
	Higher community-level racial segregation will predict suboptimal linkage and adherence to HIV primary medical care appointments	Lieberson Isolation Index (Unit=0.1)	Missed Visits	1.14 (1.00-1.29)
	Age structure discrepancies (defined by higher youth dependency ratios and/or elderly dependency ratios) will predict suboptimal linkage and adherence to HIV primary medical care appointments	Youth Dependency Ratio (Unit=5)	Missed Visits	1.15 (1.01-1.32)
			Visit Adherence	1.18 (1.02-1.37)
	Higher community-level crime will predict suboptimal linkage and adherence to HIV primary medical care appointments	Violent Crime Index (Unit=5)	Efficient LTC	0.41 (0.15-1.17)
			Missed Visits	0.65 (0.40-1.06)
			Visit Adherence	0.54 (0.31-0.94)
			Visit Constancy	0.59 (0.35-1.02)
		Property Crime Index (Unit=5)	Efficient LTC	0.90 (0.81-1.01)
			Visit Adherence	0.95 (0.89-1.01)

		Overall Crime Index (Unit=5)	Efficient LTC Visit Adherence	0.91 (0.82-1.01) 0.95 (0.90-1.01)
	Lower community-level labor marker viability will predict suboptimal linkage and adherence to HIV primary medical care appointments	Manufacturing Employment (Unit=5) Low-Skills Industry Employment (Unit=5) % Households with SSI (Unit=5) % Households with Cash Public Assistance Income (Unit=5) % Households with Food Stamp Benefits (Unit=5)	Gaps in Care Gaps in Care Missed Visits Visit Adherence Missed Visits Missed Visits	0.78 (0.61-1.00) 0.84 (0.69-1.02) 1.33 (1.05-1.69) 1.22 (0.97-1.54) 1.89 (0.94-3.79) 1.16 (1.02-1.31)
	The presence (or availability) of local businesses will predict suboptimal linkage and adherence to HIV primary medical care appointments.	Number of Local Business Establishments (Unit=150)	LTC Effective LTC HRSA-HAB	0.77 (0.58-1.03) 0.90 (0.81-1.01) 0.90 (0.81-1.00)
	Community-level housing characteristics are associated with suboptimal linkage and adherence to HIV primary medical care appointments	Ratio of Renters to Homeowners (Unit=5) % Housing Units Lacking Complete Kitchens (Unit=5) % Housing Units Lacking Telephone Service (Unit=5) % Housing Units with Mortgage >35% of HH Income (Unit=5)	LTC HRSA-HAB Efficient LTC Gaps in Care HRSA-HAB Missed Visits	1.57 (0.93-2.66) 1.44 (0.96-2.14) 4.73 (0.89-25.21) 1.68 (1.04-2.72) 1.67 (0.96-2.89) 1.11 (0.85-1.10)
	Lack of access to transportation will predict targeted health outcomes	% Households with an Automobile (Unit=5)	Missed Visits Visit Adherence	0.75 (0.58-0.99) 0.77 (0.59-0.99)
	Lack of access to social and health services will predict suboptimal linkage and adherence to HIV primary medical care appointments	Number of Social and Health Services (Unit=50)	Missed Visits	1.16 (1.06-1.28)
	Lack of access to and performance of local schools will predict suboptimal linkage and adherence to HIV primary medical care appointments	Number of Schools (Unit=5)	LTC	0.42 (0.18-1.00)

Units are included for continuous variables.
All variables are "Yes" or "No" responses unless otherwise specified with a unit of analysis or other response.

Mediation Models

Bivariate analyses yielded variable results. Visit adherence (KVP) was found to include the most statistically significant associations with individual- and community-level independent variables and aggregate strain domains. The remaining study outcomes, except the missed visits measure, achieved far less associations. However, associations between aggregate strain domains and the missed visits outcome were not discovered. Therefore, the KVP outcome alone was selected as the principal outcome for all mediation models. The composite strain score was initially included as the potential mediator. Twelve individual- and community-level associations with KVP described above were each sequentially included in the mediation models. An additional interaction variable, race*sex, previously found to be associated with KVP was included in the mediation models, as well.

Bivariate analyses failed to establish an association between the composite measure of strain and all study outcomes (see Tables 8 and 9). Adopting Barron and Kenny's (1986) steps for mediation, the inability to establish the relationship between composite strain (the mediator, M) and the study outcomes (Y) precludes Step 3 of this process (path *b* in Figure 3). Hence, it is impossible to establish a mediation relationship in a model with composite strain as the potential mediator. Notwithstanding this finding, composite strain was modeled accordingly. Having failed to establish a mediation effect of the composite measure of strain, additional models were investigated using statistically significant aggregate strain domains as potential mediators. Results from these analyses are presented below.

The research hypothesis linked to Research Question #3 suggests that community-level variables mediate the effects of individual-level factors on suboptimal linkage and adherence to HIV primary medical care appointments. To initially test this hypothesis, statistically significant

Table 11

Mediation Models, Composite Strain as Mediator

Independent Variables X	***Path a*** ***X → Composite Strain*** **Beta (95% CI)**	***Path b**** ***Composite Strain → KVP*** **OR (95% CI)**	***Path c*** ***X → KVP*** **OR (95% CI)**	***Path c'*** ***X → KVP, controlling Composite Strain*** **OR (95% CI)**†	**Mediation effect achieved?**
Age (per 10 years)	0.90 (0.23-1.56)	1.01 (0.96-1.06)	**0.68 (0.52-0.90)****	**0.67 (0.51-0.89)****	No
Education (≤High School Grad vs. Any College)	1.73 (0.18-3.28)	1.01 (0.96-1.06)	**1.64 (0.94-2.87)***	**1.63 (0.92-2.87)***	No
Employed (Yes vs. No)	-2.50 (-4.08 - -0.93)	1.01 (0.96-1.06)	**0.56 (0.31-1.02)****	**0.56 (0.31-1.03)***	No
Race (Non-White vs. White)	3.13 (1.60-4.66)	1.01 (0.96-1.06)	**1.94 (1.07-3.51)****	**1.96 (1.06-3.62)****	No
*Race * Sex*					
BF vs. WM	4.55 (2.24-6.87)	1.01 (0.96-1.06)	2.00 (0.84-4.78)	2.03 (0.83-5.00)	No
BM vs. WM	2.63 (1.03-4.24)		**1.94 (1.04-3.63)****	**1.96 (1.04-3.72)****	No
WF vs. WM	**-2.57 (-8.95-3.80)****		1.21 (0.10-14.12)	1.20 (0.10-14.04)	No
HIV Risk Factor					
IVDU vs. Heterosexual	**-1.18 (-4.59-2.22)****	1.01 (0.96-1.06)	**5.06 (1.39-18.39)****	**5.17 (1.42-18.84)****	No
MSM vs. Heterosexual	**-1.68 (-3.37-0.02)***		1.40 (0.74-2.63)	1.44 (0.76-2.72)	No
Other/Unknown vs. Heterosexual	**-0.58 (-3.80-2.63)****		**4.50 (1.21-16.69)****	**4.58 (1.23-1.07)****	No
Insurance					
None vs. Private	**1.31 (-0.25-2.88)***	1.01 (0.96-1.06)	**2.98 (1.61-5.53)****	**3.01 (1.62-5.61)****	No
Public vs. Private	3.36 (0.55-6.17)		**5.66 (1.96-16.30)****	**5.80 (1.98-16.97)****	No
ASSIST (Substance Use)					
Current vs. Never	**0.78 (-1.55-3.07)****	1.01 (0.96-1.06)	**2.34 (1.01-5.43)****	**2.32 (1.00-5.37)****	No
Prior vs. Never	**0.98 (0.94-2.89)***		0.90 (0.44-1.83)	0.88 (0.43-1.81)	No
HIV-SI (HIV Symptoms)					
Trouble remembering	2.03 (0.16-3.91)	1.01 (0.96-1.06)	**2.09 (1.03-4.24)****	**2.07 (1.00-4.25)****	No
Bloating pain or gas	2.02 (0.14-3.90)		**2.03 (1.00-4.12)***	**1.99 (0.97-4.09)***	No
Muscle aches or joint pain	**1.10 (-0.76-2.97)***		**1.82 (0.91-3.66)***	1.80 (0.89-3.61)	No
% Households with SSI	2.88 (2.36-3.40)	1.01 (0.96-1.06)	**1.22 (0.97-1.54)***	**1.30 (0.97-1.73)***	No
% Households with an Automobile	-2.29 (-2.94 - -1.64)	1.01 (0.96-1.06)	**0.77 (0.59-1.00)****	**0.75 (0.56-0.99)****	No

**p<0.10, **p<0.05*
Path a results from Ordinary Least Squares (OLS) linear regression with Composite Strain as the outcome.
Paths b and c results from bivariate logistic regression with dichotomized KVP as the outcome.
Path c' results from multivariable logistic regression with dichotomized KVP as the outcome.
****Due to lack of statistical significance for the relationship represented by path b, no mediation effect could be achieved.*
†To establish that the proposed variable (M) mediates the X-Y relationship, the effect of X on Y controlling for M should be <X-Y relationship.

individual- and community-level variables in the bivariate analyses for the KVP study outcome were independently included as X. Composite strain was included as M, and kept-visits proportion (KVP) was included as the principal outcome, Y. The model of the composite measure of strain as a mediator is illustrated in Figure 2, and the results of these models are included in Table 11. Using composite strain as the mediator, these results are insufficient to reject the null hypothesis.

Next, community age structure strain was modeled as the potential mediator. Age structure strain was previously found to have a weak association (OR=1.45, 95% CI=0.98-2.16) with visit adherence in the bivariate analyses. To initially test the hypothesis, statistically significant individual- and community-level variables in the bivariate analyses for the KVP study outcome were independently included as X. Community age structure strain was included as M, and kept-visits proportion (KVP) was included as the principal outcome, Y. The model results for the community age structure strain as a mediator are included in Table 12. Using community age structure strain as the mediator, the null hypothesis could not be rejected in any of the models.

When *IVDU vs. Heterosexual* as HIV risk factor is included as X in the mediation model, a statistically significant association was found for path *c*; self-report of IVDU vs. Heterosexual HIV risk factor is associated with KVP (OR=5.06, 95% CI=1.39-18.39) in Step 1. IVDU vs. Heterosexual HIV risk factor was also found to be associated with community age structure strain (OR=3.09, 95% CI=1.23-12.37) in Step 2 (path *a*). As is the case for all models that include community age structure strain as the mediator, Step 3 (path *b*) results in a statistically significant relationship between community age structure strain and visit adherence (OR=1.45, 95% CI=0.98-2.16). The association between IVDU vs. Heterosexual HIV risk factor and KVP

was mediated by community age structure strain (OR=4.50, 95% CI=1.22-16.61) for path *c'*.

Table 12

Mediation Models, Community Age Structure Strain as Mediator

Independent Variables X	***Path a*** ***X → Community Age Structure Strain*** **OR (95% CI)**	***Path b*** ***Community Age Structure Strain → KVP*** **OR (95% CI)**	***Path c*** ***X → KVP*** **OR (95% CI)**	***Path c'*** ***X → KVP, controlling Community Age Structure Strain*** **OR (95% CI)†**	**Mediation effect achieved?**
Age (per 10 years)	1.11 (0.89-1.39)	**1.45 (0.98-2.16)***	**0.68 (0.52-0.90)****	**0.67 (0.51-0.88)****	No
Education (≤High School Grad vs. Any College)	1.18 (0.70-1.99)	**1.45 (0.98-2.16)***	**1.64 (0.94-2.87)***	**1.62 (0.92-2.85)***	No
Employed	0.60 (0.35-1.03)	**1.45 (0.98-2.16)***	**0.56 (0.31-1.02)****	**0.60 (0.33-1.09)****	No
Race (Non-White vs. White)	0.97 (0.57-1.64)	**1.45 (0.98-2.16)***	**1.94 (1.07-3.51)****	**1.97 (1.08-3.59)****	No
*Race * Sex*					
BF vs. WM	0.10 (0.45-2.22)	**1.45 (0.98-2.16)***	2.00 (0.84-4.78)	2.03 (0.85-4.89)	No
BM vs. WM	0.89 (0.51-1.55)		**1.94 (1.04-3.63)****	2.00 (1.06-3.76)	No
WF vs. WM	0.22 (0.02-2.53)		1.21 (0.10-14.12)	1.50 (0.13-17.82)	No
HIV Risk Factor					
IVDU vs. Heterosexual	**3.90 (1.23-12.37)****	**1.45 (0.98-2.16)***	**5.06 (1.39-18.39)****	**4.50 (1.22-16.61)****	Yes
MSM vs. Heterosexual	1.46 (0.83-2.58)		1.40 (0.74-2.63)	1.35 (0.71-2.55)	No
Other/Unknown vs. Heterosexual	2.41 (0.82-7.12)		**4.50 (1.21-16.69)****	**4.16 (1.11-15.51)****	No
Insurance					
None vs. Private	1.02 (0.60-1.72)	**1.45 (0.98-2.16)***	**2.98 (1.61-5.53)****	**3.01 (1.62-5.60)****	No
Public vs. Private	1.77 (0.68-4.67)		**5.66 (1.96-16.30)****	**5.37 (1.85-15.58)****	No
ASSIST (Substance Use)					
Current vs. Never	**2.29 (1.04-5.06)****	**1.45 (0.98-2.16)***	**2.34 (1.01-5.43)****	**2.15 (0.92-5.02)***	No
Prior vs. Never	1.19 (0.62-2.67)		0.90 (0.44-1.83)	0.88 (0.43-1.80)	No
HIV-SI (HIV Symptoms)					
Trouble remembering	0.71 (0.36-1.41)	**1.45 (0.98-2.16)***	**2.09 (1.03-4.24)****	**2.23 (1.08-4.60)****	No
Bloating pain or gas	0.84 (0.42-1.66)		**2.03 (1.00-4.12)***	**2.10 (1.03-4.30)****	No
Muscle aches or joint pain	0.86 (0.44-1.67)		**1.82 (0.91-3.66)***	**1.87 (0.92-3.78)***	No
% Households with SSI	**1.32 (1.06-1.64)****	**1.45 (0.98-2.16)***	**1.22 (0.97-1.54)***	1.19 (0.94-1.51)	No
% Households with an Automobile	**0.99 (0.78-1.26)***	**1.45 (0.98-2.16)***	**0.77 (0.59-1.00)****	**0.77 (0.59-1.00)****	No

**p<0.10, **p<0.05*
Path a results from bivariate logistic regression with Community Age Structure Strain as the outcome.
Paths b and c results from bivariate logistic regression with dichotomized KVP as the outcome.
Path c' results from multivariable logistic regression with dichotomized KVP as the outcome.
†To establish that the proposed variable (M)mediates the X-Y relationship, the effect of X on Y controlling for M should be <X-Y relationship.

Table 13

Mediation Models, Community Crime Strain as Mediator

Independent Variables X	***Path a**** ***X → Community Crime Strain*** **OR (95% CI)**	***Path b Community Crime Strain → KVP*** **OR (95% CI)**	***Path c X → KVP*** **OR (95% CI)**	***Path c' X → KVP, controlling Community Crime Strain*** **OR (95% CI)**†	**Mediation effect achieved?**
Age (per 10 years)	1.20 (0.92-1.57)	**0.46 (0.23-0.92)****	**0.68 (0.52-0.90)****	**0.70 (0.53-0.92)****	No
Education (≤High School Grad vs. Any College)	0.75 (0.38-1.49)	**0.46 (0.23-0.92)****	**1.64 (0.94-2.87)***	1.60 (0.91-2.82)	No
Employed (Yes vs. No)	1.54 (0.79-3.02)	**0.46 (0.23-0.92)****	**0.56 (0.31-1.02)****	**0.59 (0.32-1.07)***	No
Race (Non-White vs. White)	0.87 (0.45-1.69)	**0.46 (0.23-0.92)****	**1.94 (1.07-3.51)****	**1.93 (1.06-3.52)****	No
*Race * Sex*					
BF vs. WM	0.69 (0.23-2.07)	**0.46 (0.23-0.92)****	2.00 (0.84-4.78)	1.94 (0.80-4.67)	No
BM vs. WM	1.05 (0.52-2.11)		**1.94 (1.04-3.63)****	**1.98 (1.05-3.74)****	No
WF vs. WM	7.13 (0.61-83.70)		1.21 (0.10-14.12)	1.73 (0.14-21.42)	No
HIV Risk Factor					
IVDU vs. Heterosexual	1.00 (0.24-4.11)	**0.46 (0.23-0.92)****	**5.06 (1.39-18.39)****	**5.28 (1.43-19.56)****	No
MSM vs. Heterosexual	0.97 (0.48-1.97)		1.40 (0.74-2.63)	1.40 (0.74-2.66)	No
Other/Unknown vs. Heterosexual	0.51 (0.10-2.53)		**4.50 (1.21-16.69)****	**4.43 (1.18-16.66)****	No
Insurance					
None vs. Private	1.02 (0.60-1.72)	**0.46 (0.23-0.92)****	**2.98 (1.61-5.53)****	**3.01 (1.62-5.60)****	No
Public vs. Private	1.77 (0.68-4.67)		**5.66 (1.96-16.30)****	**5.37 (1.85-16.66)****	No
ASSIST (Substance Use)					
Current vs. Never	1.08 (0.40-2.90)	**0.46 (0.23-0.92)****	**2.34 (1.01-5.43)****	**2.41 (1.03-5.63)****	No
Prior vs. Never	1.30 (0.59-2.87)		0.90 (0.44-1.83)	0.92 (0.45-1.91)	No
HIV-SI (HIV Symptoms)					
Trouble remembering	1.87 (0.83-4.22)	**0.46 (0.23-0.92)****	**2.09 (1.03-4.24)****	**2.36 (1.13-4.94)****	No
Bloating pain or gas	0.65 (0.28-1.52)		**2.03 (1.00-4.12)***	**1.96 (0.96-3.99)***	No
Muscle aches or joint pain	0.83 (0.37-1.87)		**1.82 (0.91-3.66)***	1.79 (0.88-3.63)	No
% Households with SSI	0.98 (0.75-1.29)	**0.46 (0.23-0.92)****	**1.22 (0.97-1.54)***	**1.22 (0.97-1.55)***	No
% Households with an Automobile	1.09 (0.80-1.50)	**0.46 (0.23-0.92)****	**0.77 (0.59-1.00)****	**0.78 (0.60-1.00)***	No

**p<0.10, **p<0.05*
Path a results from bivariate logistic regression with Community Crime Strain as the outcome.
Paths b and c results from bivariate logistic regression with dichotomized KVP as the outcome.
Path c' results from multivariable logistic regression with dichotomized KVP as the outcome.
****Due to lack of statistical significance for the relationship represented by path a, no mediation effect could be achieved.*
†To establish that the proposed variable (M)mediates the X-Y relationship, the effect of X on Y controlling for M should be <X-Y relationship.

The next series of analysis included community crime strain as the potential mediator. Community crime strain was previously found to have a strong association (OR=0.46, 95% CI=0.23-0.92) with visit adherence in the bivariate analyses, although this relationship was counterintuitive. To initially test the hypothesis, statistically significant individual- and community-level variables in the bivariate analyses for the KVP study outcome were independently included as X. Community crime strain was included as M, and kept-visits proportion (KVP) was included as the principal outcome, Y. The model results for the community crime strain as a mediator are included in Table 13. Using community crime strain as the mediator, there is insufficient evidence to reject the null hypotheses.

A final mediation model was analyzed in which community family structure strain was included as a potential mediator. Community family structure strain was previously found to have a strong association (OR=1.44, 95% CI=1.11-1.86) with visit adherence in the bivariate analyses. To initially test the hypothesis, statistically significant individual- and community-level variables in the bivariate analyses for the KVP study outcome were independently included as X. Community family structure strain was included as M, and kept-visits proportion (KVP) was included as the principal outcome, Y. The model results for the community family structure strain as a mediator are included in Table 14. Using community family structure strain as the mediator, there is insufficient evidence to reject the null hypotheses in all models.

Table 14

Mediation Models, Community Family Structure Strain as Mediator

Independent Variables X	***Path a*** ***X → Community Family Structure Strain*** **OR (95% CI)**	***Path b*** ***Community Family Structure Strain → KVP*** **OR (95% CI)**	***Path c*** ***X → KVP*** **OR (95% CI)**	***Path c'*** ***X → KVP, controlling Community Family Structure Strain*** **OR (95% CI)†**	**Mediation effect achieved?**
Age (per 10 years)	1.00 (0.81-1.24)	**1.44 (1.11-1.86)****	**0.68 (0.52-0.90)****	**0.68 (0.51-0.90)****	No
Education (≤High School Grad vs. Any College)	**1.69 (1.03-2.76)****	**1.44 (1.11-1.86)****	**1.64 (0.94-2.87)***	1.49 (0.84-2.64)	No
Employed	**0.44 (0.26-0.73)****	**1.44 (1.11-1.86)****	**0.56 (0.31-1.02)****	0.65 (0.36-1.20)	No
Race (Non-White vs. White)	**4.46 (2.62-7.57)****	**1.44 (1.11-1.86)****	**1.94 (1.07-3.51)****	1.51 (0.80-2.86)	No
*Race * Sex*					
BF vs. WM	**4.37 (2.00-9.53)****	**1.44 (1.11-1.86)****	2.00 (0.84-4.78)	1.57 (0.63-3.86)	No
BM vs. WM	**5.03 (2.86-8.82)****		**1.94 (1.04-3.63)****	1.49 (0.76-2.92)	No
WF vs. WM	4.49 (0.55-36.50)		1.21 (0.10-14.12)	0.94 (0.08-11.00)	No
HIV Risk Factor					
IVDU vs. Heterosexual	0.48 (0.17-1.42)	**1.44 (1.11-1.86)****	**5.06 (1.39-18.39)****	**6.32 (1.70-23.48)****	No
MSM vs. Heterosexual	**0.42 (0.25-0.73)****		1.40 (0.74-2.63)	**1.72 (0.89-3.31)****	No
Other/Unknown vs. Heterosexual	1.29 (0.47-3.59)		**4.50 (1.21-16.69)****	**4.10 (1.09-15.42)****	No
Insurance					
None vs. Private	**1.58 (0.96-2.60)***	**1.44 (1.11-1.86)****	**2.98 (1.61-5.53)****	**2.82 (1.51-5.26)****	No
Public vs. Private	**2.32 (0.94-5.69)***		**5.66 (1.96-16.30)****	**5.05 (1.73-14.71)****	No
ASSIST (Substance Use)					
Current vs. Never	1.26 (0.60-2.63)	**1.44 (1.11-1.86)****	**2.34 (1.01-5.43)****	**2.32 (0.99-5.46)***	No
Prior vs. Never	1.40 (0.76-2.58)		0.90 (0.44-1.83)	0.83 (0.40-1.73)	No
HIV-SI (HIV Symptoms)					
Trouble remembering	1.37 (0.73-2.55)	**1.44 (1.11-1.86)****	**2.09 (1.03-4.24)****	**2.02 (0.98-4.14)***	No
Bloating pain or gas	**1.73 (0.92-3.24)***		**2.03 (1.00-4.12)***	**1.86 (0.90-3.82)***	No
Muscle aches or joint pain	1.28 (0.69-2.37)		**1.82 (0.91-3.66)***	1.76 (0.87-3.59)	No
% Households with SSI	**1.74 (1.40-2.16)****	**1.44 (1.11-1.86)****	**1.22 (0.97-1.54)***	1.11 (0.86-1.42)	No
% Households with an Automobile	**0.53 (0.41-0.68)****	**1.44 (1.11-1.86)****	**0.77 (0.59-1.00)****	0.86 (0.65-1.13)	No

**p<0.10, **p<0.05*
Path a results from bivariate logistic regression with Community Family Structure Strain as the outcome.
Paths b and c results from bivariate logistic regression with dichotomized KVP as the outcome.
Path c' results from multivariable logistic regression with dichotomized KVP as the outcome.
†To establish that the proposed variable (M)mediates the X-Y relationship, the effect of X on Y controlling for M should be <X-Y relationship.

Table 15 provides a summary of all statistically significant results for the strain domain bivariate analyses corresponding to Research Question #3.

Table 15

Statistically Significant (p<0.10) Results of Bivariate Analyses, Community-Level Strain Domains as Independent Variables

	Hypothesis	Statistically Significant Strain Domain Independent Variable (p<0.10)	Principal Outcome	OR (95% CI)
Research Question #3	*Community-level variables mediate the effects of individual-level factors on suboptimal linkage and adherence to HIV primary medical care appointments*	Age Structure (Unit = 1)	Visit Adherence	1.45 (0.98-2.16)
			Gaps in Care	1.67 (1.08-2.57)
		Family Structure (Unit = 1)	Missed Visits	1.58 (1.22-2.03)
			Visit Adherence	1.44 (1.11-1.86)
			Visit Constancy	1.23 (0.96-1.58)
			Gaps in Care	1.41 (1.07-1.86)
		Crime Rate (Unit = 1)	Visit Adherence	0.46 (0.23-0.92)
		Social and Health Services (Unit = 1)	LTC	2.73 (0.88-8.46)
			Missed Visits	0.46 (0.27-0.79)

Units are included for continuous variables.

CHAPTER 5

DISCUSSION

This study is the first to investigate linkage to and retention in HIV primary medical care within a new conceptual framework that borrows from the epidemiology and criminology fields and has at its foundation General Strain Theory (GST). After investigating associations that have been established in the literature between individual-level factors and the study outcomes (Research Question #1), the study examined possible associations between community-level factors (e.g., household income and percentage of female-headed households) and the principal outcomes (Research Question #2). Following the conceptual framework as heavily influenced by GST, community-level strain "domains" were created by aggregating similar community-level factors; each domain, in turn, was investigated for its mediation effect on the study outcomes (Research Question #3). The existing literature has often hinted at such interactions between the individual, their environment, and these outcomes (Bradford, Coleman, & Cunningham, 2007; Wong, et al., 2007; Cavaleri, et al., 2010; Kempf, et al., 2010; Ohl, et al., 2010), but mediation relationships have not yet been firmly established.

Major Conclusions

The study asserts considerable insight into the role that community strain plays in HIV-related appointment linkage and adherence. Chapter 5 includes a review of the major findings previously reported in concert with each research question and its related hypotheses while considering study limitations. Application of these findings to the broader context of research in

the area of linkage to and retention in HIV primary care is provided, as well as future directions for this research. Discussions of the most significant study findings are presented below.

Major Conclusions for Research Question #1: Investigating Individual-Level Factors

Previous research, which establishes individual-level factors are associated with linkage to and retention in care, was largely replicated. Bivariate analyses of individual-level independent variables proposed in Research Question #1 yielded 42 statistically significant associations ($p<.05$), replicating the existing literature. Age, gender, race, history of substance abuse, higher baseline CD4 and viral loads, and lack of health insurance are almost universally associated with linkage to and retention in HIV primary medical care. In fact, some may consider it more difficult to locate literature to refute these associations. Established relationships such as these were found (both strong and weaker associations) for the current study, as well. Statistically significant relationships ($p<.05$) emanating from research hypotheses (1, 2, 3, 4, 6, and 7) are discussed in detail below. No associations could be established for variables modeled in Hypothesis 5 (educational attainment).

Hypothesis 1. Hypothesis 1 asserted that demographic characteristics—age, race, gender, and HIV transmission risk factor—are associated with study outcomes.

Age was confirmed as associated with retention in care when measured using the visit adherence metric. The findings suggest that, as age increases (unit = 10 years), individuals' chances of having poorer visit adherence decreases. Although the retention measures utilized from study to study vary, this association replicates work by many others in the field (Catz, McClure, Jones, & Brantley, 1999; Napravnik, et al., 2006; Rumptz, et al., 2007; Giordano, et al., 2009; Mugavero, et al., 2009; Ulett, et al., 2009). Researchers have often speculated reasons for this association; however, a 2007 study by Barclay, et al., sought to establish a theoretical

framework that included demographics, related health beliefs/attitudes, and treatment self-efficacy to explain why younger populations are less adherent to ARV regimens than their older counterparts. Treatment utility—or the health belief that treatment would not benefit them—and self-efficacy related to treatment—the belief that they do not have the capability to achieve necessary treatment compliance—emerged as significant conditions predictive of ARV adherence. Given the similarity between behaviors associated with ARV adherence and appointment adherence (described in Chapter 2), the same may be true for retention in HIV primary medical care.

Race (white vs. non-white) was found to be associated with both linkage to care and retention in care. Although non-white individuals in the study sample may eventually link to HIV primary care, they are less likely to efficiently do so (within 60 days of initial clinic contact). Mugavero, et al. (2007), and Ulett, et al. (2009), also noted the association between racial minorities and African-Americans, respectively, and linkage to care. However, both of these previous studies operationalized linkage to care differently—either as an arrived primary care provider appointment within 180 days of initial clinic contact (Mugavero, et al., 2007) or as a baseline CD4 <350 indicating delayed linkage to care (Ulett, et al., 2009). Race was also found to be associated with retention in care as measured by the missed visits and visit adherence metrics. This finding supports similar results previously reported by others (Kissinger, et al., 1995; Catz, et al., 1999; Israelski, et al., 2001; Napravnik, et al., 2006; Rumptz, et al., 2007; Giordano, et al., 2009; Mugavero, et al., 2009; Hall, et al., 2012). The inability of racial minorities to (efficiently) link to and be retained in HIV primary medical care to the degree of their white counterparts provides support for the established debate regarding health disparities. Further elucidating the issue of health disparities in HIV/AIDS care, results of this study

documented differences in certain race*gender interactions, as well. When compared to white males, black females were more likely to have poorer retention in care when the missed visits metric is used. This finding, as has been established in this study, is not surprising, and the existing literature documents poorer linkage to care for women (see below) and for African-Americans (Mugavero, et al., 2007; Ulett, et al., 2009). Race also appeared to be the driving factor when the differences between black males compared to white males was analyzed. For this interaction, black males performed poorer for efficient linkage to care as well as for two measures of retention in care—missed visits and visit adherence. In light of the National HIV/AIDS Strategy that explicitly challenges HIV/AIDS care and support service providers to reduce such disparities, findings that further confirm these disparities should suggest action rather than subtle mention. Researchers in the area of health disparities have identified a narrowing in HIV/AIDS mortality between African-Americans and whites, indicating a noteworthy public health success; these same researchers suggest that such health disparities are likely due, in part, to minorities' poorer access to ARV treatment and health services (Singh, Azuine, & Siahpush, 2011).

Supporting findings by Mugavero, et al., (2007) and by Mugavero, Castellano, Edelman, & Hicks (2007), an association was established between gender and linkage to care. While there was no difference in males' and females' ability to link to care generally, study results suggest that females are less likely than males to achieve efficient linkage to care (an arrived primary care visit within 60 days of initial clinic contact). Many researchers have established a relationship between gender and retention in care (Rumptz, et al., 2007; Mugavero, et al., 2009; Hall, et al., 2012); however, the inability to confirm an association in this study appears to support very recent research conducted in Taiwan focusing on gender differences in HIV

manifestations. Interestingly, the Taiwanese study found that gender did not relate to continuity of HIV care among a sample of 682 HIV-infected patients receiving care in Southern Taiwan (Ko, et al., 2011). More research is necessary—both domestic and international—to determine if gender is consistently associated with retention in care in addition to the many studies that investigate these disparities in ARV adherence.

Finally, the only HIV transmission risk factor that demonstrated a relationship with the study outcomes was intravenous drug use (IVDU). No other associations could be established between HIV risk factors (MSM or heterosexual risk, for example) and linkage to or retention in HIV primary medical care. When compared to heterosexual transmission risk, IVDU was significantly more likely to have poorer retention in care outcomes when the missed visits and visit adherence metrics were used. This finding is consistent with the work of other researchers who have established that IVDU is associated with poorer retention in care (Kissinger, et al., 1995; Hall, et al., 2012).

Hypothesis 2. Hypothesis 2 suggested that psychosocial characteristics, such as depression, alcohol use, substance use, and quality of life, are associated with the study's principal outcomes.

Responses to the Patient Health Questionnaire-9 (PHQ-9) were categorized in two ways to better understand potential associations between depression and the study outcomes. First, participants who reported "Moderately Severe" and "Severe" depressive symptoms were compared to those who reported "Mild" or "None" depressive symptoms. Self-reported depressive symptoms were found to be statistically associated with retention in care when the missed visits metric was used; individuals with moderately severe and severe depressive symptomotology were more likely to miss visits than those with mild symptoms or no experience

with depression. A broader effect of depression on study outcomes was observed when participants with responses of “Severe” symptoms were compared to those with “None”. Results from this model suggested that individuals with “Severe” symptoms were statistically more likely than those without depressive symptoms to have less efficient and less effective linkage to care and to have poorer retention in care when measured using the missed visits metric. The association of severe depressive symptomotology and linkage to care was also found by Tobias and her colleagues (2007). Analyzing a sample of 1,000 HIV-infected individuals from 10 national sites, Tobias, et al., (2007), found that individuals who received “no care” after first testing HIV positive had significantly lower mental health scores (using the SF-12) than individuals who reported receiving “some care.” Although little has been documented for the relationship between depression and retention in care, depression has been repeatedly found to be a strong indicator of non-compliance with general medical treatment (DiMetteo, Lepper, & Croghan, 2000), and these findings have been substantiated in the ARV adherence literature (Berg, Michelson, & Safren, 2007). Similarly, Rumptz, et al., (2007) reported that individuals in their study were more likely to not be engaged in treatment when they had no mental health outpatient appointments within the past six months.

Individuals reporting current substance use were significantly more likely to have poorer retention than those who reported no history of use. Specifically, current substance use was associated with both the missed visits and visit adherence measures. Substance use has previously been linked to poorer retention (Giordano, et al., 2007; Mugavero, et al., 2009). Of note, there were no associations between individuals who reported past substance use and linkage to and retention in HIV primary medical care when compared to those with no history of substance use. Additionally, an association between alcohol use and study outcomes could not

be established in this study; this non-finding is counter-intuitive to some of the existing literature (Mugavero, et al., 2009).

The Euro-QOL instrument, which measures self-reported quality of life, provided five domains in which to model with study outcomes: Mobility, Self-care, Usual Activities, Pain/Discomfort, and Anxiety/Depression. Of these, only Pain/Discomfort was found to be statistically associated with any of the principal study outcomes. Individuals endorsing Pain/Discomfort symptoms were more likely to have missed visits than those who did not. Similar results for the same measure of pain were recently reported by Merlin, et al. (2013). Merlin and her colleagues dichotomized the Euro-QOL pain item as present or not present, as well, and found that pain increased the odds of a no-show visit by 1.5 times. The OR for the current study is somewhat higher (OR=2.14), but replication of this finding may have considerable implications for continued work in HIV palliative care.

Hypothesis 3. Hypothesis 3 asserted that biologic markers or characteristics, such as CD4 and viral load measures, ARV adherence, and HIV symptoms, are associated with linkage to and retention in HIV primary medical care.

The similarities between ARV adherence and HIV primary medical care appointment adherence was further demonstrated by this study. Considering the four questions on the ACTU-4 ARV adherence instrument, each was found to be statistically associated with at least one of the study's retention in care outcomes. None of the ACTU-4 items were associated with linkage to care, and this is not surprising given that most patients would first successfully link to HIV primary care before they could respond to their experiences with ARVs. Findings suggest that individuals who are better at taking their ARV medications are, likewise, better at attending their doctor appointments. Specifically, currently taking ARVs was found to be associated with better

retention when measured by the gaps in care metric. "Excellent" ability to take ARVs in the past four weeks, zero dosages missed in the last four days, and never skipping medications were statistically associated with better retention in care as measured by the missed visits metric. Similarly, never skipping medications was also associated with better retention as measured by the visit adherence metric. These associations are not surprising, but the question of why these associations exist still looms. Certainly, explanations such as those purported by Tugenberg, Ware, and Wyatt (2006) are viable; individuals who regularly attend appointments with their physicians may be more adherent to ARV regimens because of the patient's perceived expectations of their doctor. However, an equally likely and more simplistic explanation is that individuals motivated to attend medical care are likewise motivated to follow treatment plans.

A number of relationships were established between HIV symptoms and retention in HIV primary medical care. Individuals who reported changes in the way their body looked and problems with weight loss or wasting were more likely to have gaps in medical care than those who did not endorse these items. Participants were also more likely to have poorer retention in care when measured by the visit adherence metric if they reported trouble remembering and bloating pain or gas. The missed visits measure, however, yielded a broader array of associations with HIV symptoms. When operationalizing retention in care as the number of missed visits, individuals were more likely to have missed visits if they reported fever, chills, or sweats, trouble remembering, nausea or vomiting, bloating pain or gas, or muscle aches or joint pain. It is unknown why this is the case. It is plausible that, if participants experience recurring symptoms, the symptoms may be more likely considered conditions that can be best addressed by self-care rather than a medical provider and could, hence, influence an individual's decision to not attend a medical appointment on a given day when they don't feel well enough to attend.

One unlikely association between HIV symptomotology and linkage to care was identified in the study, as well; individuals who reported skin problems were statistically less likely to efficiently link to care—a finding difficult to explain. Contemporary pilot research has linked some skin disorders among HIV-infected individuals to lower CD4 counts (Kim, Lee, & Oh, 2010). Although not a finding in this study, lower CD4 counts have been shown to be associated with appointment non-compliance. Hence, it is reasonable to conclude that individuals who eventually link to care (although not efficiently) are then more likely to report these co-morbid skin conditions on self-administered surveys. Alternately, researchers have also recently found that individuals with HIV more frequently experience skin problems than the general population, and the manifestations of these problems has shifted from severe to more trivial in recent years (Rothengatter, et al., 2009). Therefore, skin problems—while troublesome for persons living with HIV—may not be significant enough to seek medical attention for until a more serious diagnosis of HIV is determined.

Hypothesis 4. Hypothesis 4 asserted that individual-level economic status as operationalized by insurance status or enrollment in the Ryan White C.A.R.E. Act program, is associated with linkage to and retention in HIV primary medical care.

Insurance status was found to be associated with retention in care. Insurance status was analyzed in two ways: No insurance vs. Private insurance and Public insurance vs. Private insurance. For both models, individuals with private insurance were less likely to have poorer retention in care as measured by the missed visits and visit adherence metrics. This supports findings of other researchers in the field (Napravnik, et al., 2006; Mugavero, et al., 2009). Unlike some of the existing literature that suggests insurance status is also associated with linkage to care (Mugavero, et al., 2007), this association could not be established in the current

study. Likewise, enrollment in the Ryan White C.A.R.E. Act did not indicate poorer outcomes with this sample. To be eligible to participate in the Ryan White C.A.R.E. Act program, individuals must have no insurance and no other means to cover the costs of their HIV-related health care. The program is meant to be a payer of last resort. Generally speaking, the program has been incredibly successful in breaking down barriers to optimal HIV primary medical care, including access to life-saving medications, social services, and transportation. It can be argued that the Ryan White program has been so successful that it acts any other public health insurance coverage. In this way, individuals receiving Ryan White benefits may have considerably less barriers to face than individuals with no health insurance coverage.

Hypothesis 6. Hypothesis 6 suggested that employment status is associated with linkage to and retention in HIV primary medical care.

Being employed was found to be associated with linkage to care and retention in care. Employed participants were less likely than those who were not employed to have poorer retention when measured by the missed visits metric. No other associations with linkage to or retention in care could be established in this study. While intriguing, little evidence exists in the literature to support or refute this finding. Several factors could be at play when considering the role of employment in the HIV-infected person's linkage to and retention in care. First, it is reasonable to think that it is more difficult for any employed individual—not just those who are HIV-infected—to adhere to primary care appointments. Scheduling around work hours and coordinating sick leave may be a challenge for anyone, but these challenges may be exacerbated for individuals living with HIV who have to conduct these activities while, often, having to hide their status to their employer. Additionally, research on HIV and employment is limited as only recently have individuals who are HIV-infected been able to maintain good health necessary to

seek and keep employment (Braveman & Kielhofner, 2006). These alternatives, however, are counterintuitive to study results which trend toward employment being a protective rather than a risk factor for one's linkage to care and appointment adherence. This latent finding in the current study may shed light on a whole new area where more research is needed. Investigating types of employment that may be protective or not (e.g., full-time, part-time, and/or skilled positions or not) should be considered.

Hypothesis 7. Hypothesis 7 suggested that family status, such as marital status and the presence of children in the home, is associated with linkage to and retention in HIV primary medical care.

While a relationship between marital status and the study outcomes could not be established, the presence of children in the home was found to be associated with both efficient and effective linkage to care. Participants reporting children residing in their homes were less likely to efficiently or effectively link to care, although they do generally link to care as well as those without children in the home. There has been no research that investigated this relationship, suggesting another area for future investigations. The challenges of having children in the home would, in many cases, supersede any efforts to seek or maintain good personal health of a child's caregiver, so it is not surprising that individuals faced with such challenges may not have HIV primary care as a priority in their lives.

Major Conclusions for Research Question #2: Investigating Community-Level Factors

A number of structural factors were found to be associated with linkage to and retention in care. Bivariate analyses of community-level independent variables proposed in Research Question #2 yielded 16 statistically significant associations ($p<.05$). While research on neighborhood effects or community-level factors and health, in general, have burgeoned, little of

this research has focused on HIV, and virtually none of it has considered the possible associations between structural factors and linkage to or retention in HIV primary medical care. Nonetheless, recent studies have found relationships between neighborhood socioeconomic context and HIV mortality (Arnold, Hsu, Pipkin, McFarland, & Rutherford, 2009). Specific community-level influences such as employment, housing conditions, schools, and violence have been investigated as conditions associated with increased neighborhood rates of HIV transmission (Furr-Holden, Milam, Reynolds, MacPherson, & LeJuez, 2012). Some of these established relationships (both strong and weaker associations) were replicated in the current study, as well. Statistically significant relationships ($p<.05$) emanating from research hypotheses (1, 4, 5, 6, 7, 9, 10, and 11) are discussed in detail below. No associations could be established for variables modeled in Hypothesis 2 (economic deprivation), Hypothesis 3 (income inequality), Hypothesis 8 (availability of local businesses), nor Hypothesis 12 (access to and performance of local schools).

Hypothesis 1. Hypothesis 1 asserted that community socioeconomic factors—divorce rate, percentage of female-headed households, and percentage of single-parent homes—are associated with study outcomes.

As previously discussed, contemporary research suggests that females tend to perform poorer in terms of linkage to and retention in HIV primary medical care (Rumptz, et al., 2007; Mugavero, et al., 2007; Mugavero, et al., 2009). For this study, additionally the percentage of female-headed households at the community-level was found to be associated with retention in care when retention is calculated by the missed visits and visit adherence metrics. For every five unit increase in the percentage of female-headed households in the community, a participant was statistically more likely to miss visits and have poorer visit adherence. Certainly, this finding

may be no coincidence given that females, in general, are linked and retained less consistently. In a 2004 study, Whetten, Reif, Lowe, and Eldred found that HIV-infected African-American women specifically, and HIV-infected women in general were less knowledgeable about how to access HIV resources. Additionally, women in the Whetten, et al., (2004) study—all of whom resided in the Southeast United States—indicated multiple barriers to accessing medical and ancillary care including transportation and insurance availability. At the community level, these barriers, when compounded with responsibilities as the sole householder, may be more difficult to overcome by women who have multiple demands placed on them.

Percentage of single-parent homes in the community was also associated with study outcomes. However, the associations differed depending on the gender of the single-parent. As the percentage of male householders with children but no wife present increases, linkage to care, in general, was poorer for participants residing in these communities. Associations between percentage of single-parent households with female householders and linkage to care outcomes could not be established. However, as the percentage of single-parent households with a female householder with children but no husband present increases, participants from these communities were more likely to have poorer retention in care when retention was measured by the missed visits and visit adherence metrics. Addressing both the female-headed household and single-parent household variables, Sharpe and her colleagues (2012) recently established that these factors influence sexual risks among African-American women. Hence, emerging research in this field will likely continue to expose the role of community-level household structure in HIV outcomes.

Hypothesis 4. Hypothesis 4 suggested that community-level racial segregation was associated with the study outcomes.

Using the Lieberson Isolation Index, an association was found between community-level racial segregation and the missed visits measure of retention in care. This finding may be the first to link neighborhood segregation by race with one's inability to adhere to HIV primary medical appointments. Previous studies have discussed racial disparities in access to HIV treatment and subsequent lack of treatment success among racial minorities. In their study on these disparities in San Francisco, Arnold, et al. (2009) found that HIV-infected African-Americans had a greater risk of mortality than their white counterparts, and individuals residing in lower socioeconomic communities had greater mortality risks than those residing in higher socioeconomic areas. However, in a finding that demonstrates considerable work is left to do in research that investigates the aggregate effect of neighborhood disadvantage and other negative health factors, the differences observed between whites and African-Americans was attenuated when the researchers controlled for HIV medication initiation. Nevertheless, the combination of neighborhood factors such as racial segregation and individual-level challenges appear, in some cases, to prevent HIV-infected individuals from seeking regular health care. Community-level racial segregation could not be associated with linkage to HIV primary medical care or any of the remaining four measures of retention.

Hypothesis 5. Hypothesis 5 asserted that age structure discrepancies in communities will be associated with suboptimal linkage and retention in HIV primary medical care.

The age structure of a population represents a community strain when there are greater numbers of youth or elderly relative to the working age population. An association between the neighborhood's youth dependency ratio (calculated as the ratio of those under age 18 to those aged 18 to 64) and two measures of retention in care was found. When retention in care is measured by the missed visits and the visit adherence metric, those residing in communities with

a higher youth dependency ratio are more likely to have poorer retention. Younger individuals, in general, are less likely to achieve good linkage or retention in care (Catz, et al., 1999; Napravnik, et al., 2006; Giordano, et al., 2009; Mugavero, et al., 2009; Ulett, et al., 2009), but we know less about the influences of living in a neighborhood with a younger population. It is still unclear if the influence of a younger neighborhood mitigates the relationship between age and HIV health outcomes, but the significant results linking community age structure and poorer retention suggest that there may be more to the story than an individual's age alone.

Hypothesis 6. Hypothesis 6 predicted that higher community-level crime will be associated with poorer linkage to and retention in HIV primary medical care.

The study investigated the role of three measures of community crime: Violent crime, property crime, and overall crime. While weaker associations were established between each crime index and both measures of linkage to and retention in HIV primary medical care, only one of these associations was statistically significant for an alpha level at 0.05. A community's Violent Crime Index was associated with better visit adherence, i.e., participants residing in communities with more violent crime are actually more likely to be retained in HIV primary medical care when retention is measured with the visit adherence metric. Of course, this finding is counterintuitive to the conceptual framework that is heavily grounded in the criminology literature. A number of factors may have influenced these findings. First, the independent variable, crime, was one of a handful of variables that could not be obtained at the census tract level. Instead, crime statistics are only available at the municipality (city or county) level. Certainly, crime statistics are available in these areas because there is a law enforcement presence to identify or respond to local crime. In addition to protective factors in these communities such as a police force, other resources are likely available to assist residents to

obtain needed medical attention. Another theory is that crime occurs most often in areas of higher poverty; poverty, then, is mostly concentrated in urban centers. For UAB 1917 Clinic patients, living in the urban center of Birmingham may afford you better access to public transportation and/or walking to your clinic appointments which also occur in the urban center. However, this theory was further investigated by analyzing household median income values and crime statistics finding no correlation between the two. This suggests that household median income as a proxy for poverty could not explain why individuals who reside in higher crime areas—but may be better located to access medical care—are better at being retained in primary medical care.

Clearly the role of neighborhood crime on study outcomes should be further investigated. One recent study (Soto, Komaie, Nielands, & Johnson, 2013) of over 300 HIV-infected MSM found that two-thirds of the sample reported exposure to crime-related trauma. The authors were unable to link exposure to crime (or to sexual or physical trauma) to adherence to ARV regimens. Of particular interest, however, is their finding that exposure to crime (and other trauma) was associated with HIV stigma and social support—both factors known to be associated with treatment engagement (Soto, et al., 2013).

Hypothesis 7. Hypothesis 7 asserted that community-level labor market viability will influence one's success at linking to or being retained in HIV primary medical care.

Hypothesis 7 consisted of a number of variables meant to capture the viability of the community's labor market. These variables included travel time to work, availability of types of employment (manufacturing, low-skills, retail, etc.) and the types of earnings in the community. Of these, statistically significant associations could be established only for types of earnings. Specifically, the higher percentage of households with Social Security Income was associated

with poorer retention in care when retention was measured using the missed visits metric. Similarly, the higher percentage of households with Food Stamp benefits was associated with more missed visits. While these findings provide insight into the role of community strain on HIV health outcomes, these factors may be elements of community economic strain rather than labor market viability. While statistically significant associations were not established between the measure of community-level economic deprivation and the study outcomes, others have identified that measures of economic deprivation are the most sensitive to expected socioeconomoic gradients of health (Krieger, Chen, Waterman, Rehkopf, & Subramanian, 2004).

Hypothesis 9. Hypothesis 9 suggested that community-level housing characteristics are associated with linkage to and retention in HIV primary medical care.

While relationships could not be established between types of housing occupants (renters vs. owners), types of housing payments (rent vs. mortgage), or the ratio of housing payments to household income and the study outcomes, one factor indicative of poor housing stock was found to be associated with retention in HIV primary medical care. The percentage of housing lacking telephone service was associated with poorer retention when measured by the gaps in care metric. While the impact of this rather latent finding is currently unclear, it is certainly understandable. The UAB 1917 Clinic, as well as many outpatient clinics at UAB, rely heavily on an automated telephone call to all patients prior to upcoming medical appointments. Additionally, the clinic has benefitted from time to time from volunteers who routinely provided reminder calls to patients one to two days prior to their scheduled appointments. Lack of a working telephone would prevent patients from receiving these reminders. It is important to remember that this factor is measured at the community level, and the question remains about

whether a study participant is more likely to not have access to a telephone simply because there is a higher percentage of his/her neighbors who do not.

Hypothesis 10. Hypothesis 10 asserted that access to transportation will influence one's success at linking to or being retained in HIV primary medical care.

As the percentage of households with access to their own transportation increases, individuals residing in these communities attain better retention on care when measured by the missed visits and visit adherence metrics. Simply put, for this study sample, if one lives in a neighborhood where a higher percentage of residents have access to a car, the participant is more likely to be retained in care. Given that this variable is measured at the community-level and not the individual-level, it may be surmised that lack of personal transportation may not alone prevent individuals from keeping their HIV primary care appointments if they have the support of neighbors who have access to transportation. This finding supports the work of Wong, et al., (2007) which suggested that transportation needs increased a person's life chaos, and life chaos, in turn, was predictive of fewer arrived outpatient visits to the medical doctor. However, very recent research in Uganda has called into question self-reported access to transportation and its potential association with missed clinic visits; Siedner and his colleagues (2013) found that geocoded distance from clinic was highly correlated with clinic attendance while self-reported access to transportation was not. They suggest that objective measurements of transportation (e.g., geocoding distance to care) are necessary to determine one's risk for clinic absenteeism in resource-poor settings. Additionally, work by Tuller, et al. (2010) found that it was specifically the cost of transportation that influenced treatment adherence and access to care in Uganda.

Hypothesis 11. Hypothesis 11 stated that access to social and health services will be associated with one's success at linking to or being retained in HIV primary medical care.

A surprising finding in terms of one's access to social and health services was identified in the study. It was predicted that increased access to these services would improve an individual's performance on linkage to care and retention in care measures. However, the opposite was true. As the number of health and social services at the community-level increases, individuals are more likely to have gaps in care. A number of explanations can be asserted for this finding. First, with more options of places to receive health and social services, a person may exercise their right to choose between multiple agencies. In this case, when measuring one's efficient and effective linkage to care and retention in care, a patient may appear to be non-compliant with medical care when, in fact, they are receiving those services elsewhere. Secondly, it can be assumed that communities with higher numbers of health and social services are more densely populated. These areas, in general, may consist of more protective and risk factors for residents' health, e.g., crime and poverty. Hence, one's inability to achieve optimal linkage to and retention in care within these communities may have nothing to do with access to health and social services at all. Finally, the number of health and social services in a given community may not be comparable to access to these services. In Birmingham, Alabama, for example, the medical district is located on the south side of the city. While these services are convenient for most people, it can take several hours by public transportation for residents in some of the most disadvantaged communities to reach medical care.

Aggregate neighborhood strain domains were found to be associated with linkage to and retention in care. Of the 12 strain domains and the composite measure of strain, only three (age structure strain, crime strain, and family strain) were found to be statistically associated with the study outcomes. Associations were found for strain domains and retention in care outcomes; no associations could be established between strain domains and linkage to care measures.

Age Structure Strain. The age structure of the community was associated with poorer retention in care when retention is measured by the gaps in care metric. For every one unit increase in age structure strain, individuals are 1.67 times more likely to have gaps between their medical appointments). As a reminder, the measure of age structure strain consisted of a youth dependency ratio and an elder dependency ratio. At the community level, only the youth dependency ratio was associated with study outcomes; the youth dependency ratio was, too, associated with poorer retention in care, but this association was found only when retention in care was measured using the missed visits and visit adherence metrics—not the gaps in care measure. At the community level, the elder dependency ratio could not be associated with any study outcomes.

The strain that results from a disproportionate number of youth or elderly compared to the working population can best be addressed by Jeffrey Morenoff's contribution to the conceptual framework. In his explanation of the spatial dynamics of health (especially low birth weight), Morenoff identifies a number of mechanisms that may work congruently to influence health outcomes, and each may serve as reasonable explanations for the role of age structure strain with the study outcomes. One explanation is the role of social capital. Although beyond the scope of this dissertation, social capital generally refers to how a person might focus attention on the positive consequences of social relationships while somewhat ignoring the negative features of their environment (Portes, 1998; Morenoff, 2003). Age structure—defined by disproportionate numbers of individuals who are not in the working ages (18-64)—is heavily influenced by the numerator in the equation, those under the age of 18 for the youth dependency ratio and those over the age of 64 for the elder dependency ratio. This portion of a community's population is often plagued with less resources to form and/or maintain meaningful social

engagement among neighbors who are more likely to assist with favors, provide health-related advice and other information, aide in everyday tasks such as child care, monitor property, and co-participate in volunteer activities (Morenoff, 2003). It can be argued that social engagement among the young and elderly within a given community may be much less organized; without social capital, individuals residing in these communities may be more likely to be affected by age structure strain.

Another explanation for why age structure strain is associated with HIV primary care retention is related to community resources. Individuals who are not within the working ages may be considered to have fewer financial resources at their disposal. Hence, communities with higher numbers of young people and elderly may have fewer resources for which they can access. Morenoff (2003) refers to this socioeconomic composition, and he notes that the geographical concentration of socioeconomic disadvantage as determined by the community's socioeconomic composition has been linked to multiple health risks.

Finally, the idea of collective efficacy purported by the work of Morenoff and his colleagues (Sampson, et al., 1997; Sampson, et al., 1999) may provide another explanation for how community age structure influences health outcomes. Collective efficacy is defined as "the shared willingness of residents to actively cooperate in pursuit of commonly held goals" (Morenoff, 2003, p. 984). Collective efficacy can be thought of as the community-level version of self-efficacy—an individual-level concept that is defined as an individual's expectation that he/she can accomplish a behavior successfully (Corliss, et al., 2012). Self-efficacy is a more familiar term in HIV care than collective efficacy, and it has been the focus of much research investigating influences on HIV prevention and treatment behaviors, including reported correlations with treatment adherence (Catz, et al., 2000; Gifford, et al., 2000; Kalichman, et al.,

2001; Ammassari, et al., 2002; Murphy, et al., 2002; Johnson, et al., 2003; Reynolds, et al., 2004). Some of these previous studies found that younger age was associated with less self-efficacy for HIV treatment (Barclay, et al., 2007). It is reasonable to consider that lower individual-level self-efficacy among youth or elder populations within a community may manifest as lower community-level collective efficacy, influencing one's poorer retention in necessary HIV primary medical care.

Crime Strain. The crime strain domain consisted of property crime, violent crime, and overall crime rates collected at the city or county level. As previously discussed, a community's violent crime index was found to be associated with retention in care when retention is measured with the visit adherence metric, but this association was in the opposite direction of what one would expect.. Similarly, the crime strain domain was also found to be associated with visit adherence, and it was discovered that as a community's crime strain increased, individuals residing in that community were more likely to be retained in HIV primary care. Alternative explanations for why this may occur have been presented above, and they provide suggestions of how community crime might influence individual-level health behavior. However, when aggregate community-level crime as a potential domain of neighborhood strain is investigated, another plausible explanation may be offered. Singer and his colleagues (2006) provide an eloquent explanation of syndemics theory in their qualitative study of 125 young African-American and Puerto Rican individuals in Hartford, Connecticut. When syndemics theory is applied to the neighborhood context, the inherent difficulty of isolating a particular community factor when these factors (e.g., poverty, unemployment, and crime) are highly correlated and so often coexist is evident. This explanation suggests that any of the findings from this study (including those that are counterintuitive) could have less to do with a specific variable and may

have more to do with the interaction of the variables and other community correlates—an issue to be further discussed later.

Family Structure Strain. When considering potential associations between aggregate strain domains and the principal outcomes, none of the strain domains demonstrated relationships with the study outcomes like family structure strain. Four variables contributed to this community-level strain domain including divorce rate, percentage of female-headed households, total percentage of households—both male and female householders with own children under age 18, and percentage of households with children under age 18 who are not living with both parents. Independently, both the measure of percentage of both male and female householders with own children under age 18 and the measure of percentage of female-headed households were determined to have associations with at least one of the study outcomes. At the individual-level, no association could be established for divorce rate or percentage of children under age 18 not living with both parents and the study outcomes.

Family structure strain was associated with retention in care when retention was measured using the missed visits, visit adherence, and gaps in care metrics. For every increase in community-level family structure strain (unit=1), individuals residing in the community were 1.58 times more likely than those who live elsewhere to have more missed visits. Similarly, for every unit increase in community-level family structure strain, residents were 1.44 times more likely than others to have poorer visit adherence. Family structure strain also was a statistically significant factor for the gaps in care measure of retention; for every one unit increase in family structure strain, individuals were 1.41 times more likely to have gaps in care.

The recent work by Sharpe and her colleagues (2012) begins to highlight the impact of changing family structure on HIV outcomes, especially for African-American women. Female-

headed households and single-parent homes, in general, are more likely to face challenges with poverty and other negative social outcomes (Sharpe, et al., 2012). As the research in this area expands, investigation of how living in a community with higher family structure strain may compound these challenges.

Major Conclusions for Research Question #3: Investigating Community-Level Strain

Mediation effects were achieved between individual- and community-level factors and study outcomes. Research Question #3 was informed by the study's conceptual framework, and the findings related to this question provide new contributions to the literature. The hypothesis emanating from Research Question #3 was not completely supported in this study, and this result, alone, requires further discussion. Two mediation effects were established. It was found that the association between trouble remembering and visit adherence was mediated by age structure strain and that the association between HIV risk factor and visit adherence was mediated by family structure strain. This means that, in this study, it is not self-reported trouble remembering nor HIV risk factor alone that results in poorer visit adherence. The mediation relationship by age structure strain and family structure strain, respectively, is significant.

However, in light of the research questions that informed this study and focus on the proposed mediation of composite community-level strain on the principal outcomes, further explanation is warranted. In considering alternative explanations, certainly, it may be—as shown in this study—that the concept of community-level strain does not a mediate individual- and community-level influences on the principal outcomes. This seems unreasonable, though, as various measures of strain at both the individual- and community-level were shown to be associated with outcomes, and two models resulted in the identification of mediation relationships as described above. Additionally, direct relationships were established between

three strain domains (age structure, crime, and family structure) and retention outcomes. Associations between the strain domains and linkage to care measures were not found. However, the absence of a mediation relationship of community strain in this study should not suggest that the concept of strain does not exist at all. This is further discussed in the Limitations section below.

Given the inability to establish relationships between strain components and linkage to care, the role of strain in the community for retention in care may be of greater interest. However, there are many reasons why the community strain experienced by a newly-diagnosed individual may not affect their ability to link to care. Often individuals will present directly to the 1917 Clinic for HIV testing or the HIV testing will occur in the community but is facilitated by trained 1917 Clinic Education and Outreach staff and volunteers. The level of strain overcome by these individuals in order to eventually arrive at the testing venue is largely unknown. It may be suggested that challenges created by community strain are lessened by a trained in-clinic testing team and immediate access to a structured new patient orientation program such as Project CONNECT. This may be especially true for individuals who have already effectively navigated strain inherent in their community of residence in order to arrive at the HIV testing venue. Additionally, members of the 1917 Clinic HIV Testing Team are well-trained in providing immediate (same day) linkage to Project CONNECT for individuals with positive HIV tests. As the local community has responded to potential gaps in care by providing a more seamless referral to HIV medical care, we have attempted to make HIV testing and immediate linkage to care more uniform; hence, the linkage achieved by a person from a strained community may look no different than the linkage achieved by someone from a less strained area. As such, community-level strain may be a greater influence on the long-term health

outcomes of HIV-infected patients after they have received their initial HIV diagnosis and successfully linked to primary medical care at least once. The mediation relationships established between community-level age structure and community-level family structure and the principal outcomes in this study further supports this explanation, but still leaves questions about why this is the case.

The study found a number of significant associations between community-level characteristics and the study's retention in care outcomes. Each of these independent variables was included in aggregate conceptualizations of strain (strain domains), but relationships between the strain domains and retention in HIV primary medical care were less likely to be identified. Likewise, the concept of composite strain (aggregate community strain across all domains) was not found to be associated with study outcomes. These findings may suggest that the operationalization of strain should be modified and factors that have been consistently associated with negative health outcomes in the literature should be included in future conceptualizations. As the analysis of this study progressed, it became increasingly clear that the measure of composite strain should also take into account the experiences of the individual residing in the community in addition to the contextual components of strain. The way a person perceives, reacts, and responds to a strained environment should be considered. Researchers focusing on neighborhood effects have frequently noted the importance of the individual's perception of their own community (see Ross & Mirowshy, 2009, for example), including those aligned with Morenoff's spatial dynamics position (Sampson, 2004) and those aligned with Agnew's GST (Hoffman & Ireland, 2004).

Limitations

The results of this study should be considered only in light of its limitations. As with all studies that use a convenience sample of relatively small size, the generalizability of study findings are limited. Additionally, all participants in the study sample were from a single HIV clinic in the Southeast United States. Findings may not be generalizable to other clinic settings.

The study was hindered by an inability to investigate the data using hierarchical or multilevel modeling. Once the sample was cleaned and a number of cases excluded, little variance could be seen in the remaining census tracts (i.e., many cases where only one study participant resided in a specific census tract). Given this condition, the argument for a clustering effect could not be supported, and, ultimately, community-level independent variables were analyzed as if they were extensions of individual-level characteristics. This limitation hindered the study from investigating individual-level variables as nested within the broader community.

Every effort was made to use data from the time period that individual participant information was collected at the clinic level. That is, only community level data from 2010 (the median point in time for a participant's entry into the study) were used. However, multiple challenges were faced when attempts were made to assure consistency with the data level. Most, but not all, data were available at the census tract level. Census tract-level data on crime, schools, and health and social services was not available. This information was available at the city, ZIP code, or county level, and the most granular level of data available for each was used. The inability to consistently define community strain domains at the census tract level could have implications for study results. As previously discussed, crime and access to health and social services results that appear to be counterintuitive could be a consequence of this

limitation; additionally, failure to establish an association between school strain and study outcomes could be effected by use of school data available only at the system level.

Inability to establish statistically significant associations between aggregate domains for community-level strain in Research Question #2 prohibited statistically significant findings for the mediation models asserted in Research Question #3. By definition, a mediation effect occurs when the established relationship between X (individual- and community-level factors for this study) and Y (study outcomes) is reduced by the introduction of M (community strain; see explanation of the mediation model in Chapter 3 and Figure 3). To achieve this, correlations must be present for XY, XM, and MY. Due to the inability to establish correlations between composite strain and study outcomes, investigation into potential mediation relationships had to be modified. Although strain domains could be included as the mediator in three models (community age structure, community crime, and community family structure), composite strain could not be investigated.

As previously alluded to, the lack of a standard definition or operationalization of the concept of strain was limiting for this study. Given this, the research focused on a single measure of community-level strain, although there are many other ways to measure it. The way community-level strain was measured in this study (e.g., using blunt cut-offs above and below the median in Alabama) likely prevented the predicted effects. Many community-level variables previously identified as contributing to strain were included in study analyses. However, each factor varied considerably in terms of the way it was measured. Grouping of certain variables into particular domains could also have limited our results (e.g., factors included as contributing to local labor market viability may, in fact, be more related to community economic deprivation). For future research, efforts to establish how each of these factors load with one another should be

considered. Clearly, measuring community-level strain with greater precision and sensitivity is suggested.

Since study activities commenced, emerging research has identified potential challenges in measuring retention in care (Mugavero, et al., 2012). Mugavero and his colleagues (2012) analyzed data on over 10,000 participants from six national academic-affiliated HIV clinics. In their investigation, they identified that measures of retention in care were heavily correlated by the type of measure, e.g., those based on missed visits and those based on kept visits. Nonetheless, all measures were associated with viral load suppression at 12-month observation. From this study, the researchers suggested that there is no "gold standard" for measuring retention in care. This finding could make for considerable limitations to this study. Additionally, results found in the Mugavero article and replicated in this study suggest a major area for future research (discussed in Future Directions further below).

Relevance to Social Work

A background of the social work profession's contribution to research in the area of linkage to and retention in HIV primary medical care and the significance of this study to social work have been provided in Chapter 2. Given the results of the study, implications for social work are further highlighted.

First, research that provides additional understanding of the individual- and/or structural-level processes that influence health disparities is directly related to social work. One aspect of the social work profession that differentiates it from other helping professions is its focus on eliminating social and economic injustices. As this study confirms, disproportionate numbers of younger adults, women, and minorities have poorer performance on measures of linkage to and retention in care. Additionally, the study suggests that characteristics endemic to strained

communities (e.g., neighborhood racial segregation, disproportionate age structure, female-headed and single-parent households, and crime) and disparate in health outcomes are associated with HIV treatment linkage and retention. Studies such as the current one may not only answer calls by Wheeler (2007) and Hall (2008) for social work to increase its role in the HIV field and to resolve related structural inequalities, but also further encourage social work-driven research on HIV-related health disparities.

Findings from this study confirm and even shed new light on individual- and community-level factors that influence poorer linkage to and retention in HIV primary medical care. These findings are particularly relevant to social workers in the field. With results from this study and others like it, social workers can begin their relationship with HIV-infected individuals—even at the very first encounter—equipped with knowledge about that person's disposition for successful engagement across their HIV treatment continuum. Social workers are well-equipped to provide linkage, mediation, and brokerage services for their consumers, and these skills can be enhanced when a person's profile, including their specific challenges—are known from the start. Combined with contemporary research on the role of patient "activation" or one's self-efficacy to achieve positive health behaviors, for example (Marshall, et al., 2013), information about one's community of residence may provide social workers with a very clear picture of a patient's likelihood to succeed in HIV treatment. For individuals who live in strained communities—especially those with higher community age structure, community crime, and community family structure—new interventions that alleviate the effects of strain may be developed to provide these patients with the added social support necessary to overcome such barriers at the earliest encounters.

Additionally, the results of this study provide insight into possible interventions that may be uniquely facilitated by social workers. Taking into account the linkage and engagement potential of a person and the opportunity to provide early intervention, social workers are not only better prepared to provide needed assistance, but they are also able to do so at a critical time in a person's HIV treatment experience. This nexus between linkage to care and subsequent retention in care—fostered by the relationship between a newly-diagnosed HIV-infected person and their social worker—may be an optimal time for social workers to implement various empirically-based strategies such as patient navigation and/or strengths-based case management to maximize a patient's HIV treatment adherence. Similarly, social workers should continue to be accessed for widespread training of facilitators who conduct specific interventions.

This study sets the stage for additional social work research that takes into account the role of neighborhood or community. Considering the broader context follows social work's longstanding preference to practice from a systems and socio-ecological approach. While these frameworks have shaped social work practice for years, they are beginning to gain momentum in other fields that provide important care to people living with HIV, e.g., medicine, nursing, and psychology. In light of the recent "perfect storm" reference in Chapter 1, social work is in a unique position to assert its potential contributions within the HIV treatment cascade (Gardner, et al., 2011) and to the science that informs related practice.

Policy practice in the social work profession has been identified as a core competency behavior by the Council on Social Work Education (CSWE, 2008). Specifically, social workers should "analyze, formulate, and advocate for policies that advance social well-being," and they should "collaborate with colleagues and clients for effective policy action" (p. 6). This study suggests a tremendous opportunity for social workers to be catalysts for a public dialogue on the

potential role of aggregate community conditions on health disparities among individuals with HIV. If community strain—or elements of it—mediate other individual-level factors and one's HIV primary medical care adherence, social workers have an opportunity, or even an obligation, to advocate for improved community conditions. For example, An HIV-infected patient who is not linked to primary medical care because of his/her lack of access to adequate transportation may benefit from a social work-driven, grassroots effort to upgrade local public transportation. This type of structural improvement will not generally occur by a single social worker picketing outside county commission or city government meetings. Instead, social work professionals may lead local efforts to mobilize community leaders, stakeholders, and gatekeepers through participation in targeted community coalitions that provide a unified voice representing the needs of not only the HIV-infected patient, but all disenfranchised people. Similarly, community coalitions may be the most effective vehicle for achieving macro-level change. In January 2013, the National Minority AIDS Council (NMAC) and the UAB CFAR hosted a regional dialogue in Birmingham, Alabama titled, "Ending AIDS in Alabama." The dialogue focused on the state of HIV-related services in Alabama, including a discussion about the most significant gaps in care. Resultant of this regional dialogue, a committed group of stakeholders from the Jefferson County, Alabama area met to strategize how best to address the identified gaps in local HIV care. Ultimately, the group formed the Jefferson County HIV/AIDS Community Coalition, and the 16-member Coalition has since actively planned a unified approach to building a model HIV/AIDS continuum of care. Communication deficits between AIDS service organizations and HIV treatment facilities have been identified and strategies to streamline service delivery to the most disenfranchised persons have been implemented such as immediate assessment for substance use disorders and referral to residential and outpatient substance abuse treatment. Collaborative

efforts to eliminate structure-level barriers resulting from the closing of the county's charity hospital and in-house HIV clinic have been formalized including programs that use peer mentors to provide additional support to individuals who are transitioning HIV primary care to a new clinic. Advocacy for streamlined reporting of HIV test results, CD4 counts, and viral loads between area treatment facilities and service providers has occurred and now offers hope that, one day, individuals who face the most significant structural barriers are immediately linked to primary medical care, and those who fall out of care—perhaps due to community strain—may be identified at participating healthcare facilities as needing re-engagement services. Through a strong education in generalist practice, social workers have the capacity to work collaboratively with members of other helping professions, and they may be often sought to lead community mobilization efforts due to their extensive understanding of a socio-ecological framework and strengths-based perspective. In the example mentioned above, social work professionals see more than an HIV-infected patient who fails to make a clinic appointment; they see a well-meaning person who has no available, adequate transportation resources on which to rely.

Future Directions

The findings from this study highlight the need for additional research focusing on neighborhood effects, in general, and General Strain Theory, specifically, and the role the broader neighborhood or community environment plays in linkage to and retention in HIV primary medical care. Certainly, there is much more to learn about possible associations and the nature of these relationships. Four primary areas for next steps are introduced to inform future research strategies.

First, differentiating between individual- and community-level effects is an area that could benefit from additional research. Although this study initially sought to analyze individual

characteristics as nested within the community, this goal could not be achieved with the available sample. Future studies should seek to achieve a larger sample size in order to gather more complete data measured for the individual participant and for the groups in which they function. This is a problem not unique to this study. It is indicative of a much broader issue that considers the non-experimental study design and the inability to make causal inference. Oakes (2004) outlines a number of shortcomings to research on community-level variables and the resultant "(mis)estimation of neighborhood effects". A number of health-related studies have suggested that consideration of the randomized control trial (RCT) and the inclusion of longitudinal data should direct next steps in this research (Agnew, 2001; Oakes, 2004; Thomas, Torrone, & Browning, 2009).

Second, our study suggests the need for future research to explicitly conceptualize community-level strain. Agnew himself (2001) has noted challenges presented by hundreds of conditions that could potentially meet the definitions of objective (events that are disliked by most members of a given group) or subjective (events that are disliked by people who are experiencing them) strain. Agnew (2001) suggests that one way to address these issues is for strain researchers to provide participants with a predetermined list of strain factors and elicit participant feedback on factors that most directly relate to experiences of strain as well as provide participants the opportunity to add to the list. As with this study, a number of strain domains were included in order to capture strain in the community. These strain domains were aggregated in order to create a composite strain domain. Agnew (2001) also suggests that future research using GST consider a single, standardized composite measure of strain. However, this suggests yet another area for future research as existing single composite measures of strain

generally investigate factors that contribute to the development of criminal activity or delinquency and not on the potential effect of strain on an individual's or a community's health.

Third, the conceptual framework which forms the foundation of this study is one grounded in extensive criminology and epidemiology research and one that provides a theoretical lens conducive to the values of the social work profession. Given these compatibilities, study findings suggest an opportunity to refine the framework. Initial efforts to do this may include a closer investigation of the role of community resources. This is a logical next step from a social work perspective driven by the strengths of the client/patient; taking advantage of the strengths/resources within one's community is likewise, implicit to social work practice. Next, in addition to considering possible mediation effects among study variables, moderating effects should also be studied. Rather than explaining the relationship between study variables (e.g., mediation models), moderating variables would potentially be shown to influence the strength of relationships which have previously been established in the HIV/AIDS linkage to and retention in care literature. Additionally, analysis of study variables and their correlations (e.g. factor analysis) could further inform decisions to include or exclude variables into similar studies.

Finally, one of the most intriguing results of this study is the variability demonstrated between established and accepted measures of retention in HIV primary medical care. This finding supports emerging research in this area that has appeared since our study began. The research poses important questions about how retention is measured and how these measures are used to inform policy. Mugavero and his colleagues (2012) were the first to identify significant differences in each of the six measures of retention; while each measure performed well for viral load suppression of participants at 12-month follow-up, measures displayed a wide range of variability with one another—with both metrics based on missed-visits and metrics based on

kept-visits closely correlating within measure group but failing to correlate with each other. This work was substantiated at the International Association of Providers in AIDS Care Adherence 2013. Batey, et al., found that individuals categorized by specific demographic characteristics perform differently on retention in care depending on the measure of retention used. For missed-visits based measures (no show and visit adherence), African-Americans and IVDUs were more likely to have poorer retention in care, while males were more likely to have better retention in care. However, when the kept-visits based measures were observed, there was no difference in the performance of African-Americans or IVDUs and their counterparts. In fact, males performed worse than females on one of the kept-visits based measures. These findings suggest that different measures of retention in care may have value and utility according to the setting and circumstance. The authors suggest that there may be merit in using a missed-visits based measure and a kept-visits based measure in future research settings and public health surveillance (Batey, et al., 2013).

Research focusing on the community-level factors associated with linkage to and retention in HIV primary medical care is at a precipice, and opportunities for science to inform policy are boundless (Mugavero, Amico, Horn, & Thompson, 2013). In March 2010, President Barack Obama signed the Patient Protection and Affordable Care Act into law. The law is meant to provide access to affordable healthcare to currently uninsured people. Subsequently, the U.S. Supreme Court upheld the constitutionality of the act in June 2012. The following month, in July 2010, President Obama signed the nation's first strategic plan in response to the growing HIV/AIDS pandemic in the United States. Both policies represented significant victories for healthcare disparities, in general, but HIV prevention and treatment specifically. However, before additional progress can be made in the science of HIV appointment adherence, we must

focus future research on completion of significant formative work that clearly conceptualizes both the influence of community-level strain and the health outcomes associated with linkage to and retention in care.

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Appendix A:
Permission to Use 1917 Clinic Cohort Data

SCHOOL OF MEDICINE
Department of Medicine

TO: The University of Alabama Institutional Review Board

FROM: Michael Mugevero, MD, MHSc

DATE: August 17, 2012

RE: Permission to use existing dataset for research: *Exploring Individual- and Community-Level Predictors and Mediators of Suboptimal HIV Primary Care Appointment Adherence: The Importance of Place*

As the Administrative Principal Investigator for the CNICS 0702 protocol #X020923009, I am writing to inform you that D. Scott Batey, MSW, has my permission to access these data in accordance with the proposed protocol.

If you have any questions, please feel free to call me at (205) 996-5822.

Thank you.

Michael J. Mugavero, MD, MHSc
Department of Medicine, Division of Infectious Diseases
University of Alabama at Birmingham
BBRB 206H
1530 3RD AVE S
Birmingham, AL 35294-2050

The University of Alabama at Birmingham
Outpatient Clinic • 908 20th Street South
Birmingham, Alabama 35294-2050 • (205) 934-1917 • FAX (205) 934-8490

Appendix B:
The University of Alabama Office for Research Compliance Approval Letter

September 24, 2012

Office for Research

Institutional Review Board for the
Protection of Human Subjects

THE UNIVERSITY OF
ALABAMA
RESEARCH

David Batey
School of Social Work
The University of Alabama
Box 870314

Re: IRB # 12-OR-319-ME, "Exploring Individual and Community-Level Predictors and Mediators of Suboptimal HIV Primary Care Appointment Adherence: The Importance of Place"

Dear Mr. Batey:

The University of Alabama Institutional Review Board has granted approval for your proposed research.

Your application has been given expedited approval according to 45 CFR part 46. Approval has been given under expedited review category 5 as outlined below:

(5) Research involving materials (data, documents, records, or specimens) that have been collected, or will be collected solely for nonresearch purposes (such as medical treatment or diagnosis).

Your application will expire on September 23, 2013. If the study continues beyond that date, you must complete the IRB Renewal Application. If you modify the application, please complete the Modification of an Approved Protocol form. Changes in this study cannot be initiated without IRB approval, except when necessary to eliminate apparent immediate hazards to participants. When the study closes, please complete the Request for Study Closure form.

Should you need to submit any further correspondence regarding this application, please include the assigned IRB application number.

Good luck with your research.

Sincerely,

Carpantato T. Myles, MSM, CIM
Director & Research Compliance Officer
Office for Research Compliance
The University of Alabama

358 Rose Administration Building
Box 870127
Tuscaloosa, Alabama 35487-0127
(205) 348-8461
FAX (205) 348-7189
TOLL FREE (877) 820-3066

Appendix C:
1917 Clinic Project CONNECT Interview

Date: _____/_____/2008 Time Began: _____ Time Ended: _____ Team Member's Initials: _____

The 1917 Clinic
a member of the UAB Health System

Project CONNECT Interview

NAME: _____ Preferred Name: _____

MR#: _____ DOB: _____AGE: _____

INSURANCE: ☐ None—Ryan White/ADAP ☐ Medicare ☐ Medicaid ☐ BC/BS
☐ Aetna ☐ Other _____

1. INTRODUCTION

Marital Status:
☐ Single ☐ Married ☐ Separated ☐ Divorced ☐ Partner ☐ Widowed

Race: ☐ Black ☐ White ☐ Hispanic ☐ Asian ☐ Other

Gender: ☐ Male ☐ Female ☐ Trans. (M TO F) ☐ Trans. (F TO M)

Height _____' _____" Weight _____lbs.

2. HOUSEHOLD

Lives in City: _____ State: ____
Recently Moved from City: _____ State: ____

Presently lives with/at:
☐ Lives Alone ☐ Spouse ☐ Partner ☐ Mother ☐ Father
☐ Both Parents ☐ Brother ☐ Sister ☐ Friends ☐ Roommate
☐ Stepfather ☐ Stepmother ☐ Relatives ☐ Alethia House
☐ The Rectory ☐ Fellowship House ☐ Neighborhood House
☐ Other _____

3. FAMILY HISTORY

Biological Family

Mother is ☐ Living ☐ Deceased Date _____, Cause _____
Father is ☐ Living ☐ Deceased Date _____, Cause _____

_____ Biological brothers living; _____ Biological brothers deceased
_____ Stepbrothers living; _____ Stepbrothers deceased
_____ Biological sisters living; _____ Biological sisters deceased
_____ Stepsisters living; _____ Stepsisters deceased

Children

_____ I do not have any children
_____ Sons living; _____ Sons deceased
_____ Daughters living; _____ Daughters deceased

4. HIV DIAGNOSIS

WHEN did you find out that you were HIV Positive? ____ /_____ / _____

Updated August 22, 2008

Do you remember *WHY* you got tested?

- ☐ I thought my sexual partner might be HIV positive.
- ☐ I was contacted by the local health department to come in for a test.
- ☐ I was donating blood or plasma.
- ☐ I shared needles with someone who might be positive.
- ☐ My physician recommended I get tested when I was sick.
- ☐ I was incarcerated (in prison or jail) at the time.
- ☐ I went to a hospital emergency room and they tested me.
- ☐ I was in the hospital and they tested me.
- ☐ I went to my doctor's office and they tested me.
- ☐ I am/was pregnant and my doctor's office tested me.
- ☐ I just thought it was a good thing to be tested.
- ☐ I had a possible exposure at work.
- ☐ I was born with HIV.
- ☐ I don't remember.
- ☐ Other _____

HIV Test Facility:
☐ Home ☐ Work ☐ Hospital ☐ ER ☐ Doctor's Office
☐ Jail/Prison ☐ Health Department ☐ Other _____

HIV Test Location City: _____ State: _____

Have you *EVER* participated in an HIV/AIDS Vaccine Trial?
☐ YES ☐ NO Approximate date _____/_____/_____

Did you ever have a Negative HIV test *BEFORE* you tested Positive?
☐ YES ☐ NO Approximate date _____/_____/_____

Did you ever *GIVE BLOOD BEFORE* you tested Positive?
☐ YES ☐ NO Approximate date _____/_____/_____

5. HIV TREATMENT HISTORY

☐ New DX ☐ NDX-1 (New dx in Hosp. or ER) ☐ TRC-1 (Transferring Care) ☐ TRC-2 (Out of care >1 yr)

☐ NEW PT to Clinic ☐ RETURN PT to the Clinic

☐ Previous Provider Managing HIV ☐ No Previous Provider Managing HIV

Name: _____

Address: _____

Phone: _____ Fax: _____

Do you know your most recent CD4 count? ☐ YES ☐ NO
If yes, most recent CD4: _____ Date: ____/_____/____

Updated August 22, 2008

Do you know your most recent Viral Load count? ☐ YES ☐ NO
If yes, most recent Viral Load _____ Date: ___/_____/_____

Have you ever taken HIV medications? ☐ YES ☐ NO
If yes, when did you start taking HIV meds: Date: ____/____/____

Are you taking HIV medications now? ☐ YES ☐ NO

Would you like for us to get a copy of your records faxed to us?
☐ YES, permission form signed ☐ NO ☐ NOT NEEDED

Have you brought previous medical records? ☐ YES ☐ NO

6. MEDICATIONS AND ALLERGIES

Present Medications: If the patient is on ANY medication, please list below while the patient is filling out the Health Questionnaire.

Medicine	mg	Frequency	Route	Dispense Date
1.		_____ tab _____ cap _____ daily _____ weekly _____ prn	☐ Oral ☐ Rectal ☐ Mucosal ☐ Patch/skin ☐ Injection	____/____/____
2.		_____ tab _____ cap _____ daily _____ weekly _____ prn	☐ Oral ☐ Rectal ☐ Mucosal ☐ Patch/skin ☐ Injection	____/____/____
3.		_____ tab _____ cap _____ daily _____ weekly _____ prn	☐ Oral ☐ Rectal ☐ Mucosal ☐ Patch/skin ☐ Injection	____/____/____
4.		_____ tab _____ cap _____ daily _____ weekly _____ prn	☐ Oral ☐ Rectal ☐ Mucosal ☐ Patch/skin ☐ Injection	____/____/____
5.		_____ tab _____ cap _____ daily _____ weekly _____ prn	☐ Oral ☐ Rectal ☐ Mucosal ☐ Patch/skin ☐ Injection	____/____/____
6.		_____ tab _____ cap _____ daily _____ weekly _____ prn	☐ Oral ☐ Rectal ☐ Mucosal ☐ Patch/skin ☐ Injection	____/____/____
7.		_____ tab _____ cap _____ daily	☐ Oral ☐ Rectal ☐ Mucosal	____/____/____

Updated August 22, 2008

Medicine	mg	Frequency	Route	Dispense Date
		_____ weekly _____ prn	☐ Patch/skin ☐ Injection	
8.		_____ tab _____ cap _____ daily _____ weekly _____ prn	☐ Oral ☐ Rectal ☐ Mucosal ☐ Patch/skin ☐ Injection	____/____/____
9.		_____ tab _____ cap _____ daily _____ weekly _____ prn	☐ Oral ☐ Rectal ☐ Mucosal ☐ Patch/skin ☐ Injection	____/____/____
10.		_____ tab _____ cap _____ daily _____ weekly _____ prn	☐ Oral ☐ Rectal ☐ Mucosal ☐ Patch/skin ☐ Injection	____/____/____
11.		_____ tab _____ cap _____ daily _____ weekly _____ prn	☐ Oral ☐ Rectal ☐ Mucosal ☐ Patch/skin ☐ Injection	____/____/____
12.		_____ tab _____ cap _____ daily _____ weekly _____ prn	☐ Oral ☐ Rectal ☐ Mucosal ☐ Patch/skin ☐ Injection	____/____/____
13.		_____ tab _____ cap _____ daily _____ weekly _____ prn	☐ Oral ☐ Rectal ☐ Mucosal ☐ Patch/skin ☐ Injection	____/____/____
14.		_____ tab _____ cap _____ daily _____ weekly _____ prn	☐ Oral ☐ Rectal ☐ Mucosal ☐ Patch/skin ☐ Injection	____/____/____
15.		_____ tab _____ cap _____ daily _____ weekly _____ prn	☐ Oral ☐ Rectal ☐ Mucosal ☐ Patch/skin ☐ Injection	____/____/____

Do you have any medication allergies?
☐ YES ☐ NO (skip to #7 if answer is NO)

If YES, what medicine(s)?
☐ Penicillin ☐ Sulfa drugs ☐ Insulin preparations
☐ Muscle relaxants ☐ Local anesthetics ☐ Other _____

If YES, what type of reaction?
☐ Itching ☐ Hives ☐ Throat swelling ☐ Loss of consciousness
☐ Asthma ☐ Drop in blood pressure ☐ Irregular heart rhythm
☐ Nausea ☐ Vomiting ☐ Abdominal Cramping

7. HIV DISCLOSURE/EMOTIONAL SUPPORT

Since you found out that you are HIV positive, who have you told about your diagnosis in your family?

☐ Everyone in my family knows about my HIV diagnosis.
☐ No one in my family knows about my HIV diagnosis.
☐ Only the following persons in my family know (mark all that apply):

☐ Husband ☐ Wife ☐ Partner ☐ Cousin(s)
☐ Mother ☐ Father ☐ Sister(s) ☐ Brother(s)
☐ Aunt(s) ☐ Uncle(s) ☐ Stepsister(s) ☐ Stepbrother(s)
☐ Stepparent ☐ G-Mother ☐ G-Father ☐ Other _____

Since you found out that you are HIV positive, who have you told about your diagnosis outside your family (friends)?

☐ I am totally open with my friends about my HIV diagnosis.
☐ Only a few friends know about my HIV diagnosis.
☐ Only one friend knows about my HIV diagnosis.
☐ None of my friends know about my HIV diagnosis.

8. HIV TESTING OF PARTNER OR SPOUSE

Are you sexually active with anyone presently?
☐ Yes ☐ No (if No, skip to next section for Spirituality or Faith Beliefs)

Has he or she been tested for HIV?
☐ Yes ☐ No (skip to next section) ☐ Don't Know

His/Her latest test result was ☐ HIV Positive ☐ HIV Negative
If Yes, approximate date of the test: _____/_____/_____

Would he or she like to be tested for HIV?
☐ Yes ☐ No ☐ Not Sure

9. SPIRITUALITY OR FAITH BELIEFS

Are your spiritual beliefs or faith important to you?

☐ YES ☐ NO ☐ NOT SURE

Do you attend a church, synagogue, mosque or other spiritual community?

☐ YES ☐ NO ☐ IN THE PAST, BUT NOT ANYMORE

Are there any spiritual needs or concerns that you would like to discuss with one of our Chaplains?

☐ YES ☐ NO ☐ NOT SURE

10. EDUCATION HISTORY/LEARNING ABILITY

The last grade I completed in school was the

☐ 1ST grade ☐ 2ND grade ☐ 3RD grade ☐ 4th grade ☐ 5th grade ☐ 6th grade
☐ 7th grade ☐ 8th grade ☐ 9th grade ☐ 10th grade ☐ 11th grade ☐ 12th grade
☐ GED ☐ Some college ☐ Undergraduate Degree
☐ Post graduate degree ☐ Other _____

Are your reading skills adequate to understand material we may give you?

☐ Yes ☐ No ☐ Yes, but may need a little help

Are your writing skills adequate to fill out information for contact information?

☐ Yes ☐ No ☐ Yes, but may need a little help

Do you have any other learning disabilities?

☐ No ☐ Attention Deficit ☐ Dyslexia ☐ Auditory/Visual

11. WORK HISTORY

Type of work (or what field)?

In the past, I worked at _____ ☐ None

Presently working at _____ ☐ Not Working

Since _____ (year), I have been on disability ☐ On Disability

Is your income greater than $31,200 annually or $2,600 monthly?

☐ YES ☐ NO If No, please introduce to Social Worker before lab work.

12. INCARCERATION HISTORY

Have you ever been in prison? ☐ YES ☐ NO

13. REFERRALS COMPLETED

☐ **Chaplain** (Grief, Spiritual issues, make appt. with Malcolm Marler)

☐ **CompSAT** (Substance Use History, make appointment with Paige Ingle-Pang)

☐ **Dental Clinic** (fill out blue referral form and give to Tonesa Spivey, encourage pt. to make own appt)

Updated August 22, 2008

- ☐ **HIV Testing for Spouse/Partner** (Overhead page a member of Testing Team, or give contact information to Kelly Ross-Davis/Chris Hamlin)
- ☐ **Mental Health Counselor** (Depression, anxiety, emotional support, make appt. w/Charles Wright)
- ☐ **Nutritionist** (healthy eating, vitamin/supplement consult, make appt. with Donna Yester)
- ☐ **OB-GYN**
- ☐ **Peer Navigator** (support from experienced patient, get consent form signed, assignment made)
- ☐ **Research Study Possibility—**HAART naïve (email patient's contact information and Provider appt to Karen Savage)
- ☐ **Social Services** (Ryan White/ADAP, Housing, Medicine Acquisition,
- ☐ **Volunteering or Patient Advisory Board** (give contact info to Kelly Ross-Davis)

14. DOCUMENTATION REQUESTED TO BRING TO FIRST PHYSICIAN APPOINTMENT

- ☐ Present Medicines
- ☐ Proof of Residence
- ☐ Proof of Income
- ☐ Previous medical records
- ☐ Other _____

REMINDER FOR INTERVIEWER

☐ **IF YOU DO NOT HAVE INSURANCE**

We will need to meet with one of our social workers TODAY BEFORE we do lab work to get you enrolled into the Ryan White and ADAP programs to help cover most of the cost of doctor's visits and HIV medicines. (Note to Interviewer: Overhead page Wes or Kathy or Crystal and let them know you have a new patient who needs Ryan White and ADAP. Meet him/her in lab or office.)

☐ **IF YOU ARE NEWLY DIAGNOSED OR HAVE JUST MOVED TO ALABAMA AND ALREADY HAD A DIAGNOSIS OF HIV?**

Because HIV is a transmissible virus and in the interest of Public Health, the County Health Department in the county where you live is going to contact you by phone to set up an interview with you. We encourage you to call the County Health Department in the county where you live if you have not talked with them yet, and ask to speak to the HIV coordinator.

Appendix D:
1917 Clinic New Patient Health Questionnaire

The 1917 Clinic
a member of the UAB Health System

NEW PATIENT HEALTH QUESTIONNAIRE

TODAY'S DATE: _____ / _____ / _____

NAME: _____
Thank you for printing clearly

MEDICAL RECORD #: _____

DATE OF BIRTH: _____

HIV TREATMENT HX:

_____ New DX (NDX)
_____ New DX in hospital of ER (NDX-1)
_____ Diagnosed over 6 mo ago, new to treatment (NDX-2)
_____ Transferring care (TRC-1)
_____ Out of care for >1 year (TRC-2)
_____ Released from prison in the last 30 days (TRC-P1)
_____ Released from prison over 30 days ago (TRC-P2)

What is the highest grade you completed?

1-6 7-9 10 11 12 GED

Technical Training Some College College graduate Post Graduate

INSTRUCTIONS:

Please take a few mintues to fill out the Patient Health Questionnaire in order for your Medical Team to understand your history.

We appreciate your honesty in answering all of the questions so that we can have the most accurate information possible to be able to be your partner in caring for your health.

This questionnaire includes the following areas:

- Depression and Anxiety
- Alcohol Consumption
- Substance Use
- Safety
- Social Support
- Quality of Life
- HIV Stigma

DEPRESSION AND ANXIETY

Please indicate how often *over the* ***LAST 2 WEEKS*** you have been bothered by any of the following problems.

For each question, please indicate the answer that best applies by checking the box.

Have you felt?	Not at all	Several Days	More than half the days	Nearly every day
1. Little interest or pleasure doing things	☐	☐	☐	☐
2. Feeling down, depressed, or hopeless	☐	☐	☐	☐
3. Trouble falling or staying asleep, or sleeping too much	☐	☐	☐	☐
4. Feeling tired or having little energy	☐	☐	☐	☐
5. Poor appetite or overeating	☐	☐	☐	☐
6. Feeling bad about yourself-or that you are a failure or have let yourself or your family down	☐	☐	☐	☐
7. Trouble concentrating on things, such as reading the newspaper or watching television	☐	☐	☐	☐
8. Moving or speaking so slowly that other people could have noticed? Or the opposite - being so fidgety or restless that you have been moving around a lot more then usual	☐	☐	☐	☐
9. Thought that you would be better off dead or hurting yourself in someway	☐	☐	☐	☐

1. **In the last 4 weeks, have you had an anxiety attack - suddenly feeling fear or panic?**

   ☐ Yes
   ☐ No (If NO, go to the next page)

   If YES,
2. **Has this ever happened before?**

   ☐ Yes
   ☐ No

3. **Do some of these attacks come suddenly out of the blue - that is, in situations where you don't expect to be nervous or uncomfortable?**

   ☐ Yes
   ☐ No

4. **Do these attacks bother you a lot or are you worried about having another attack?**

   ☐ Yes
   ☐ No

5. **During your last bad anxiety attack, did you have symptoms like shortness of breath, sweating, your heart racing or pounding, dizziness or faintness, tingling or numbness, or nausea or upset stomach?**

   ☐ Yes
   ☐ No

ALCOHOL CONSUMPTION

This portion of the questionnaire is about your use of alcoholic beverages during the ***PAST YEAR***

For each question, please indicate the answer that best applies by checking the box.

1. How often do you have a drink containing alcohol?

- ☐ Never
- ☐ Monthly or less
- ☐ 2-4 times a month
- ☐ 2-3 times a week
- ☐ 4 or more times a week

2. How many drinks containing alcohol do you have on a typical day when you are drinking?

- ☐ 1 or 2
- ☐ 3 or 4
- ☐ 5 or 6
- ☐ 7 or 8
- ☐ 9 or more

3. How often do you have 5 or more drinks on one occasion?

- ☐ Never
- ☐ Less than monthly
- ☐ Monthly
- ☐ Weekly
- ☐ Daily or almost daily

SUBSTANCE USE

Now we are going to ask you about drug use.

For each question, please indicate the answer that best applies by checking the box.

1. **In your life, have you EVER used marijuana?**
   - ☐ No (If NO, Skip to Question 6 on the next page)
   - ☐ Yes

2. **In the PAST 3 MONTHS, how often have you used marijuana?**
   - ☐ Never
   - ☐ Once or twice
   - ☐ Monthly
   - ☐ Weekly
   - ☐ Daily or almost daily

3. **During the PAST 3 MONTHS, how often have you been preoccupied or concerned about your use of marijuana?**
   - ☐ Never
   - ☐ Once or twice
   - ☐ Monthly
   - ☐ Weekly
   - ☐ Daily or almost daily

4. **During the PAST 3 MONTHS, how often has your use of marijuana led to problems with family, friends, legal authorities, your employment (or school), your personal finances or your health?**
   - ☐ Never
   - ☐ Once or twice
   - ☐ Monthly
   - ☐ Weekly
   - ☐ Daily or almost daily

5. **Have you tried to control, cut down or stop using marijuana?**
   - ☐ No
   - ☐ Yes, but not in the last 3 months
   - ☐ Yes , in the past 3 months

6. **In your life, have you EVER used cocaine or crack?**
   - ☐ No (If NO, Skip to Question 6 on the next page)
   - ☐ Yes

7. **In the PAST 3 MONTHS, how often have you used cocaine or crack?**
   - ☐ Never
   - ☐ Once or twice
   - ☐ Monthly
   - ☐ Weekly
   - ☐ Daily or almost daily

8. **During the PAST 3 MONTHS, how often have you been preoccupied or concerned about your use of cocaine or crack?**
   - ☐ Never
   - ☐ Once or twice
   - ☐ Monthly
   - ☐ Weekly
   - ☐ Daily or almost daily

9. **During the PAST 3 MONTHS, how often has your use of cocaine or crack led to problems with family, friends, legal authorities, your employment (or school), your personal finances or your health?**
   - ☐ Never
   - ☐ Once or twice
   - ☐ Monthly
   - ☐ Weekly
   - ☐ Daily or almost daily

10. **Have you tried to control, cut down or stop using cocaine or crack?**
    - ☐ No
    - ☐ Yes, but not in the last 3 months
    - ☐ Yes , in the past 3 months

11. **In your life, have you EVER used amphetamines (crystal meth, speed, crank)? (non-medical use only)**
    - ☐ No (If NO, Skip to Question 11)
    - ☐ Yes

12. **In the PAST 3 MONTHS, how often have you used amphetamines (crystal meth, speed, crank)?**
    - ☐ Never
    - ☐ Once or twice
    - ☐ Monthly
    - ☐ Weekly
    - ☐ Daily or almost daily

13. **During the PAST 3 MONTHS, how often have you been preoccupied or concerned about your use of amphetamines (crystal meth, speed, crank)?**
   - ☐ Never
   - ☐ Once or twice
   - ☐ Monthly
   - ☐ Weekly
   - ☐ Daily or almost daily

14. **During the PAST 3 MONTHS, how often has your use of amphetamines (crystal meth, speed, crank) led to problems with family, friends, legal authorities, your employment (or school), your personal finances or your health?**
   - ☐ Never
   - ☐ Once or twice
   - ☐ Monthly
   - ☐ Weekly
   - ☐ Daily or almost daily

15. **Have you tried to control, cut down or stop using amphetamines (crystal meth, speed, crank)?**
   - ☐ No
   - ☐ Yes, but not in the last 3 months
   - ☐ Yes , in the past 3 months

16. **In your life, have you EVER used opiates (heroin or non-prescribed opioid pain medications)? (non-medical use only)**
   - ☐ No (If NO, skip to Question 16)
   - ☐ Yes

17. **In the PAST 3 MONTHS, how often have you used opiates (heroin or non-prescribed opioid pain medications)?**
   - ☐ Never
   - ☐ Once or twice
   - ☐ Monthly
   - ☐ Weekly
   - ☐ Daily or almost daily

18. **During the PAST 3 MONTHS, how often have you been preoccupied or concerned about your use of opiates (heroin or non-prescribed opioid pain medications)?**
   - ☐ Never
   - ☐ Once or twice
   - ☐ Monthly
   - ☐ Weekly
   - ☐ Daily or almost daily

19. During the PAST 3 MONTHS, how often has your use of opiates (heroin or non-prescribed opioid pain medications) led to problems with family, friends, legal authorities, your employment (or school), your personal finances or your health?

- ☐ Never
- ☐ Once or twice
- ☐ Monthly
- ☐ Weekly
- ☐ Daily or almost daily

20. Have you tried to control, cut down or stop using opiates (heroin or non-prescribed opioid pain medications)?

- ☐ No
- ☐ Yes, but not in the last 3 months
- ☐ Yes , in the past 3 months

21. Have you EVER used any drug by injection (non-medical use only)?

- ☐ No
- ☐ Yes, but not in the last 3 months
- ☐ Yes , in the past 3 months

22. During the past year, have you received any treatment for drug or alcohol use?

- ☐ No
- ☐ Yes

SAFETY

In this clinic, we are concerned about your health and safety. Many people have experienced violence or are in relationships where they are afraid their partners or others who are close to them may hurt them. Because of this, we are going to ask you about safety in relationships.

Please read each of the following activities and fill in the square of that best

1. Are you presently emotionally or physically abused by your partner or someone important to you?
   - ☐ No
   - ☐ Yes

2. Are you presently being hit, slapped, kicked, or otherwise physically hurt by your partner or someone important to you?
   - ☐ No
   - ☐ Yes

3. Are you presently forced to have sexual activities?
   - ☐ No
   - ☐ Yes

4. Are you afraid of your partner or anyone of the following?
   - ☐ Current or former intimate partner
   - ☐ Other family member
   - ☐ Acquaintance or friend
   - ☐ Coworker
   - ☐ Other
   - ☐ Does not apply

5. (If pregnant) Have you ever been hit, slapped, kicked, or otherwise physically hurt by your partner or someone important to you during your pregnancy?
   - ☐ No
   - ☐ Yes
   - ☐ Does not apply

6. Prior to now, have you EVER been emotionally or physically abused by your partner or someone important to you?
   - ☐ No
   - ☐ Yes

7. Prior to now, have you EVER been hit, slapped, kicked, or otherwise physically hurt by your partner or someone important to you?

- ☐ No
- ☐ Yes

8. Prior to now, have you EVER been forced to have sexual activities?

- ☐ No
- ☐ Yes

SOCIAL SUPPORT

People sometimes look to others for friendship, assistance, or other types of support. How often is each of the following kinds of support available to you if you need it? For each question, please indicate the answer that best applies by checking the box.

1. **How often do you have someone to turn to for suggestions about how to deal with a personal problem?**
   - ☐ None of the time
   - ☐ A little of the time.
   - ☐ Some of the time
   - ☐ Most of the time
   - ☐ All of the time

2. **How often do you have someone to help with daily chores if you were sick?**
   - ☐ None of the time
   - ☐ A little of the time.
   - ☐ Some of the time
   - ☐ Most of the time
   - ☐ All of the time

3. **How often do you have someone to love you and make you feel wanted?**
   - ☐ None of the time
   - ☐ A little of the time.
   - ☐ Some of the time
   - ☐ Most of the time
   - ☐ All of the time

4. **How often do you have someone to do something enjoyable with?**
   - ☐ None of the time
   - ☐ A little of the time.
   - ☐ Some of the time
   - ☐ Most of the time
   - ☐ All of the time

QUALITY OF LIFE

For each question, please indicate the answer that best applies by checking the box.

1. Mobility

☐ I have no problems in walking about

☐ I have some problems in walking about

☐ I am confined to a bed or wheelchair

2. Self-care

☐ I have no problems with self-care

☐ I have some problems with washing and dressing myself

☐ I am unable to wash or dress myself

3. Usual activities (e.g. work, study, housework, family, or leisure activities)

☐ I have no problems with performing my usual activities

☐ I have some problems with performing my usual activities

☐ I am unable to perform my usual activities

4. Pain/discomfort

☐ I have no pain or discomfort

☐ I have moderate pain or discomfort

☐ I have extreme pain or discomfort

5. Anxiety/depression

☐ I am not anxious or depressed

☐ I am moderately anxious or depressed

☐ I am extremely anxious or depressed

This set of questions asks about some of the social and emotional aspects of having HIV. For most of the questions, just mark the letters that go with your answer. There are not right or wrong answers. Many of the items assume that you have told other people that you have HIV, or that others know. This may not be true for you. If the item refers to something that has not actually happened to you, please imagine yourself in that situation. Then give your answer ("Strongly Disagree", "Disagree", "Agree", "Strongly Agree") based on how you think you would feel or how you think others would react to you.

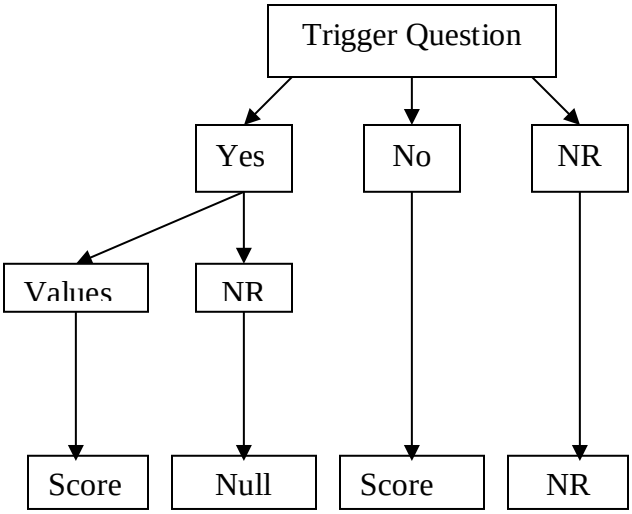
	Strongly Disagree (SD)	Disagree (D)	Agree (A)	Strongly Agree (SA)
1. I have been hurt by how people reacted to learning I have HIV.	SD	D	A	SA
2. I have stopped socializing with some people because of their reactions of my having HIV.	SD	D	A	SA
3. I have lost friends by telling them I have HIV.	SD	D	A	SA
4. I am very careful who I tell that I have HIV.	SD	D	A	SA
5. I worry that people who know I have HIV will tell others.	SD	D	A	SA
6. I feel that I am not as good a person as others because I have HIV.	SD	D	A	SA
7. Having HIV makes me feel unclean.	SD	D	A	SA
8. Having HIV makes me feel that I'm a bad person.	SD	D	A	SA
9. Most people think that a person with HIV is disgusting.	SD	D	A	SA
10. Most people with HIV are rejected when others find out.	SD	D	A	SA

Thank you for your assistance in helping us care for you better by knowing more about your health history.

Appendix E:
1917 Clinic/CNICS Patient-Based Metrics (PBM) Scoring Guide

PBM Scoring

- **Language**
  - NR = No response
  - Null = Unable to calculate
  - Off = Question turned off because of the skip patterns (The logic in the PBM system that “skips” the participant from one question to another depending on their responses to trigger questions, identified questions that “trigger” the beginning of a skip pattern)



- **Depression (PHQ-9)**
  - *Details* No skip pattern
  - *Values*

	No Response	1	2	3	4
Q. 225	NR	0 points	1 point	2 points	3 points
Q. 226	NR	0 points	1 point	2 points	3 points
Q. 227	NR	0 points	1 point	2 points	3 points
Q. 228	NR	0 points	1 point	2 points	3 points
Q. 229	NR	0 points	1 point	2 points	3 points
Q. 230	NR	0 points	1 point	2 points	3 points
Q. 231	NR	0 points	1 point	2 points	3 points
Q. 232	NR	0 points	1 point	2 points	3 points
Q. 233	NR	0 points	1 point	2 points	3 points

  - *Scoring*

        - If all nine questions have been answered the result is the sum of all of the values
        - If eight questions have been answered the result is the sum of all the values plus the sum divided by eight (sum + sum/8)
        - If seven questions have been answered, the result is the sum of all the values plus two times the sum divided by seven- (sum + (2*sum/7))
        - If less than seven questions have been answered then score is null.
        - If none of the questions are answered, then NR
    - *Interpretation* - Numerical
        - Mild (5-9)
        - Moderate (10-14)
        - Moderately Severe (15-19)
        - Severe (> 20)
    - Suicidal Ideation is calculated from question 233 currently (3/6/09) the cutoff is 3 points (response 4). If the question is NR, the PHQ-9 score can still be calculated- see scoring above. If 233 = NR no suicide assessment was preformed.

- **Anxiety (PHQ-A)**
    - *Details*
        - Skip patterns = yes; trigger question = 234
        - If 234 is response 2 then the remaining questions are turned off
    - *Values*

	No Response	1	2
Q. 234	NR	1 point	0 points
Q. 235	NR	1 point	0 points
Q. 236	NR	1 point	0 points
Q. 237	NR	1 point	0 points
Q. 238	NR	1 point	0 points

    - *Scoring*
        - If all 5 questions have been answered the result is the sum of all of the values
        - If the trigger question is answered “Response 1 (Yes) =1” and any of the subsequent questions are unanswered “NR”, then the score is “null” unable to calculate.
        - If the trigger question is answered “Response 2 (No) =0” the rest of the questions are “off” and the score is 0.
        - If the trigger question is “NR” then the remaining questions will be NR and the score will be NR
    - *Interpretation*- Numerical
        - No Anxiety (0)
        - Anxiety symptoms (1 to 4)
        - Panic syndrome ($\geq$5)

- **Quality of life – EuroQOL**

- *Details* no skip patterns
- *Value*

	No Response	1	2	3
Q. 135	NR	No Problems	Some Problems	Unable
Q. 136	NR	No Problems	Some Problems	Unable
Q. 137	NR	No Problems	Some Problems	Unable
Q. 138	NR	No Problems	Some Problems	Extreme
Q. 139	NR	No Problems	Some Problems	Unable

- *Scoring*- Categorical
  - Each question is categorized into no problems, some problems and unable/extreme problems.
- *Interpretation*- Categorical

- **Adherence (ACTU-4)**
  - *Details*
    - Skip patterns= yes; trigger question = 155
    - If 155 is response 2 then the remaining questions are turned off
  - *Values*

	No Response	1	2	3	4	5	6
Q. 182	NR	Yes	No	///////	///////	///////	//////
Q. 248	NR	Very Poor	Poor	Fair	Good	Very Good	Excellent
Q. 183	NR	0	1	2	3	4	>4
Q. 184	NR	Yes	No	///////	///////	///////	//////
Q. 185	NR	Within the past week	1-2 weeks ago	2-4 weeks ago	1-3 months ago	> 3 months	Never skip medications

  - *Scoring:*
    - If all 5 questions have been answered the values (text) should be listed in columns.
    - If the trigger question is answered “Response 1 (Yes)” and any of the subsequent questions are unanswered the value is “NR”
    - If the trigger question is answered “Response 2 (No)” all of the subsequent questions are turned “off”
    - If the trigger question is “NR” then the remaining questions will be NR.

- *Interpretation:* Categorical
  - Question 1 “Currently taking HIV Meds”: Y, N, NR
  - Question 5 “last dose missed” : 1, 2, 3, 4, 5, 6, NR, Off

- **Tobacco use:**
  - *Details*
    - 2 Skip patterns= yes; trigger question = 155 (historical smoking) and trigger question 2= 156 (current smoking)
    - If 155 is response 1 then the remaining questions are turned off
    - If 156 is response 1 then the remaining questions are turned off
  - *Values*

	No Response	1	2	3	4	5
Q. 155	NR	No	Yes	///////	///////	///////
Q. 156	NR	No	3 or 4	///////	///////	///////
Q. 157	NR	0-5	6-10	11-15	16-20	< 20
Q. 158	NR	< ½ pack	1/2 to 1 pack	Between 1 & 2	> 2	///////

  - *Scoring*
    - Trigger question 155 (historical smoking)
      - If N then all remaining questions turned “off”
      - If Y then proceed to trigger question 156 (current smoking)
      - If NR then the rest of the values are NR
    - Trigger question 156 (current smoking)
      - If N then all remaining questions turned “off”
      - If Y then proceed to subsequent questions
      - If NR then the rest of the values are NR
    - If all 4 questions have been answered the values (text) should be listed in columns.
  - *Interpretation:* Categorical
    - Question 1 “history of tobacco use”: Y, N, NR
    - Question 2 “current tobacco use”: Y, N, NR, Off

- **Alcohol Abuse (AUDIT-C)**
  - *Details*
    - Skip patterns = yes; trigger question = 151
    - If 151 is response 1 then the remaining questions are turned off
  - *Values*

	No Response	1	2	3	4	5
Q. 151	NR	0	1	2	3	4
Q. 152	NR	0	1	2	3	4
Q. 153	NR	0	1	2	3	4

- *Scoring*
  - If all 3 questions have been answered the result is the sum of all of the values
  - If the trigger question is answered anything other than “Response 1 (Never) =0” the score is the sum of the values.
  - If any of the questions (not the trigger) are unanswered “NR”, then the score is “null” unable to calculate.
  - If the trigger question is “NR” then the remaining questions will be NR and the score will be NR.
- *Interpretation*
  - Please note that interpretation of this measure is dependant on gender (male or female).

Men	Women
No Risk (0)	No Risk (0)
Low Risk (1-4)	Low Risk (1-3
At-Risk (≥5)	At-Risk (≥4)

- **Substance Abuse (ASSIST)**
  - *Details*
    - Skip patterns= yes
      - Cocaine or Crack -trigger question = 145
      - Amphetamines- trigger question = 215
      - Opioids- trigger question = 220
      - Marijuana- trigger question = 265
      - IVDU- trigger question= 150
    - If the response to the trigger is 1 (No) then the remaining questions are turned “off” for that section
  - *Values*

Cocaine or Crack						
	No Response	**1**	**2**	**3**	**4**	**5**
Q. 145	NR	No	Yes	//////	//////	//////
Q. 146	NR	Never	Once or twice	Monthly	Weekly	Daily
Q. 147	NR	Never	Once or twice	Monthly	Weekly	Daily
Q. 242	NR	Never	Once or twice	Monthly	Weekly	Daily
Q. 148	NR	Never	Once or twice	Monthly	Weekly	Daily
Q. 243	NR	No	Yes, but not in last 3 mo	Yes, in the last 3 mo	/////	/////
Q. 149	NR	No	Yes, but not in last 3 mo	Yes, in the last 3 mo	/////	/////

Amphetamines						
	No Response	**1**	**2**	**3**	**4**	**5**
Q. 215	NR	No	Yes	//////	//////	//////
Q. 216	NR	Never	Once or twice	Monthly	Weekly	Daily
Q. 217	NR	Never	Once or twice	Monthly	Weekly	Daily
Q. 244	NR	Never	Once or twice	Monthly	Weekly	Daily
Q. 218	NR	Never	Once or twice	Monthly	Weekly	Daily
Q. 245	NR	No	Yes, but not in last 3 mo	Yes, in the last 3 mo	/////	/////
Q. 219	NR	No	Yes, but not in last 3 mo	Yes, in the last 3 mo	/////	/////

Opioids						
	No Response	**1**	**2**	**3**	**4**	**5**
Q. 220	NR	No	Yes	//////	//////	//////
Q. 221	NR	Never	Once or twice	Monthly	Weekly	Daily
Q. 222	NR	Never	Once or twice	Monthly	Weekly	Daily
Q. 246	NR	Never	Once or twice	Monthly	Weekly	Daily
Q. 223	NR	Never	Once or twice	Monthly	Weekly	Daily
Q. 247	NR	No	Yes, but not in last 3 mo	Yes, in the last 3 mo	/////	/////
Q. 224	NR	No	Yes, but not in last 3 mo	Yes, in the last 3 mo	/////	/////

Marijuana						
	No Response	**1**	**2**	**3**	**4**	**5**
Q. 265	NR	No	Yes	//////	//////	//////
Q. 266	NR	No	Yes	//////	//////	//////
Q. 221	NR	Never	Once or twice	Monthly	Weekly	Daily
Q. 222	NR	Never	Once or twice	Monthly	Weekly	Daily
Q. 246	NR	Never	Once or twice	Monthly	Weekly	Daily
Q. 223	NR	Never	Once or twice	Monthly	Weekly	Daily
Q. 247	NR	No	Yes, but not in last 3 mo	Yes, in the last 3 mo	/////	/////
Q. 224	NR	No	Yes, but not in last 3 mo	Yes, in the last 3 mo	/////	/////

IVDU						
	No Response	**1**	**2**	**3**	**4**	**5**
Q. 150	NR	No	Yes, but not in last 3 mo	Yes, in the last 3 mo	/////	/////
Q. 264	NR	Never	Few times or less	Few times each month	Few times each wk	/////

Failed Treatment History						
	No Response	**1**	**2**	**3**	**4**	**5**
Q. 154	NR	No	Yes	//////	//////	//////

- *Scoring:*
  - Trigger question 145 (Cocaine or crack)
    - If N then all remaining questions turned “off”
    - If Y then proceed to subsequent questions
    - If NR then the rest of the values are NR
  - Trigger question 215 (Amphetamines)
    - If N then all remaining questions turned “off”
    - If Y then proceed to subsequent questions
    - If NR then the rest of the values are NR
  - Trigger question 220 (Opioids)

            - If N then all remaining questions turned “off”
            - If Y then proceed to subsequent questions
            - If NR then the rest of the values are NR
        - Trigger question 265 (Marijuana)
            - If N then all remaining questions turned “off”
            - If Y then proceed to subsequent questions
            - If NR then the rest of the values are NR
        - Trigger question 150 (IVDU)
            - If N then all remaining questions turned “off”
            - If Y then proceed to subsequent questions
            - If NR then the rest of the values are NR
        - Final question 154 (Failed Treatment History) Y; N; NR
    - *Interpretation*
        - Categorical

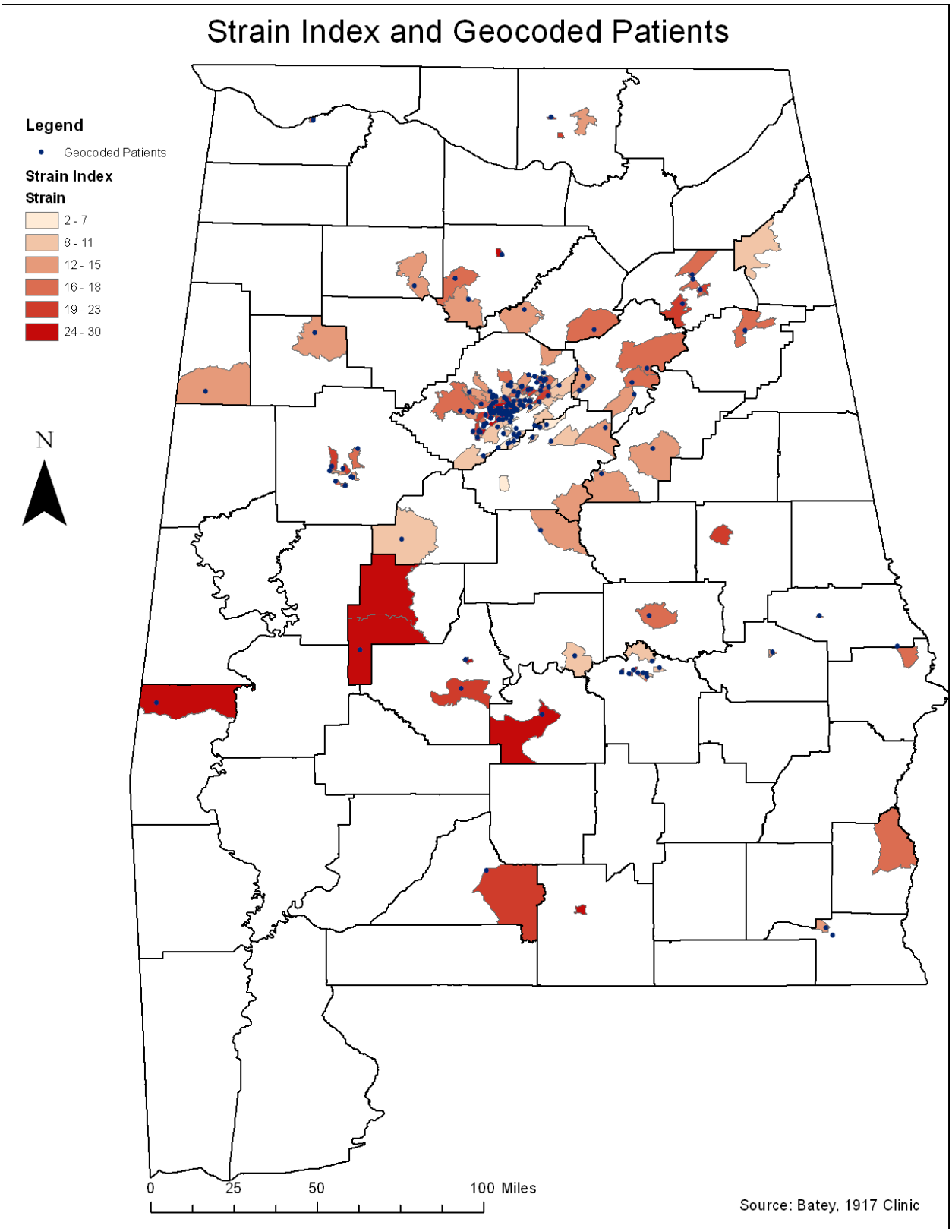
- **HIV symptom index:**
    - *Values*
        - Each symptom scored as Response 1 (have, but doesn’t bother); Response 2 (bothers a little); Response 3 (bothers some); Response 4 (bothers a lot)
        - If unanswered, NR.
    - *Scoring:* The number of symptoms that were in each category (doesn’t bother; bothers a little; bothers some; bothers a lot; NR – no response)

Appendix F:
Frequency Tables for Principal Outcomes

Frequency Table for Principal Outcomes

Outcome Measures	Frequency	Percent
Linkage to Care		
Arrived first PC visit ≤183 days of first clinic contact		
No	11	4.87
Yes	215	95.13
Efficient Linkage to Care		
Arrived PC visit ≤60 days of first clinic contact		
No	32	14.16
Yes	194	85.84
Effective Linkage to Care		
At least 2 PC visits within 6 months of first clinic contact		
No	33	14.60
Yes	193	85.40
Missed Visits		
At least one "no show" scheduled PC appointment		
No	108	47.79
Yes	118	52.21
Visit Adherence		
Completed PC visits/Scheduled PC visits		
≤80%	88	39.46
>80%	135	60.54
Visit Constancy		
At least 1 PC visit in each time period		
100%	136	60.18
<100%	90	39.82
Gaps in Care		
More than 183 between arrived PC visits		
No	161	71.24
Yes	65	28.76
HRSA-HAB		
≥2 PC visits separated by ≥3 months during a 12-month period		
No	36	15.93
Yes	190	84.07

Appendix G:
Composite Strain Index and Geocoded Participants


Strain Index and Geocoded Patients
Legend
Geocoded Patients
Strain Index
Strain
2 - 7
8 - 11
12 - 15
16 - 18
19 - 23
24 - 30
N
0
25
50
100 Miles
Source: Batey, 1917 Clinic