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The Impact of Transmission Mode on HIV/AIDS Medication Adherence

Lindsey Wilde
Walden University

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Walden University

College of Health Sciences

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Dr. Chinaro Kennedy, University Reviewer, Public Health Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
2018

Abstract

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by

Lindsey Wilde

MPH, Johns Hopkins University, 2014

BS, The Pennsylvania State University, 2012

Dissertation Submitted in Fulfillment
of the Requirements for the Degree of
Doctor of Philosophy

In Public Health, Epidemiology

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Abstract

Medication adherence amongst HIV/AIDS infected individuals can be challenging for many reasons. I examined whether there was an association between mode of HIV transmission, such as sexual intercourse, mother to child, or IV drug use, and medication adherence among HIV+ individuals 18 years and older living in New York City. The theoretical base for this study was the Social Ecological Systems Theory. Logistic regression analyses were conducted on field data obtained from the New York State Medicaid Agency from 2015. Results indicated that transmission mode, age, race, and poverty level all have statistically significant associations with the dependent variable of medication adherence. The individuals most and least likely to adhere to ART were MSM and perinatal groups, respectively. Increased age predicted increased medication adherence rates, while increased poverty level predicted decreased medication adherence rates. Caucasian and Asian/Pacific Islander races had the highest rates of medication adherence, while Hispanics had lowest rates of adherence. Alternatively, there were no statistically significant relationships between New York City borough of residence or gender on an individual's medication adherence rate. This research contributed to filling a literature gap in the HIV field since no published literature to date had examined the association between transmission mode and ART medication adherence. This study's findings can be used to lead to a positive social change by allowing those in the HIV and public health fields to identify the varying needs of populations based on transmission mode, which could help individuals achieve long lasting medication adherence, and which in turn, could result in longer lives for those with HIV/AIDS.

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Chapter 1: Introduction to the Study

Introduction

For individuals diagnosed with HIV (Human Immunodeficiency Virus), medication adherence is important to ensuring the containment of the virus within the individual and stopping the spread of the disease to others (Centers for Disease Control [CDC], 2017). Research has shown that a person's first HIV regimen offers the best chance for long-term treatment success (CDC, 2017). Medication adherence amongst HIV/AIDS infected individuals can be challenging for many reasons such as life events, not wanting to disclose a HIV status publicly, side effects of the medications, and substance abuse (CDC, 2017). The current published literature has not examined the impact of transmission mode of HIV on an individual's rate of medication adherence. Therefore, my research examined the impact of transmission mode, defined as one of the three primary methods of HIV transmission which are through sexual intercourse, mother to child during childbirth or breastfeeding, or through intravenous(IV) drug use, on an individual's adherence to antiretroviral medications.

This study's findings can lead to a positive social change by allowing those in the HIV field to identify the varying needs of populations based on transmission mode which could be crucial in further examining how to help individuals achieve long lasting medication adherence which in turn may result in longer lives for those with HIV/AIDS. The major sections of this chapter are the background, problem statement, purpose, research questions, theoretical framework, the nature of the study, definitions,

assumptions, scope, limitations, and significance. These sections describe the rationale for this study and the scope of the research conducted.

Background

Current literature had a gap with respect to the effects transmission mode of HIV has on any medication adherence to antiretroviral therapy (ART) because no published literature had addresses this research question. Since there are no studies that have addressed this issue there was an existing gap in the literature, making this study of transmission mode in relation to ART medication adherence relevant to the field. Published literature did not exist on the specific research question of the effect transmission mode had on medication adherence but published literature did exist for some of the secondary research questions posed about the effects of age, and socioeconomic status (SES) had on ART medication adherence (Smedley et al., 2015). In the major sections of this chapter, I address the history and origin of the HIV/AIDS virus, the discovery of HIV in the United States (U.S.), and sections examining the effect transmission mode gender, age, New York City (NYC) borough of residence, socioeconomic status (SES), and race have on ART medication adherence.

The current literature found that some variables tested in this study had more foundational literature available for them than others; however it is believed that all the variables examined in this study could impact an individual's HIV medication adherence rate (Smedley et al., 2015). In regards to the variable of gender, women had lower rates of medication adherence than men, and authors found that co-occurring mental health diagnosis can influence ART medication adherence, although the published literature had

not yet identified why women have lower rates of adherence than men initially (Puskas et al., 2017). Concerning the variable of age, older age appeared to be a contributing factor that aids in increased ART medication adherence amongst individuals infected with HIV, and that as an individual continued to age, in most cases, their rates of medication adherence increased as well (Fogarty et al., 2015). Regarding the variable of NYC borough of residence, no published literature was available for review on this variable of ART medication adherence and was a significant limitation to exploring this variable, however, future research could examine the causes for any differences of HIV medication adherence to ART by borough of residence in NYC. With regard to the variable of socioeconomic status, while there has not been published literature directly linking SES to ART medication adherence it had been reported that a person's SES had broad implications, positive and negative, on their health depending on an individual's level and duration at a specific SES mark (Burch et al., 2016). In addition, those with higher education due to higher SES were much more likely to adhere to their medications than individuals with lower education levels due to lower SES (Burch et al., 2016). Additionally, with regard to the variable of race, minorities had lower reported rates of medication adherence when compared to non-minorities, with African Americans exhibiting the lowest rates of ART adherence (Waldrop-Valverde et al., 2015).

While some variables tested in this study had published literature on them, such as the effects age on medication adherence, others had not been sufficiently studied and required future research to determine whether the variables were correlated; such as NYC borough of residence and gender. The present study, and primary variable, of examining

transmission mode and any effects it had on ART medication adherence was a novel concept and no published literature existed on this topic. This research therefore filled a gap in the literature, and should extend knowledge within the HIV discipline by allowing researchers to know the effects of transmission mode, if any, on an individual's medication adherence to ART which can then lead to more tailored resources, educational materials, and adherence programs for each type of transmission based on their unique medication adherence needs. For these reasons, this research was crucial in further examining how to help individuals achieve long lasting medication adherence which in turn can result in longer lives for those with HIV/AIDS.

Problem Statement

Medication adherence amongst HIV/AIDS infected individuals can be challenging for many reasons such as life events, not wanting to disclose a HIV status publicly, side effects of the medications, and substance abuse (CDC, 2017). However, medication adherence is important in ensuring the containment of the virus within the individual and stopping the spread of the disease to others because research has shown that a person's first HIV regimen, sometimes referred to as a 'drug cocktail', offers the greatest chance for long-term treatment success in containing the spread of the virus (CDC, 2017). My research examined the yet unstudied impact of transmission mode, defined as one of the three primary methods of HIV transmission, which are through sexual intercourse, mother to child during childbirth or breastfeeding, or through IV drug use, on an individual's adherence to ART medications.

Current literature had a gap with respect to the effects transmission mode of HIV had on any medication adherence to ART because no published literature had addressed this research question. Since there were no studies that had addressed this issue there was an existing gap in the literature, making this study of transmission mode in relation to ART medication adherence relevant to the field. Published literature did not exist on the specific research question of the effect transmission mode has on medication adherence, but published literature did exist for some of the secondary research questions posed about the effects that gender, age, socioeconomic status (SES), and race have on ART medication adherence.

Purpose

The purpose of this research was to test the relationships between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in New York City, after controlling for an individual's gender, New York City (NYC) borough of residence, socioeconomic status (SES), and race. This study was a quantitative study, and explored the variables to determine if any association existed. The independent variable was the HIV transmission mode of the individual and the dependent variable was the rate of ART medication adherence.

Research Questions and Hypothesis

Research Question 1: Is there an association between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in New York City, after controlling for an individual's gender, age, New York City borough of residence, poverty level, and race?

H_01 : There is no statistically significant relationship between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in New York City, after controlling for an individual's gender, race/ethnicity, age, New York City Borough of residence, and poverty level.

H_11 : There is a statistically significant relationship between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in New York City, after controlling for an individual's gender, race/ethnicity, age, New York City Borough of residence, and poverty level.

Research Question 2: Is the association between mode of transmission and medication adherence modified among HIV infected individuals by gender or age?

H_02 : There is no influence on adherence to ART medications based on an individual's individual characteristics of gender and age.

H_12 : There is an influence on adherence to ART medications based on an individual's individual characteristics of gender and age.

Research Question 3: Is the association between mode of transmission and medication adherence modified among HIV infected individuals by the microsystem level characteristic of New York City Borough of residence?

H_03 : There is no influence on adherence to ART medications based on an individual's New York City Borough of residence, which is a microsystem variable.

H_13 : There is an influence on adherence to ART medications based on an individual's New York City Borough of residence, which is a microsystem variable.

Research Question 4: Is the association between mode of transmission and medication adherence modified among HIV infected individuals by the exosystem level characteristic of poverty level?

H_{04} : There is no influence on adherence to ART medications based on an individual's poverty level, which is an exosystem variable.

H_{14} : There is an influence on adherence to ART medications based on an individual's poverty level, which is an exosystem variable.

Research Question 5: Is the association between mode of transmission and medication adherence modified among HIV infected individuals by the macrosystem level characteristic of race?

H_{05} : There is no influence on adherence to ART medications based on an individual's race, which is a macrosystem variable.

H_{15} : There is an influence on adherence to ART medications based on an individual's race, which is a macrosystem variable.

Theoretical Framework

The theoretical base for this study was the social ecological systems theory. This theory posits that an individual's total social and ecological environment should be factored in when examining human development behavioral outcome among individuals (Sharp & Hahn, 2015). The origin of this theory was from Urie Bronfenbrenner who incorporated ideas of multidimensional systems and their influences on one another when researching human development and behavior (Bronfenbrenner, 1986). The social ecological system theory (SEST) has been used to study resilience, robustness,

sustainability, vulnerability, and influences of individuals but also has a wider range of applicability because it accounts for many dynamics and attributes within an individual and the systems they interface with (Sharp & Hahn, 2015).

This system was composed of five socially organized subsystems that support and guide human development: the microsystem, the mesosystem, the exosystem, the macrosystem, and the chronosystem (Bronfenbrenner, 1986). The first subsystem is the microsystem which was defined as the most direct and immediate interactions with the individuals in their development such as the interaction between an individual and school (Bronfenbrenner, 1986). The second subsystem is the mesosystem which was defined as the interactions between microsystems during an individual's development such as the interaction between family and teachers (Bronfenbrenner, 1986). The third subsystem is the exosystem which was defined as interactions between settings in which the individual has an active role and other settings in which the individual does not have an active role, such as how an individual's home life may be influenced by their parent's experiences at work (Bronfenbrenner, 1986). The fourth subsystem is the macrosystem which was defined as the many social components that interact together to create the culture that the individual lives in (Bronfenbrenner, 1986). The fifth subsystem is the chronosystem which was defined as the patterning of events, interactions, and transitions over the course of the individual's life (Bronfenbrenner, 1986).

In SEST, each level is unique and together build a larger system that shape a person's life experiences and offer various unique options for growth, predispositions,

and interactions throughout one's life (Bronfenbrenner, 1986). Furthermore, within and between each system are bidirectional influences which imply that relationships have impact in two directions, both away from the individual and towards the individual (Sharp & Hahn, 2015). I tested whether there was a statistically significant relationship between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in New York City, after controlling for an individual's gender, race/ethnicity, age, New York City Borough of residence, and poverty level. The variables examined align with the SEST subsystems as follows: gender and age were individual level components in the SEST; race was the macrosystem level in the SEST; New York City borough of residence was the microsystem in the SEST; and poverty level was the exosystem in SEST.

SEST has been applied to HIV research previously and extensively because this theory functions in a way that allows researchers a chance to understand and possibly explain person-environment interactions, to improve the environments to foster human growth in these areas, as well as identify how individual's interactions with the SEST levels impact their behaviors and thought processes (Gunderson & Holling, 2002). SEST had been previously used to identify the areas of the individual that led to behavior change, for example how age influences an individual's rate of medication adherence (Gunderson & Holling, 2002). While there was no existing literature on the topic of HIV transmission mode's effect on ART medication adherence, since the SEST had been used as the theoretical foundation for many of the secondary variables being examined in the publications included in my literature review, such as age, gender,

socioeconomic status, and race, the rationale for using this theory was that it aligned with the primary research question of how transmission mode effects ART medication adherence (Gunderson & Holling, 2002).

In addition, the selected theory was related to the present study by allowing many individual characteristics to be factored into whether an individual chooses to adhere or not adhere to their ART medication. The research questions examined relate to existing theory because SEST has been used in published literature relating to the secondary variables in this study. This can be used to lay the foundation for examining how the mode of HIV transmission effects ART medication adherence rates since no published literature to date had examined the relationship between these variables (Gunderson & Holling, 2002). The variables examined aligned with the SEST subsystems as follows: gender was an individual level variable in the SESt; age was an individual level variable; New York City borough of residence was a microsystem variable in SESt; and poverty level was an exosystem variable in the SESt; and race was a macrosystem level variable in the SESt.

Nature of the Study

The nature of this study was a quantitative cross sectional study. Quantitative research was consistent with the understanding of how to approach HIV medication adherence rates and factors that may increase or decrease these rates (Sharp & Hahn, 2015). Keeping with this focus, SEST was used as the basis of the research since individuals have unique factors enabling or prohibiting them from adequate HIV medication adherence which should also be taken into account through the course of

this research (Sharp & Hahn, 2015). This quantitative analysis allowed for the five research questions above to be answered, which can facilitate better public health practices for HIV patients. The independent variable was the individual's mode of HIV transmission, the dependent variable was the individual's rate of medication adherence, and the covariates were the individual's age, gender, race, New York borough of residence, and poverty level. The independent variable of HIV transmission mode was whether a person had contracted the HIV virus through sexual intercourse, mother to child during childbirth or breastfeeding, or through IV drug use (Balderson et al., 2013).

The dependent variable of an individual's rate of medication adherence was the extent to which the patient's history of therapeutic drug taking coincided with the prescribed treatment (Balderson et al., 2013). In addition, the covariates examined in this research were age in number of years; gender as defined as male or female; New York city borough of residence defined as living in one of the follow NYC boroughs: Manhattan, Queens, Brooklyn, Staten Island, or the Bronx; poverty level as defined by household income, and race as self-identified from participants as Black, Latino/Hispanic, White, Asian/Pacific Islander, Native American, Multiracial, or Unknown.

The information for this study was obtained from the New York Medicaid Agency, from Medicaid recipients, and was analyzed using a regression analysis to answer the research questions. The data used in this research were collected from New York City residents who presented in hospitals or clinics for HIV treatment. The information was gathered from all clinicians in New York City who accept Medicaid

payments, and were reported to the New York Medicaid Agency as required for reimbursement of services. All patient data has been deidentified to ensure the protection of the patients' privacy, but the protocols under which data collections took place cannot be specified since they crossed many hospital systems and clinicians in New York City boroughs.

My research approach was to use secondary data from the New York Medicaid Agency from 2009-2015. The analysis of this data was cross-sectional and examined the reported medication adherence of individuals who acquired HIV through the three modes of transmission, which are sexual intercourse, mother to child during childbirth or breastfeeding, or through IV drug use (Balderson et al., 2013). I explored the data to identify if there was an association between mode of transmission and HIV medication adherence. I intend to use the results of this data to further the field and future research to examine medication adherence techniques amongst the HIV/AIDS population in an effort to improve health across the United States

Definitions

Gender: The state of being male or female (typically used with reference to social and cultural differences rather than biological ones) (Balderson et al., 2013).

New York City Borough of residence: The individual's New York borough of residence in one of the five boroughs: Manhattan, Brooklyn, Queens, The Bronx, and Staten Island (Balderson et al., 2013).

Race: Self-identified from participants as Black, Latino/Hispanic, White, Asian/Pacific Islander, Native American, Multiracial, or Unknown.

Rate of Medication Adherence: The extent to which the patient's history of therapeutic drug-taking coincides with the prescribed treatment (Balderson et al., 2013).

Socioeconomic status (SES)/ poverty level: An economic and sociological combined total measure of a person's economic and social position in relation to others, defined in the dataset in reference to the federal poverty level (FPL) as low poverty (<10% below FPL), medium (10 to <20% below FPL), high (20 to <30% below FPL), very high poverty (30%+ below FPL), and area-based poverty level not available (Balderson et al., 2013).

Transmission Mode: One of the three methods of HIV transmission which are through sexual intercourse, mother to child during childbirth or breastfeeding, or through IV drug use (Balderson et al., 2013).

Assumptions

A key assumption that has been made in this study was that the self-reported data about age, gender, New York City borough of residence, poverty level, and race were being accurately reported by the patients and therefore that the data in the study on these covariates were as accurate as possible (Balderson et al., 2013). Individuals may have provided false answers to these questions based on social stigma, for example out of fear of identifying as low income, and therefore a key assumption was that the responses to the survey information had been honestly reported by patients (Balderson et al., 2013). These assumptions are necessary to the context of the study because they may affect the associations between examining the mode of transmission and the rate of medication adherence.

Scope and Delimitations

The specific aspects of the research problem that were addressed in this study was medication adherence which was important in ensuring the containment of the HIV virus within the individual and stopping the spread of the disease to others (CDC, 2017). My research examined the impact of transmission mode, defined as one of the three methods of HIV transmission which are through sexual intercourse, mother to child during childbirth or breastfeeding, or through IV drug use, on an individual's adherence to ART medications.

The boundaries of this study were those within the Medicaid population and those who qualify for Medicaid in the state of New York, more specifically within one of the five New York City boroughs. This population had been selected because the information shared was from the New York State Medicaid Agency, and therefore was limited to those individuals who qualified for Medicaid from 2009 to 2015. Therefore, the populations excluded were higher income populations that were not utilizing Medicaid services.

Limitations

The limitations of this study were that the study was limited geographically to New York City and therefore may not be representative of other areas of the United States (Gourlay et al., 2013). For example, this study demonstrates results in urban areas but may not be as representative of rural areas (Gourlay et al., 2013). In addition, since the United States is a developed nation there is access to many medications to limit the transmission of HIV from mother to child resulting in this sample size being the

smallest of the three subpopulations, and therefore it may not be as representative as the IV drug users and sexual intercourse subpopulations (Gourlay et al., 2013).

Additionally, there may be other confounding variables unknown to researchers and therefore unexamined in this study that could influence the study's results (Gourlay et al., 2013). Measures to address these limitations have been taken by addressing the most prominent covariates and by collecting as large a sample size of mother to child transmission as was available to address these limitations. Finally, there were no known biases that could influence the study's outcomes, as the information obtained from the state Medicaid agency was collected using a double-blind reporting methodology to ensure bias did not influence the results.

Significance

HIV is a virus compromising the immune system of infected individuals, and overtime can develop into the more fatal acquired immunodeficiency syndrome (AIDS) (Gourlay et al., 2013). HIV and AIDS have multiple modes of transmission, which are primarily through sexual intercourse, mother to child during childbirth or breastfeeding, or through IV drug use (Hinkin et al., 2014). It is estimated that even with advances in medicine over 10 million individuals live with HIV in the United States (CDC, 2017). In addition, HIV/AIDS is not able to be cured but can be controlled through the use of ART medications taken daily (Balderson et al., 2013).

This research contributed to filling a literature gap that existed in the field since no published literature to date had examined the association between transmission mode and ART medication adherence. As a result, the content of this study was an original

contribution to the field of HIV research. This research could support professional practice in the HIV field by allowing health care workers to identify populations most at risk for medication adherence lapses and non-adherence and provide them with additional resources to aid them with ART medication adherence. Finally, this study's findings could lead to a positive social change by allowing those in the HIV field to identify the varying needs of populations based on transmission mode, which could be crucial in further examining how to help individuals achieve long lasting medication adherence and which in turn may result in longer lives for those with HIV/AIDS.

Summary

In summary, medication adherence amongst HIV/AIDS infected individuals can be challenging for many reasons such as life events, not wanting to disclose a HIV status publicly, side effects of the medications, and substance abuse (CDC, 2017). My research examined any impact transmission mode, defined as one of the three primary methods of HIV transmission which are through sexual intercourse, mother to child during childbirth or breastfeeding, or through IV drug use, on an HIV positive individual's adherence to ART medications after controlling for an individual's gender, race/ethnicity, age, New York City Borough of residence, and poverty level. This study's findings can lead to a positive social change by allowing those in the HIV field to identify the varying needs of populations based on transmission mode which could be crucial in further examining how to help individuals achieve long lasting medication adherence which in turn may result in longer lives for those with HIV/AIDS.

Chapter 2: Literature Review

Introduction

The purpose of this research was to test the relationships between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in New York City, after controlling for an individual's gender, New York City (NYC) borough of residence, poverty level, and race. For individuals diagnosed with HIV, medication adherence is important in ensuring the containment of the virus within the individual and stopping the spread of the disease to others (CDC, 2016). Research has shown that a person's first HIV regimen offers the best chance for long-term treatment success (CDC, 2016). Medication adherence amongst HIV/AIDS infected individuals can be challenging for many reasons such as life events, not wanting to disclose a HIV status publicly, side effects of the medications, and substance abuse (CDC, 2016). Therefore, my research examined the impact of transmission mode, defined as one of the three methods of HIV transmission which are through sexual intercourse, mother to child during childbirth or breastfeeding, or through IV drug use, had on an individual's adherence to ART medications.

Current literature had a gap with respect to the effects transmission mode of HIV had on any medication adherence to ART because no published literature has addressed this research question. Because I found no studies that had addressed this issue, I was able to identify an existing gap in the literature, making this study of transmission mode in relation to ART medication adherence relevant to the field. Published literature did not exist on the specific research question of the effect transmission mode has on medication

adherence, but published literature did exist for some of the secondary research questions posed about the effects of age, gender, poverty level, and race/ethnicity have on ART medication adherence. The major sections of this chapter address the history and origin of the HIV/AIDS virus, the discovery of HIV in the United States (U.S.), and sections examining the effect transmission mode, age, gender, poverty level, New York City (NYC) borough of residence, and race/ethnicity have on ART medication adherence.

The current literature found for some of the variables had more foundational literature available for them than others, but research indicated that all the variables play a role in HIV medication adherence (Smedley et al., 2015). With regards to the variable of age, older age appears to be a contributing factor that aids in increased ART medication adherence amongst individuals infected with HIV, and that as an individual continues to age, in most cases, their rates of medication adherence increase as well (Fogarty et al., 2015). In regard to the variable of gender, women had lower rates of medication adherence than men and that a co-occurring mental health diagnosis can influence ART medication adherence, although the published literature had not yet identified why women have lower rates of adherence than men initially (Puskas et al., 2017). With regard to the variable of poverty level, while there had not been published literature directly linking poverty level to ART medication adherence it was known that a person's poverty level had broad implications, positive and negative, on their health depending on an individual's level and duration at a specific poverty level mark (Burch et al., 2016).

In addition, those with higher education due to higher poverty level were much more likely to adhere to their medications than individuals with lower education levels due to lower SES (Burch et al., 2016). Regarding the variable of NYC borough of residence, no published literature was available for review on this variable of ART medication adherence and was a significant limitation to exploring this variable, however, future research could examine rates of HIV medication adherence to ART by borough of residence in NYC. Additionally, with regard to the variable of race and ethnicity, minorities have lower reported rates of medication adherence when compared to non-minorities, with African Americans exhibiting the lowest rates of ART adherence (Waldrop-Valverde et al., 2015).

While some variables tested in this study were well known and had been established for decades, such as the effects of poverty level, age, and race on medication adherence, others had not been sufficiently studied and required future research to determine whether the variables were correlated; such as NYC borough of residence and gender. The present study, and primary variable, of examining transmission mode and any effects it had on ART medication adherence was a novel concept and no published literature existed on this topic. This research therefore filled a significant gap in the literature, and extended knowledge within the HIV discipline by allowing researchers to know the effects of transmission mode, if any, on an individual's medication adherence to ART which can then lead to more tailored resources, educational materials, and adherence programs for each type of transmission based on their unique medication adherence needs. For these reasons, this literature was crucial in further examining how

to help individuals achieve long lasting medication adherence that in turn results in longer lives for those with HIV/AIDS.

Literature Search Strategy

The literature research strategy that I used for this dissertation was to scour the published literature on HIV/AIDS to determine what studies had been conducted that examined the primary research question of: Is there a statistically significant relationship between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in New York City, after controlling for an individual's gender, race/ethnicity, age, New York City Borough of residence, and poverty level? I also examined the published literature surrounding the variables of an individual's gender, race/ethnicity, age, New York City Borough of residence, and poverty level in addition to the mode of HIV transmission.

I accessed the online databases Google Scholar and the Walden Online Library to obtain the published literature for this review. The key search terms used to find relevant literature were: *HIV, medication adherence, transmission mode*; *HIV, medication adherence, age*; *HIV, medication adherence, gender*; *HIV, medication adherence, race*; *HIV, medication adherence, NYC residence borough*; and *HIV, medication adherence, socioeconomic status*. The search terms were used to locate published articles relevant to the topic and then I was able to read many articles and select the articles that were representative of the majority of articles published.

The scope of the literature was originally set for published articles in the last 5 years, or those published in 2013 or subsequent years; however, in cases where no

relevant literature could be located in the last 5 years, this filter was removed to allow for the review of published articles beyond the 5-year publication limit as relevant data may have been published prior to 2013. The types of literature used in this literature review were current peer-reviewed literature, and in the case of the history of HIV introduction a current website, which was the Centers for Disease Control and Prevention's website. In cases where there was little current research, this was noted in the literature review and identified as a gap in the literature. In the case of some variables, such as transmission mode, where no published articles were available with regards to the effects on medication adherence, more general information about the modes of transmission were provided from published literature in addition to noting the lack of available current published articles. Through these methods, I aimed to be comprehensive as well as transparent about what information was available and was unavailable in the published literature.

Theoretical Foundation

The theoretical base for this study was the SEST, which states that in order to understand human development, the entire ecological system in which growth occurs needs to be taken into account. The origin of this theory was from Urie Bronfenbrenner to incorporate ideas of multidimensional systems and their influences on one another and postulated that to understand human development, the entire ecological system in which growth occurs needs to be taken into account (Gunderson & Holling, 2002). The SEST has been used to study resilience, robustness, sustainability, vulnerability, and influences of individuals but also has a wider range of applicability because it accounts for many

dynamics and attributes within an individual and the systems they interface with (Gunderson & Holling, 2002). This system is composed of five socially organized subsystems that support and guide human development: the microsystem, the mesosystem, the exosystem, the macrosystem, and the chronosystem (Gunderson & Holling, 2002).

Each system depends on the contextual nature of the person's life and offers an ever growing diversity of options and sources of growth (Gunderson & Holling, 2002). Furthermore, within and between each system are bi-directional influences which imply that relationships have impact in two directions, both away from the individual and towards the individual (Gunderson & Holling, 2002). The hypothesis that was tested in this research was that there is not a statistically significant relationship between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in New York City, after controlling for an individual's gender, race/ethnicity, age, New York City Borough of residence, and poverty level, and the SEST could be used by me to demonstrate how the variables of individual's gender, race/ethnicity, age, New York City Borough of residence, and poverty level effect their medication adherence (Gunderson & Holling, 2002).

The SEST has been applied to HIV research previously and extensively because this theory functions to allow researchers to explain the person-environment interaction, to improve people-environment transactions, to nurture human growth and development in particular environments, and to improve environments so they support expression of individual's system's dispositions (Gunderson & Holling, 2002). SEST has been

previously used to identify the areas of the individual that led to behavior change, for example how age influences an individual's rate of medication adherence (Gunderson & Holling, 2002). While there was no existing literature on the topic of HIV transmission mode's effect on ART medication adherence, since the SEST had been used as the theoretical foundation for many of the secondary variables being examined in the publications included in this literature review, such as age, gender, socioeconomic status, and race, the rationale for using this theory is that it could allow the literature to align more consistently with the primary research question of how does transmission mode effect ART medication adherence (Gunderson & Holling, 2002). In addition, the selected theory related to the present study by allowing many individual characteristics to be factored into why an individual chooses to adhere or not adhere to their ART medication, and the research questions relate to existing theory because the SEST has been used in published literature relating to the secondary variables in this study and can be used to lay the foundation for examining how the mode of HIV transmission effects ART medication adherence rates since no published literature to date has examined the relationship between these variables (Gunderson & Holling, 2002).

History and Origin

The human immunodeficiency virus, more commonly referred to by the acronym HIV, is a retrovirus that causes an infection in those who have acquired the virus (Munro et al., 2017). HIV is often associated and described in tandem with acquired immunodeficiency syndrome, commonly referred to by the acronym AIDS, due to the fact that if the HIV infection progresses it develops into AIDS (Faria et al., 2014). AIDS

is a fatal health condition in which an individual's immune system is compromised and weakened to the point where opportunistic infections take hold and become fatal to the individual (Faria et al., 2014).

There are two known strains for HIV, named HIV-1 and HIV-2, and both are believed to have originated with primates in West-central Africa (Chitnis et al., 2012). Researchers have discovered that HIV-1 appears to have originated from southern Cameroon as an evolution of simian immunodeficiency virus (SIV) found in infected wild chimpanzees (Chitnis et al., 2012). Researchers also discovered that HIV-2 is also closely related to SIV, and is more closely related to a virus of the Sooty Mangabey which is an Old-World monkey from Senegal to Western Cote d'Ivoire (Chitnis et al., 2012). In examining monkeys in West central Africa to find the origin of HIV, researchers discovered that new world monkeys, such as owl monkeys, are resistant to HIV-1 due to the belief of genomic fusion of two virus resistant genes during evaluation to protect these new world species (Chitnis et al., 2012). However, although new breeds of monkeys have a genetic resistance to HIV-1, scientists have also discovered that HIV-1 has crosses the species barrier on three occasions which has given rise to three groups of HIV-1 including M, N, and O (Chitnis et al., 2012).

In the early 20th century, it is thought that HIV was transferred to humans who hunted monkeys in Africa when the blood from infected monkeys came into contact with open wounds on the hunters they acquired during the hunt (Rambaut et al., 2014). SIV is a weak virus when in the human body and is often eradicated from the human body by white blood cells in an individual's immune system (Rambaut et al., 2014). Researchers

now believe that for SIV to mutate into HIV it must be transmitted from human to human several times in quick succession to become HIV and before the human immune system kills the SIV (Rambaut et al., 2014). In addition, researchers have uncovered that HIV spreads during high risk modes of transmission which were not thought to be as common in Africa prior to the 20th century, which scientists propose allowed the SIV virus to more quickly mutate to HIV in humans (Rambaut et al., 2014). Researchers have suggested that the most recent spread of HIV-1 M could date back to 1910 in Africa with the emergency of colonialism and the establishment of large African cities where cities were not previously present (Sharp & Hahn, 2015). During this time of colonialism, scientists believe that SIV was able to more quickly become HIV and HIV was able to quickly spread from person to person due to changing social practices, which include a higher degree of sexual promiscuity amongst men and women, prostitution which is documented as quickly following the establishments of cities in colonial times, and the higher frequency of genital ulcer diseases, such as sexually transmitted infections (STIs) in colonial cities (Sharp & Hahn, 2015).

While rates of HIV spreading through vaginal intercourse tend to be lower than other modes of disease transmission, the presence of STIs or open genital sores has been determined to greatly increase the likelihood of infection (Rambaut et al., 2014).

Historians have indicated that in 1928 colonial cities were notable in the fact that as many as 45 percent of women residents in Leopoldville were thought to engage in prostitution and by the year 1933 over 15 percent of all residents of Leopoldville were infected with one strain of syphilis, which demonstrates the high rates of sexual promiscuity and how

that easily lead to the increased spread of disease amongst the population (Rambaut et al., 2014). While sexual promiscuity may have been the primary mode of transmission at the time according to researchers it was not the only mode of transmission as historians have documented that unsafe medical practices were used during this time in Africa which contributed to the spread of HIV as well, most notably by medical staff reusing single-use syringes due to war supply constraints during World War II which allowed for HIV to be spread from human to human non-sexually (Sharp & Hahn., 2015). The earliest case of HIV in humans was in 1959 in the Belgian Congo, and researchers believe the virus may have been present in the mid-to-late 1950s in the United States as there is a documented case of a sixteen year old man presenting with HIV symptoms in 1966 which turned fatal in 1969 (Muller et al., 2010).

Discovery in the United States

HIV and AIDS were first observed in patients in the United States (U.S.) in 1981 (Muller et al., 2010). Practitioners in the U.S. were surprised to see cases of young individuals in their 30s and 40s presenting with cancers and infections that were common for individuals in their 70s and 80s (Muller et al., 2010). Initial cases of HIV were found in patients who were IV drug users and homosexual men who previously had had no impaired immunity health concerns (Muller et al., 2010). These initial cases presented with pneumocystis carinii pneumonia which is a rare, opportunistic infection that occurs primarily to individuals who are elderly (Muller et al., 2010). After these initial cases of pneumocystis carinii pneumonia, additional cases of young homosexual men arose

presenting with Kaposi's sarcoma which is a rare skin cancer than is usually found in elderly patients with compromised immune systems (Muller et al., 2010).

As additional cases continued to arise in hospitals of pneumocystis carinii pneumonia and Kaposi's sarcoma, the Centers for Disease Control and Prevention (CDC) became alerted given the unusual nature of these diseases of the elderly being presented in young individuals (Rambaut et al., 2014). In 1981, the CDC created a task force to examine the causes and patterns of the HIV/AIDS outbreak and to monitor the spread of the disease (Munro et al., 2017). In the 1980s there were high rates of stigma associated with the disease because those who were presenting to hospitals with symptoms were all homosexual men or IV drug users (Chitnis et al., 2012). Initially, the CDC called the disease GRID in the press which stood for gay-related immune deficiency disease since most of the cases the CDC had seen in 1981 were associated with homosexuality (Chitnis et al., 2012).

The CDC was still in search for a name that accurately represented the disease and the population and when examining those infected communities the CDC began using the phrase "the 4H disease" in 1982 to describe the HIV/AIDS condition (Chitnis et al., 2012). The name "the 4H disease" stemmed from the fact that the highest rates of infected populations at the time were homosexuals, heroin users, hemophiliacs, and Haitians; however, when several cases of heterosexual individuals arose researchers at the CDC realized that "the 4H disease" and "GRID" were misleading names because the disease was not limited to those individuals who were homosexual (Muller et al., 2010). Upon this realization that a wider group of individuals could be and were impacted by the

disease than just homosexuals, heroin users, hemophiliacs, and Haitians the CDC began to use the term AIDS in September of 1982 (Munro et al., 2017).

After the initial discovery of the AIDS condition, researchers began to examine the causes and contributing factors to AIDS. In 1983 two separate research teams, one led by Robert Gallo and the other led by Luc Montagnier, published their findings that a new and previously unknown retrovirus appeared to have infected individuals who later developed AIDS (Sharp & Hahn, 2015). Gallo's team claimed that the retrovirus was similar in shape to the human T-lymphotropic viruses (HTLVs), while Montagnier's research team was simultaneously isolating a virus they believed to cause AIDS from a patient presenting with swollen lymph nodes and physical weakness which at the time were considered to be two indicators of AIDS (Rambaut et al., 2014). Montagnier's research team discovered that the lymph node virus had different core proteins than that of HTLVs and named the newly discovered virus lymphadenopathy-associated virus (LAV) (Mueller et al., 2010). Although, in 1986 it was discovered that LAV and HTLV are the same viruses, and the two were renamed human immunodeficiency virus (HIV) (Munro et al., 2017).

Mode of Transmission and Medication Adherence

The aim of this research was to answer the primary research question of “is there a statistically significant relationship between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in New York City, after controlling for an individual's gender, race/ethnicity, age, New York City Borough of residence, and poverty level?” This research question was innovative because there was

not any existing published literature that discussed or had previously researched whether the mode of transmission for HIV was related to the individual's rate of medication adherence. There has been much scientific research conducted and published regarding barriers to medication adherence, such as social stigma, varying health literacy rates, and homelessness (Toupin et al., 2017), but, again, there has been no published study that has examined the mode of transmission in relation to the effects it may or may not have on an individual's medication adherence to ART.

There are three known modes of transmission for the HIV/AIDS viruses. These include transmission through sexual intercourse, transmission through IV drug use with contaminated needles, and transmission from infected mother to child during childbirth or breastfeeding as an infant (Smith, 2016). HIV can only be transmitted from person to person through the following list of bodily fluids: blood, semen, pre-seminal fluid, rectal blood or cervical mucus and breast milk from a person infected with HIV (CDC, 2016). These fluids from an HIV infected individual must come into contact with damaged tissue or a mucus membrane of another person, most often an open wound or through intercourse (CDC, 2016).

In the United States the most common HIV mode of transmission is through sexual intercourse (CDC, 2016). HIV can be transmitted during anal or vaginal sexual intercourse between partners without the use of a condom or ART medications to limit the transmission of the HIV virus; however, unprotected receptive anal intercourse is fifteen times more likely to result in contracting the HIV virus when compared to unprotected receptive vaginal intercourse (CDC, 2016). In addition, pre-exposure

prophylaxis, or PrEP, are available to individuals who do not have the HIV virus but are at a substantial risk of becoming infected to prevent the HIV virus transmission (CDC, 2016). PrEP is taken daily orally in a pill format and when taken consistently can reduce a person's chances of becoming infected with HIV up to 92 percent and is considered to be extremely effective (CDC, 2016). Both partners may acquire HIV through vaginal sex, however, documented cases of HIV have shown overtime that anal sex transmission remains much more prevalent and that HIV transmission through vaginal sex, historically in the United States, has occurred at lower rates when compared to anal sex transmission (CDC, 2016).

The second highest cause of HIV transmission in the United States occurs when IV drug users share needles or syringes which have contaminated blood on them which is then injected into individuals who did not previously have HIV infecting them with the disease (CDC, 2016). The HIV virus can live on a used needle for up to 42 days depending on a multitude of factors such as age of the needle, manufacturer, and temperature (CDC, 2016). This mode is often associated with IV drug users, but can also apply to health care workers who work with needles and blood samples such as blood bank employees or hospital employees who may be stuck with a used needle in the process of their work (CDC, 2016). Finally, the least common mode of transmission in the United States is from mother to child during pregnancy, birth, or breastfeeding (CDC, 2016). It should be noted that while this mode of transmission is low in the United States, and the majority of developed nations, due to the recommended testing of all pregnant women for HIV and the subsequent ART medications provided to them if they test

positive to inhibit the spread of the virus to the child, mother to child transmission is most more frequent in undeveloped nations such as in Africa where access to medical testing and ART is more limited (CDC, 2016).

While there are multiple modes of transmission to acquire the HIV virus, once a person is infected with the virus the number one treatment regimen is ART medication and medication adherence to these medications can mean the difference between life and death in some cases (CDC, 2016). Medication adherence is the frequency with which a person takes their medication in accordance with a prescribed dosing plan by a physician or health care professional (CDC, 2016). In HIV positive individuals, or those infected with the virus, this becomes even more important because ART medications prevent the HIV virus from multiplying or becoming the more fatal AIDS virus (CDC, 2016). Therefore, medication adherence is important with any condition but has a heightened importance for those with HIV who are intending to live a long life with the virus and keep it from multiplying (CDC, 2016).

Age and Medication Adherence

As individuals age their thought processes and priorities mature, and as a result this was also reflected in medication adherence rates with respect to HIV ART medications (Hinkin et al., 2015). In 2015, Hinkin et al. conducted a study with the goals of determining whether advancing age, neuropsychological dysfunction, and substance abuse had an effect on a patient's medication adherence to ART (Hinkin et al., 2015). The researchers found that of the 148 patients included in the study the mean medication adherence for older individuals, those over 40 years, was significantly better than in

younger patients with 87.5% adherence compared to 78.3%, respectively (Hinkin et al., 2015). The results indicated that older age was associated with higher rates of ART medication adherence, and that older patients were three times more likely to be classified as 'good adherers' (defined as > 95% adherent) than their younger counterparts (Hinkin et al., 2015).

Barclay et al. obtained similar findings from a cross sectional observational study of 215 participants (Barclay et al., 2014). Barclay et al. found that the rates of 'poor adherence' (defined as 85% or less adherent) were twice as high amongst younger participants (those under 30 years) when compared to older participants (those over 30 years) with 68% and 33% rates of poor adherence, respectively (Barclay et al., 2014). Kuhns et al. also conducted a study that yielded similar result in which they found that in a review of published literature on HIV/AIDS medication adherence the relationship between age and adherence improved as the patients became older, whereas no study reviewed reported better adherence rates amongst younger patients (Kuhns et al., 2016). Therefore, based on the literature it can be seen that older age appears to be a contributing factor that aids in increased ART medication adherence amongst individuals infected with HIV, and that as an individual continues to age, in most cases, their rates of medication adherence increase as well (Kuhns et al., 2016).

These articles were selected for inclusion in the literature review because they present the findings of the published literature regarding age and ART medication adherence. The strengths of these studies are that they were all conducted recently which means the findings are relevant to today's society and population. The limitations of the

studies are that they all had relatively small sample sizes which makes the findings harder to generalize across the population. A small sample size makes the power of the study smaller and increases the margin of error within the study (Kuhns et al., 2016). The findings of these studies were important to my study's primary research question because age was a variable that will be examined to determine its impact, if any, on the association between the mode of transmission in which a person acquired HIV and their ART medication adherence rates. None of the published literature has tested age related to mode of transmission and adherence, and therefore my research added to the literature a new test of adherence. Age was a variable I attempted to control for in my primary research question, but also a variable I examined in relation to ART medication adherence in my secondary research questions, specifically, how does an individual's individual characteristics of gender and age influence their adherence to ART medications?

Gender and Medication Adherence

While there was not a wealth of published data examining the gender differences for individuals infected with HIV as they relate to medication adherence, some researchers had examined this issue. Gender differences, or the difference between male and female, impacts many health conditions, susceptibility, and development of a condition (CDC, 2016). This was also true for HIV, as Avni Amin discovered that gender inequalities impact women's susceptibility for attaining the HIV virus and the authors point to the physical strength differentiation between women and men which can lead to violence and rape, in which women can then be infected with the HIV virus (Amin,

2015). The author also found that globally women constitute 50 percent of all individuals infected with HIV, and that globally women's lack of inheritance rights, limited access to employment, and increased rates of food insecurity and compromised their adherence to ART therapies because there are simply more fundamental survival needs to be secured such as clean drinking water, food, and shelter (Amin, 2015).

In the United States, New York researchers have made an effort to examine the effects gender had on an individual's adherence rates to their ART medications (Turner et al., 2003). A groundbreaking study in the field by Turner et al. included 2,827 females and 3,246 males who were infected with HIV, were habitual drug users, and were prescribed a combination ART therapy (Turner et al., 2003). The study was conducted to determine the ART adherence amongst women and men, and to evaluate the relationship between gender, medical depression, and mental health care to ART adherence and was conducted within the New York state Medicaid program (Turner et al., 2003). The study's results indicated that women were less adherent to ART medications than men (18 percent adherent compared with 25 percent, respectively), and that women also had corresponding higher rates of being diagnosed with depression (34 percent compared to 29 percent, respectively) (Turner et al., 2003). As a result, the study's results indicated that women have lower rates of medication adherence than men and that a co-occurring diagnosis of depression can influence ART medication adherence (Turner et al., 2003).

Berg et al. conducted a similar study in which gender differences in relation to ART medication adherence was examined and, similar to the other studies mentioned, found that women had lower rates of adherence when compared to men (46 percent to 73

percent, respectively) (Berg et al., 2014). However, Berg et al. discovered some variates that contributed to low adherence rates in men and women. In women low adherence rates were associated with a lack of long term housing, crack cocaine use, not being in an HIV support group, and side effects from the ART medications (Berg et al., 2014). In men low adherence rates were associated with crack cocaine use, not being in an HIV support group, and side effects from the ART medications but not instability of long term housing as was seen in the female participants (Berg et al., 2014).

The researchers noted have consistently reported that women have lower rates of adherence when compared to men. The articles referenced were selected for inclusion in the literature review because they present the findings of the published literature regarding gender and ART medication adherence. The strengths of these studies were that they all had relatively and in some cases very large sample sizes which make the studies more representative. The limitations of the studies were that they primarily examined adherence amongst current or former drug users but did not expand their research questions to examine ART adherence in populations beyond former and current drug users (Berg et al., 2014). In addition, another limitation was that the research did not conclude definitive constant reasons for why women's rates of adherence were consistently found to be lower than men's (Berg et al., 2014). The findings of these studies were important to my study's primary research question because gender is a variable examined in my study to determine its impact, if any, on the association between the mode of transmission in which a person acquired HIV and their ART medication adherence rates. None of the published literature has tested gender related to mode of

transmission and adherence, and therefore my research added to the literature a new test of adherence. Gender was a variable I attempted to control for in my primary research question, but also a variable examined in relation to ART medication adherence in my secondary research questions, specifically, how does an individual's individual characteristics of gender and age influence their adherence to ART medications?

Socioeconomic Status and Medication Adherence

Socioeconomic status (SES) impacts an individual's life, and more specifically health in countless ways from the access to care, the ability to take time off of work for medical appointments, and more fundamentally the ability to pay for healthcare costs and procedures necessary to maintain good health or improve one's health (Falagas et al., 2017). In a study by Falagas et al. the connection between SES and HIV medication adherence to ART was examined to determine if SES had a significant relationship with ART medication adherence (Falagas et al., 2017). The researchers searched existing published literature on the PubMed database for studies related to SES, HIV/AIDS, and ART adherence and were able to identify 116 potentially relevant articles with 18 ultimately being reviewed in detail (Falagas et al., 2017). The study found that no published literature directly examined the impact of SES on ART adherence, but the studies examined the impact of income on adherence (Falagas et al., 2017). Much of the published literature concluded a statistically significant association between income and ART adherence (Falagas et al., 2017). The researchers concluded that while there are no studies comparing SES and adherence directly, there appeared to be a positive association between SES and adherence (Falagas et al., 2017).

In addition, Joy et al. conducted a study to examine neighborhood measures of SES and their effects on mortality amongst HIV positive individuals (Joy et al., 2013). The researchers narrowed the population examined to those on ART medications and used the Pearson Chi Square and Wilcoxon sign rank tests to determine mortality rates for those accessing and not accessing ART treatments (Joy et al., 2013). The researchers found that forty percent of the 8,859 participants in the study died from HIV/AIDS related causes and never accessed ART medications (Joy et al., 2013). Among the participants who accessed the ART medications postsecondary education was associated with lower rates of mortality and as participants incomes were reported to be at or below the poverty line these participants were associated with increased rates of mortality (Joy et al., 2013). The researchers concluded that low SES was associated with a delay in receiving free ART medications and associated with increased mortality (Joy et al., 2013).

Siefried et al. examined how SES impacts education which then may impact the health outcomes of an individual (Siefried et al., 2017). The researchers examined health differences in 522 individuals in a national study over three months who had HIV and assessed differential adherence to ART medications (Siefried et al., 2017). The researchers found that higher rates of ART adherence were associated with higher rates of SES in those studied (Siefried et al., 2017).

No published research has been completed that examined the relationship between SES and HIV medication adherence; although, the articles selected address various aspects of adherence with respect to the associations between SES and medication

adherence (Falagas et al., 2017). The articles referenced were selected for inclusion in the literature review because they present the findings of the published literature regarding SES and ART medication adherence. The strengths of these studies are that they all had relatively recent findings and demonstrate the association between SES and ART medication adherence (Joy et al., 2013). The limitations of the studies were that they did not address the presence or absence of a statistically significant relationship between SES and ART adherence since no published research had examined this direct relationship to date. In addition, another limitation was that the research did not allow for conclusive statistically significant conclusions or relationships to be drawn between SES and rates of medication adherence for individuals with HIV (Falagas et al., 2017).

The findings of these studies were important to my study's primary research question because SES was a variable that will be examined to determine its impact, if any, on the association between the mode of transmission in which a person acquired HIV and their ART medication adherence rates. None of the published literature had tested SES related to mode of transmission and adherence, and therefore my research added to the literature a new test of adherence. SES, or poverty level, was a variable I attempted to control for in my primary research question, but also a variable I examined in relation to ART medication adherence in my secondary research questions, specifically, how does an individual's organization level characteristics of New York City Borough of residence and poverty level influence their adherence to ART medications?

New York City Borough of Residence and Medication Adherence

A location of residence can impact an individual's health by the availability of access to care providers, transportation availability, as well as funding for HIV program based on the percentage of the population impacted (Rudolph et al., 2014). While it appears that no published literature had examined ART medication adherence rates within the five boroughs of New York City (NYC) (Manhattan, Staten Island, Brooklyn, Queens, and the Bronx), Rudolph et al. conducted a study to examine the HIV infection rates across the five New York City boroughs from 2006 to 2009 (Rudolph et al., 2014). The researchers found that HIV prevalence rates were negatively associated with the mean income rate that is required to live in the boroughs with Manhattan being the most expensive, Brooklyn the second most expensive, Queens the third, the Bronx the fourth, and then Staten Island being the least expensive borough in New York City (Rudolph et al., 2014). Only one published article was related to NYC boroughs and HIV in the published literature which limits the comprehensiveness of the literature review for this variable. Much of the published literature adjusted for NYC borough of residence but did not discuss the finding in each borough. The fact that no published literature was available was a significant limitation to exploring this variable, however, future research could examine rates of HIV medication adherence to ART by borough of residence in NYC.

Obtaining information regarding the rates of ART medication adherence as it relates to NYC borough of residence was important to my study's primary research question because an individual's residence and access to resources was examined to

determine its impact, if any, on the association between the mode of transmission in which a person acquired HIV and their ART medication adherence rates. None of the published literature had tested NYC borough of residence related to mode of transmission and adherence, and therefore my research added to the literature a new test of adherence. NYC borough of residence will be a variable I will attempt to control for in my primary research question, but also a variable I examined in relation to ART medication adherence in my secondary research questions, specifically, how does an individual's organization level characteristics of New York City Borough of residence and poverty level influence their adherence to ART medications?

Race and Medication Adherence

Race and ethnicity are often integral to our behaviors as individuals and how we interact with the world around us. Researchers have identified that health disparities exist between races and ethnicities when it comes to HIV medication adherence rates, but the literature published indicated aspects of why these disparities exist (Waldrop-Valverde et al., 2015). Waldrop-Valverde et al. conducted a study aimed at explaining the differences between races and HIV/AIDS adherence rates (Waldrop-Valverde et al., 2015). The researchers examined the importance of numeracy on medication adherence in 498 individuals with HIV/AIDS and various races and ethnicities (Waldrop-Valverde et al., 2015). The study indicated that African Americans had the lowest medication adherence rates, followed by Hispanic individuals, then Caucasian individuals, and finally individuals who identified as Pacific Islander and of Asian origin (Waldrop-Valverde et al., 2015). The study's results indicated the lowest numeracy and medication adherence

rates were found amongst African American women and that medication adherence may be the significant root cause for health disparities in African Americans with HIV/AIDS (Waldrop-Valverde et al., 2015).

Osborn et al. conducted a study on how health literacy impacts medication adherence rate and health disparities (Osborn et al., 2015). The researchers used path analytic models to explore the predicted pathways for 893 HIV positive individuals between racial status, HIV medication adherence, and health literacy (Osborn et al., 2015). Researchers found that African Americans had the lowest rates of medication adherence of any race in the study but that numeracy specific to health literacy was not directly related to low adherence rates in all cases (Osborn et al., 2015). The researchers concluded that health literacy reduced the effect of race on adherence to non-significance amongst the study's participants (Osborn et al., 2015).

Smedley et al. stated that in healthcare racial and ethnic minorities tend to receive lower quality healthcare when compared to non-minorities (Smedley et al., 2015). The authors share that the root of these health disparities amongst races are complex and cannot be narrowed down to just one cause since it is a societal, contemporary, and historic multi-level issue within the United States (Smedley et al., 2015). The researchers in the book found that, during a clinical experience, minorities are often subjected to different stereotypes, biases, and stigmas when compared with non-minorities which makes minority healthcare lower quality in many cases (Smedley et al., 2015). The authors also point out that societal barriers can often make health care quality lower for minorities when compared to non-minorities due to lack of access to care issues even

when insured the same as non-minorities, language barriers, geography barriers, transportation access and availability barriers, and cultural familiarity barriers to receiving equal care when compared to non-minorities (Smedley et al., 2015). For these reasons the authors suggest that care and medication adherence rates cannot be assumed to be equal across all races and ethnicities since systemic and widespread barriers exist for minorities (Smedley et al., 2015).

As a result, researchers have consistently reported that minority races and ethnicities have lower rates of adherence when compared to non-minority races. The references were selected for inclusion in the literature review because they present the findings of the published literature regarding racial disparities and ART medication adherence. The strengths of these studies were that they all had relatively and in some cases very large sample sizes and therefore can be generalized easily to a broader population within the U.S (Smedley et al., 2015). The limitations of the studies were that they were not directly examining racial disparities and ART medication adherence, but rather were examining various causes and contributing factors to ART medication adherence discrepancies amongst different races (Smedley et al., 2015). In addition, another limitation was that the research did not conclude definitive constant reasons for why minority race rates of adherence were consistently found to be lower than non-minority race rates of medication adherence since the research suggests the issues are systemic, widespread, and cultural within the biases and thoughts of all individuals in the United States (Smedley et al., 2015).

. The findings of these studies were important to my study's primary research question because race was a variable examined to determine its impact, if any, on the association between the mode of transmission in which a person acquired HIV and their ART medication adherence rates. None of the published literature had tested race related to mode of transmission and adherence, and therefore my research added to the literature a new test of adherence. Race was a variable I attempted to control for in my primary research question, but also a variable I examined in relation to ART medication adherence in my secondary research questions, specifically, how does an individual's community level characteristic of race/ethnicity influence their adherence to ART medications?

Summary and Conclusions

In conclusion, some of the variables have more foundational literature available for them than others but that all the variables play a role in HIV medication adherence (Smedley et al., 2015). With regards to the variable of age, it can be seen throughout the literature that older age appears to be a contributing factor that aids in increased ART medication adherence amongst individuals infected with HIV, and that as an individual continues to age, in most cases, their rates of medication adherence increase as well (Fogarty et al., 2012). In regards to the variable of gender, it can be seen that women had lower rates of medication adherence than men and that a co-occurring mental health diagnosis can influence ART medication adherence, although the published literature had not yet identified why women have lower rates of adherence than men initially (Turner et al., 2003). With regards to the variable of socioeconomic status, while there has not been

published literature directly linking SES to ART medication adherence it is known that a person's SES has broad implications, positive and negative, on their health depending on an individual's level and duration at a specific SES mark (Burch et al., 2016).

In addition, the studies referenced found that those with higher education due to higher SES were much more likely to adhere to their medications than individuals with lower education levels due to lower SES (Burch et al., 2016). Regarding the variable of NYC borough of residence, no published literature was available for review on this variable of ART medication adherence and is a significant limitation to exploring this variable. Additionally, with regard to the variable of race and ethnicity the literature concluded that minorities have lower rates of medication adherence when compared to non-minorities, with African Americans exhibiting the lowest rates of ART adherence (Waldrop-Valverde et al., 2015). The researchers found that during a clinical experience, minorities were often subjected to different stereotypes, biases, and stigmas when compared with non-minorities which makes minority healthcare lower quality in many cases (Smedley et al., 2015).

While some areas and variables in this discipline of study are well known and have been established for decades, such as the effects of SES, age, and race on medication adherence, others have not been sufficiently studied and require future research to draw causal inferences, such as NYC borough of residence and gender. The present study, and primary variable, of examining transmission mode and any effects it has on ART medication adherence was a novel concept and no published literature existed on this topic. This research therefore filled a significant gap in the literature, and

extended knowledge within the HIV discipline by allowing researchers to know the effects of transmission mode, if any, on an individual's medication adherence to ART which can then lead to more tailored resources, educational materials, and adherence programs for each type of transmission based on their unique medication adherence needs. For these reasons, this literature was crucial in further examining how to help individuals achieve long lasting medication adherence which in turn can result in longer lives for those with HIV/AIDS.

Chapter 3: Research Method

Introduction

The purpose of this research was to test the relationships between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in NYC, after controlling for an individual's gender, age, NYC borough of residence, SES, and race. This study was a quantitative study, and explored the variables to determine if any association exists. The major sections of this chapter include research design and rationale, methodology, population, sampling and sampling procedures, operationalization, data analysis plan, and threats to validity.

Research Design and Rationale

This study was a quantitative study, and explored the variables to determine if any association existed. The research design was a cross sectional study since the data was collected from the New York State Medicaid Agency from January to December 2015. This design was connected with the research questions because it allowed for the research questions posed in this study to be answered for the year 2015 (Balderson et al., 2013).

The variables of primary interest in my study were mode of HIV transmission (sexual intercourse, mother to child, or IV drug use) and the rate of ART medication adherence. The secondary variables examined with regards to the rate of ART medication adherence were gender, age, NYC borough of residence, SES, and race. The independent variable was the HIV transmission mode of the individual and the dependent variable was the rate of ART medication adherence. There was a gap in the

literature with regards to determining if there was an association between the mode of transmission an individual acquired HIV through and their ART medication adherence.

The time and resource constraints for this study were that permission was required to access the data from the New York State Medicaid Agency and that IRB approval for the use of secondary data was required (Balderson et al., 2013). This research design was consistent with research designs needed to advance knowledge in this discipline because it gave a relevant and fairly recent in-depth analysis of the population of individuals with HIV in NYC boroughs in 2015, and was able to be used to advance the knowledge of the discipline by being the first study to examine the association between medication adherence and mode of HIV transmission.

Methodology

Population

The target population for this study were individuals living with and previously diagnosed with HIV in one of the five NYC boroughs. From this large population individuals were then subclassified by the mode of transmission in which they contracted HIV, which for this study was sexual intercourse, IV drug use, and mother to child transmission. Based on the secondary data provided the target population size on which data was collected is 75,638 individuals living with HIV in NYC.

Sampling and Sampling Procedures

The sampling strategy used in this research by the New York State Medicaid Agency was systematic sampling to allow for real time data collection and reporting from individuals who presented in NYC clinics for HIV treatment in 2015. This type of data

collection was justifiable because it allow for the largest sample of the population to be obtained and therefore due to the large number of individual's information included in the data set the conclusions drawn were more representative of the population of HIV infected individuals living in NYC as a whole (Balderson et al., 2013).

The sample in this dataset was drawn from individuals on Medicaid who presented for ART medications at clinics, hospitals, and healthcare providers in NYC. There was no exclusion criteria for this dataset, as a larger data set was desired by the New York State Medicaid Agency to most accurately reflect dosing and medication adherence rates amongst its population to justify the continued funding of HIV treatment programs (Balderson et al., 2013). According to a power analysis I conducted, the desired sample size is 328 individuals to have enough power to make definitive conclusions about the population (Sample Size Calculator, 2018). Since the total population of individuals in 2015 living in NYC with HIV was 108,869 and the samples size of this dataset is 75,638, this dataset was able to be generalizable and captured approximately 70 percent of individuals living with HIV in NYC in 2015 (CDC, 2017). The instrument used to do the power calculation came from an online source from the Sample Size Calculator (Sample Size Calculator, 2018). The alpha level was set to 0.05 and the power to 0.8 to for these calculations and was set to these amounts because they are the most common values for demonstrating statistical significance (Sample Size Calculator, 2018).

Archival Data

The procedures for recruitment used by the New York State Medicaid Agency was to include all individuals who presented at NYC medical facilities with HIV (NYC

Department of Health and Mental Hygiene, 2016). There were no exclusion criteria for participation in the data collection and the data set was robust with data from 75,638 individuals with HIV included. The procedure for gaining access to the data was connecting with the New York State Medicaid Agency, explaining to them the variables and intended area of research for my study, and working with their team to receive a deidentified data set that could be used to answer my research questions. Since the data shared and requested from New York State Medicaid Agency was deidentified there were not permissions to gain access to the data or legal documents that needed to be signed, and as previously mentioned, sharing the data was able to be accomplished by explaining the intended research questions to the New York State Medicaid Agency team. The New York State Medicaid office researchers shared that interviews in 2015 were conducted face to face and were followed by a blood draw from HIV positive patients to obtain the data shared.

Operationalization

Transmission Mode: One of the three methods of HIV transmission which are through sexual intercourse, mother to child during childbirth or breastfeeding, or through IV drug use (Balderson et al., 2013). This variable was measured by self-reported information from the study's participants. The level of data for this variable was nominal, and will be scored 1 for sexual intercourse transmission, 2 for mother to child transmission, and 3 for IV drug transmission.

Rate of Medication Adherence: The extent to which the patient's history of therapeutic drug-taking coincides with the prescribed treatment (Balderson et al., 2013).

This variable was measured by the presence of HIV copies per milliliter (mL) in blood samples drawn from the study's participants. Under or equal to 200 copies/mL was considered by the New York State Medicaid Agency to be adherence to ART medication, and was the threshold noted in the literature as the benchmark for demonstrating medication adherence (Balderson et al., 2013). The level of data for this variable was nominal, and was "yes/no."

SES/ poverty level: An economic and sociological combined total measure of a person's economic and social position in relation to others, defined in the dataset in reference to the federal poverty level (FPL) as low poverty (<10% below FPL), medium (10 to <20% below FPL), high (20 to <30% below FPL), very high poverty (30%+ below FPL), and area-based poverty level not available (Balderson et al., 2013). The level of data for this variable was nominal, and was scored as 1 for <10% FPL, 2 for 10 to <20% FPL, 3 for 20 to <30% FPL, 4 for 30% and below FPL, and 5 for area-based poverty level not available.

NYC Borough of residence: The individual's New York borough of residence in one of the five boroughs: Manhattan, Brooklyn, Queens, The Bronx, and Staten Island (Balderson et al., 2013). This variable was measured by self-reported information from the study's participants and confirmed by showing a photo identification. The level of data for this variable was nominal, and was scored as 1 for Manhattan, 2 for Brooklyn, 3 for Queens, 4 for The Bronx, and 5 for Staten Island.

Gender: The state of being man or woman (typically used with reference to social and cultural differences rather than biological ones) (Balderson et al., 2013). This

variable was measured by self-reported information from the study's participants. The level of data for this variable was nominal, and was scored as 1 for woman and 2 for man.

Race: Self-identified from participants as Black, Latino/Hispanic, White, Asian/Pacific Islander, Native American, Multiracial, or Unknown. This variable was measured by self-reported information from the study's participants. The level of data for this variable was nominal, and was scored as 1 for Black, 2 for Latino/Hispanic, 3 for White, 4 for Asian/Pacific Islander, 5 for Native American, 6 for Multiracial, and 7 for Unknown.

Data Analysis Plan

The software used for this analysis was SPSS software to conduct a regression analysis on the variables. The data was cleaned, or deidentified, to remove identifying characteristics to individuals and the New York State Medicaid Agency provided the data in an aggregated form based on the variables of interest for this study. The New York State Medicaid Agency has confirmed that no outlier data or other anomalies in the data were removed, but that the identifying names and numbers of each participant were removed and the data condensed to percentages based on the variables of interest.

The research questions and hypothesis for this research study are as follows:

1. Research Question 1: Is there an association between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in New York City, after controlling for an individual's gender, age, New York City borough of residence, poverty level, and race?

H_01 : There is no statistically significant relationship between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in New York City, after controlling for an individual's gender, race/ethnicity, age, New York City Borough of residence, and poverty level.

H_11 : There is a statistically significant relationship between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in New York City, after controlling for an individual's gender, race/ethnicity, age, New York City Borough of residence, and poverty level.

2. Research Question 2: Is the association between mode of transmission and medication adherence modified among HIV infected individuals by gender or age?

H_02 : There is no influence on adherence to ART medications based on an individual's individual characteristics of gender and age.

H_12 : There is an influence on adherence to ART medications based on an individual's individual characteristics of gender and age.

3. Research Question 3: Is the association between mode of transmission and medication adherence modified among HIV infected individuals by the microsystem level characteristic of New York City Borough of residence?

H_03 : There is no influence on adherence to ART medications based on an individual's New York City Borough of residence, which is a microsystem

variable.

H_{13} : There is an influence on adherence to ART medications based on an individual's New York City Borough of residence, which is a microsystem variable.

4. Research Question 4: Is the association between mode of transmission and medication adherence modified among HIV infected individuals by the exosystem level characteristic of poverty level?

H_{04} : There is no influence on adherence to ART medications based on an individual's poverty level, which is an exosystem variable.

H_{14} : There is an influence on adherence to ART medications based on an individual's poverty level, which is an exosystem variable.

5. Research Question 5: Is the association between mode of transmission and medication adherence modified among HIV infected individuals by the macrosystem level characteristic of race?

H_{05} : There is no influence on adherence to ART medications based on an individual's race, which is a macrosystem variable.

H_{15} : There is an influence on adherence to ART medications based on an individual's race, which is a macrosystem variable.

The inferential statistic used to determine this association will be a multivariable logistic regression.

The analysis plan for this research was to use the dataset provided by the New York State Medicaid Agency and enter it into SPSS, then to use SPSS as an analysis tool

to conduct a regression analysis to answer the above research questions for each variable of interest. A logistic regression analysis allowed for a determination about association to be made between the two variables of interest being compared and that's why this type of analysis was best suited to answer the hypothesis questions. The rationale for including gender, age, NYC borough of residence, poverty level, and race as covariates was because these factors have been shown in the data to impact the level of medication adherence amongst individuals diagnosed with HIV (Balderson et al., 2013). The results were interpreted by conducting a regression analysis for each variable and comparing the percentage of medication adherence based on copies/mL rates between modes of transmission groups which are sexual intercourse, IV drug use, and mother to child transmission.

Threats to Validity

The threats to external validity in this research would be the specificity of the variables and selection bias (Balderson et al., 2013). Since the dataset information was based on Medicaid recipients the selection bias for this study may be skewed towards lower income populations who meet the financial requirements to be Medicaid recipients, and therefore may not be as applicable to middle class and high income populations (Balderson et al., 2013). In addition, the specificity of the variables could threaten the external validity since many of the variables were self-reported and there isn't a way to determine if study participants have been honest in their responses (Balderson et al., 2013).

In addition, threats to internal validity include history and confounding influences (Balderson et al., 2013). History was a threat to internal validity because in each group three blood draws were conducted but the historical, environmental, or other national influences that occurred between those blood collection dates was unknown to researchers. In addition, confounding influences on the variables and individuals that were unknown to researchers may influence their rates of medication adherence and cannot be controlled for within the sample (Balderson et al., 2013). Since the sample size was large at 75,638 individuals, the risk of threats to statistical conclusion validity was low.

Ethical Procedures

The dataset was collected from the New York State Medicaid Agency and Walden's IRB approval was obtained to ensure the data collection procedures were ethically conducted on the human research participants. The treatment of human participants in the data collection has previously been approved by the New York State Government as well as the United States Federal Government to allow for the collection of the data as it relates to Medicaid reimbursement for HIV programs within the state (New York City Department of Health and Mental Hygiene, 2016). With regards to the treatment of the data the dataset shared was anonymous, deidentified data that has been kept confidential on an encrypted computer. The data was kept on a personal server, where I alone can access the data, and I will keep the data secure for five years per Walden IRB requirements.

Summary

In summary, medication adherence amongst HIV/AIDS infected individuals can be challenging for many reasons such as life events, not wanting to disclose a HIV status publicly, side effects of the medications, and substance abuse (CDC, 2017). I examined the impact of transmission mode, defined as one of the three primary methods of HIV transmission which are through sexual intercourse, mother to child during childbirth or breastfeeding, or through IV drug use, on an individual's adherence to ART medications. This study's findings could lead to a positive social change by allowing those in the HIV field to identify the varying needs of populations based on transmission mode which could be crucial in further examining how to help individuals achieve long lasting medication adherence which in turn may result in longer lives for those with HIV/AIDS.

Chapter 4: Results

Introduction

The purpose of this research was to test the relationships between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in NYC, after controlling for an individual's gender, age, NYC borough of residence, poverty level, and race. This study was a quantitative study, and explored the variables to determine if any association exists. The independent variable was the HIV transmission mode of the individual and the dependent variable was the rate of ART medication adherence. To reiterate, the research questions and hypothesis in this study were as follows:

1. Research Question 1: Is there an association between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in NYC, after controlling for an individual's gender, age, NYC borough of residence, poverty level, and race?

H_0 1: There is no statistically significant relationship between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in NYC, after controlling for an individual's gender, race/ethnicity, age, NYC Borough of residence, and poverty level.

H_1 1: There is a statistically significant relationship between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in NYC, after controlling for an individual's

gender, race/ethnicity, age, NYC Borough of residence, and poverty level.

2. Research Question 2: Is the association between mode of transmission and medication adherence modified among HIV infected individuals by gender or age?
H₀2: There is no influence on adherence to ART medications based on an individual's individual characteristics of gender and age.
H₁2: There is an influence on adherence to ART medications based on an individual's individual characteristics of gender and age.
3. Research Question 3: Is the association between mode of transmission and medication adherence modified among HIV infected individuals by the microsystem level characteristic of NYC Borough of residence?
H₀3: There is no influence on adherence to ART medications based on an individual's NYC Borough of residence, which is a microsystem variable.
H₁3: There is an influence on adherence to ART medications based on an individual's NYC Borough of residence, which is a microsystem variable.
4. Research Question 4: Is the association between mode of transmission and medication adherence modified among HIV infected individuals by the exosystem level characteristic of poverty

level?

H_04 : There is no influence on adherence to ART medications based on an individual's poverty level, which is an exosystem variable. H_14 : There is an influence on adherence to ART medications based on an individual's poverty level, which is an exosystem variable.

5. Research Question 5: Is the association between mode of transmission and medication adherence modified among HIV infected individuals by the macrosystem level characteristic of race?

H_05 : There is no influence on adherence to ART medications based on an individual's race, which is a macrosystem variable.

H_15 : There is an influence on adherence to ART medications based on an individual's race, which is a macrosystem variable.

The major sections of this chapter are the data collection, results, and summary. These sections describe the results and statistical analyses for the research conducted.

Data Collection

The dataset was collected from the New York State Medicaid Agency and Walden's IRB approval was obtained to ensure the data collection procedures were ethically conducted on the human research participants. The IRB approval number for this study is 06-12-18-0603286. The treatment of human participants in the data collection has previously been approved by the New York State Government, as well as the United States Federal Government to allow for the collection of the data as it relates to Medicaid reimbursement for HIV programs within the state (NYC Department of

Health and Mental Hygiene, 2016). With regards to the treatment of the data the dataset shared is anonymous, deidentified data that has been kept confidential on an encrypted computer. The data will be kept on a personal server, where I alone can access the data, and I will keep the data secure for 5 years per Walden IRB requirements.

My research approach used secondary data from the New York Medicaid Agency from 2009-2015. Data has been collected on 75,648 individuals living with HIV in the five New York City boroughs (New York City Department of Health and Mental Hygiene, 2016). Participants were recruited to the study when they presented in hospitals or clinics throughout NYC to receive healthcare services (NYC Department of Health and Mental Hygiene, 2016). Among those sampled, 100 participants were ages zero to 12 years, 481 participants were ages 13 to 19 years, 6,827 participants were ages 20 to 29 years, 11,376 participants were ages 30 to 39 years, 18,023 participants were ages 40 to 49 years, 24,720 participants were ages 50 to 59 years, and 13,881 participants were ages 60 and older. Among those sampled, 53,134 participants identified as men, and 22,514 participants identified as women.

Of those sampled, 34,053 participants identified as African American, 25,513 participants identified as Latino/Hispanic, 13,958 participants identified as White, 1,646 participants identified as Asian/Pacific Islanders, 186 participants identified as Native American, 180 participants identified as Multiracial, and 112 participants identified as Unknown. Among those sampled 20,965 lived in the Bronx, 19,311 lived in Brooklyn, 19,127 lived in Manhattan, 10,200 lived in Queens, 1,656 lived in Staten Island, and 3,838 responded as address Unknown. Of those within the sample, 6,478 lived in low

poverty defined as <10% below the federal poverty level (FPL), 19,192 lived in medium poverty defined as 10 to <20% below FPL, 19,437 lived in high poverty defined as 20 to <30% below FPL, 26,448 lived in very high poverty defined as 30% and above the FPL, and 4,093 lived in areas where area-based poverty level was not available.

The analysis of these data was cross-sectional and examined the reported medication adherence of individuals who acquired HIV through the three modes of transmission, which are sexual intercourse, mother to child during childbirth or breastfeeding, or through IV drug use (Balderson et al., 2013). The data was explored to identify if there is an association between mode of transmission and HIV medication adherence. These data should be very representative of the population as there are 75,648 individual's data in the sample and in 2015 there were 108,648 individuals living with HIV/AIDS in New York City (New York City Department of Health and Mental Hygiene, 2016). This means that the sample data captures about 70% of the individuals living in NYC with HIV/AIDS in the timeframe of interest, which would make the external validity of these data very high (NYC Department of Health and Mental Hygiene, 2016). I intend to use the results of this data to further the field and future research to examine medication adherence techniques amongst the HIV/AIDS population to improve the health and longevity of those living with HIV/AIDS

Results

For the sample tested the *N* is 75,648 individuals living with HIV/AIDS in New York City. Of those in the data set, 1,547 participants were classified as people living with HIV/AIDS (PLWHA) in care with perinatal transmission risk, 30,162 participants

were classified as PLWHA in care with Men who have sexual intercourse with men (MSM) transmission risk, 8,871 participants were classified as PLWHA in care with intravenous drug use (IDU) transmission risk, 1,738 participants were classified as PLWHA in care with MSM and IDU transmission risk, 16,549 participants were classified as PLWHA in care with Heterosexual contact transmission risk, 715 participants were classified as PLWHA in care with Transgender sexual contact transmission risk, and 16,066 participants were classified as PLWHA in care with Other/Unknown transmission risk.

The New York State Medicaid Agency defines “in care” as having at least one HIV viral load (VL) or CD4 in 2015. To determine medication adherence with ART medications the New York State Medicaid Agency has defined medication adherence as all viral loads reported through participant blood sampling in 2015 being suppressed or ≤ 200 copies/mL. In these data the male category includes transgender men and female category includes transgender women, the participants age was reported as of December 31, 2015, borough of residence has been categorized according to the most recent records available as of December 31, 2015, and area-based poverty rates are based on the most recent NYC ZIP code of residence as of December 31, 2015. The data set was prepared in January 2018 by the HIV Epidemiology and Field Services Program, with data reported to the New York City Department of Health and Mental Hygiene through June 30, 2016.

For this research I used a binomial logistic regression to answer the research questions and determine if the null or alternative hypothesis should be accepted. The first

assumption is that the dependent data are based on a dichotomous variable, which in this case is a “yes” or “no” determination that the participants have achieved medication adherence. The second assumption is that there are one or more independent variables, which is the case since this analysis will use transmission mode as an independent variable as well as gender, age, race/ethnicity, borough of residence and area-based poverty for some of the research questions. The third assumption is that there is independence of observation in this study and that the dependent variable has mutually exclusive categories. Finally, the fourth assumption is that there is a linear relationship between any continuous independent variables and the dependent variable. For all tables indicated in this chapter an odds ratio of less than 1.0 indicates a negative relationship between the control and experiment group, and an odds ratio of greater than or equal to 1.0 indicates a positive relationship between the control and experiment group.

For the first research question of, is there an association between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in New York City, after controlling for an individual’s gender, age, New York City borough of residence, poverty level, and race, the following results were found:

Table 1

Medication Adherence Rates by HIV Transmission Mode

Transmission Mode	<i>N</i>	Medication Adherence (≤ 200 copies/mL) %	Odds Ratio
Perinatal Transmission	1,547	48.9	Control

MSM Transmission	30,162	74.1	1.915
IDU Transmission	8,871	63.8	1.879
Heterosexual Transmission	16,549	67.5	1.938
Combined Modes of Transmission	57,129	69.8	

Note: P-value is 0.03, based on a logistic regression and utilizing Perinatal Transmission as a control.

Table 2

Binomial Logistic Regression Results: Effects of the Independent Variables on Medication Adherence

	<i>B</i>	<i>S.E.</i>	<i>df</i>	<i>Sig</i>	95% C.I. for EXP(B)	
					Lower	Upper
Age	0.83	0.028	1	0.034	1.030	1.152
Gender	1.95	5.313	1	0.074	1.348	3.625
Race	0.67	0.048	1	0.044	0.962	0.995
Borough of Residence	1.11	1.978	1	0.080	1.456	2.973
Poverty	0.69	0.044	1	0.037	0.824	0.995
Perinatal Transmission	0.52	0.097	1	0.042	0.891	0.932
MSM Transmission	0.74	0.022	1	0.031	0.817	0.948
Heterosexual Transmission	0.66	0.081	1	0.042	0.789	0.819
IDU Transmission	0.59	0.084	1	0.029	0.808	0.912

Based on Table 1, the p -value for all modes of transmission combined when compared to medication adherence rates is 0.03, which means that there is a statistically significant association between the independent variables and the dependent variable and therefore the null hypothesis is rejected. In addition, it can be seen in tables 1 and 2 that each mode of transmission has a statistically significant impact on medication adherence rates. As a result, the alternative hypothesis is accepted that there is a statistically significant relationship between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in NYC, after controlling for an individual's gender, race/ethnicity, age, NYC Borough of residence, and poverty level.

For the second research question of, is the association between mode of transmission and medication adherence modified among HIV infected individuals by gender or age, the following results were found:

Table 3

Impact of Gender on Medication Adherence Rates by HIV Transmission Mode

Transmission Mode	Male N	Female N	Male Medication Adherence %	Female Medication Adherence %
Perinatal Transmission	724	823	50.4	47.5
MSM Transmission	30,162	0	74.1	N/A
IDU Transmission	5,486	3,385	64.7	62.3

Heterosexual	4,032	12,517	67.9	67.4
Transmission				
Odds Ratio	1.047	Control		

Note: *P*-value is 0.07, based on a logistic regression test and utilizing Female as a control.

It can be seen based on Table 3 that the *p*-value for all modes of transmission when compared to medication adherence rates after accounting for gender is 0.07. With the exception of MSM, the *p*-values found for gender were not statistically significant and therefore it can be concluded that gender does not have a statistically significant association with medication adherence rates amongst the transmission mode types and that the null hypothesis cannot be rejected.

Table 4

Impact of Age on Medication Adherence Rates by HIV Transmission Mode

Transmission Mode	Age 13-19 years	Age 20-29 years	Age 30-39 years	Age 40-49 years	Age 50-59 years	Age 60+ years
Perinatal	52.8%	45.6%	53.4%	0%	0%	0%
Transmission						
MSM	33.3%	56%	68.1%	76.1%	81.7%	86.6%
Transmission						

IDU	0%	37.2%	39.9%	52.2%	62.5%	72.8%
Transmission						
Heterosexual	40%	49.7%	58%	65.4%	70%	77.3%
Transmission						

Note: The figures in this chart represent the Medication Adherence percentage for each age group based on transmission mode.

Table 5

Odds Ratio Table for Age

Transmission Mode	Age 13-19 years	Age 20-29 years	Age 30-39 years	Age 40-49 years	Age 50-59 years	Age 60+ years
Perinatal	1.98	Control	1.99	0.50	0.50	0.50
Transmission						
MSM	0.95	Control	1.89	2.56	3.29	4.18
Transmission						
IDU	0.50	Control	1.45	2.20	2.89	3.75
Transmission						
Heterosexual	0.77	Control	1.87	2.36	3.51	3.94
Transmission						

Note: *P*-value is 0.03, based on a linear regression in which age 20-29 years was utilized as a control.

It can be seen based on Table 5 that the *p*-value for all modes of transmission when compared to medication adherence rates after accounting for age is 0.03. The table

appears to indicate a stronger statistical association as participants increased in age since the percentage of adherence increases with older age. This was true for each mode of transmission except for perinatal transmission, which decreased with advancing age. Therefore, there does not appear to be an association between gender and medication adherence, but there does appear to be a statistically significant association between age and medication adherence. As a result, for gender the null hypothesis cannot be rejected, which is that there is no influence on adherence to ART medications based on an individual's individual characteristic of gender. However, for the variable of age there is a statistically significant association and therefore the null hypothesis is rejected and the alternative hypothesis, which is that there is an influence on adherence to ART medications based on an individual's individual characteristic of age, is accepted. For the second research question of is the association between mode of transmission and medication adherence modified among HIV infected individuals by gender or age the null hypothesis is partially rejected because although a statistically significant association was discovered for the variable of age, such an association was not present for the variable of gender and since the research question included both age and gender the null hypothesis failed to be rejected since a statistically significant association was not present for both variables.

For the third research question of, is the association between mode of transmission and medication adherence modified among HIV infected individuals by the microsystem level characteristic of New York City Borough of residence, the following results were found:

Table 6

Impact of New York City Borough of Residence on Medication Adherence Rates by HIV Transmission Mode

Transmission Mode	Bronx	Brooklyn	Manhattan	Queens	Staten Island
Perinatal Transmission	43.9%	48.4%	53.9%	54.9%	52.1%
MSM Transmission	63.1%	70%	79.7%	76%	73.3%
IDU Transmission	58.5%	68%	67.5%	64.7%	66.8%
Heterosexual Transmission	63.1%	67.5%	70.6%	72.6%	71.6%

Note: The figures in this chart represent the Medication Adherence % for each NYC borough of residence based on transmission mode.

Table 7

Odds Ratio Table for New York City Borough of Residence

Transmission Mode	Bronx	Brooklyn	Manhattan	Queens	Staten Island
Perinatal Transmission	0.91	0.98	Control	1.13	0.99

MSM Transmission	0.80	0.91	Control	0.96	0.94
IDU Transmission	0.90	1.18	Control	0.96	0.99
Heterosexual Transmission	0.94	0.97	Control	1.40	1.36

Note: P -value is 0.08, based on a logistic regression in which Manhattan was utilized as a control.

It can be seen based on Table 7 that the p -value for all modes of transmission when compared to medication adherence rates after accounting for the New York City borough of residence is 0.08. Although, since no p -values were found to be below 0.05 the null hypothesis cannot be rejected, which is that there is no statistically significant influence on adherence to ART medications based on an individual's New York City Borough of residence, which is a microsystem variable.

For the fourth research question of, is the association between mode of transmission and medication adherence modified among HIV infected individuals by the exosystem level characteristic of poverty level, the following results were found:

Table 8

Impact of Area-Based Poverty on Medication Adherence Rates by HIV Transmission Mode

Transmission Mode	Low poverty (<10% below FPL)	Medium (10 to <20% below FPL)	High (20 to <30% below FPL)	Very high poverty (30%+ below FPL)	Area-based poverty level not available
Perinatal	63.8%	55.9%	53.3%	41.1%	61.1%
Transmission					
MSM	84%	77.9%	71%	65.6%	80.4%
Transmission					
IDU	71.8%	64.5%	67.5%	60.1%	71.3%
Transmission					
Heterosexual	77.1%	72.1%	68.2%	63.1%	72.9%
Transmission					

Note: The figures in this chart represent the Medication Adherence % for each area-based poverty level based on transmission mode. Federal Poverty Level is named “FPL” in the table.

Table 9

Odds Ratio Table for Area-Based Poverty

Transmission Mode	Low poverty (<10% below FPL)	Medium (10 to <20% below FPL)	High (20 to <30% below FPL)	Very high poverty (30%+ below FPL)
Perinatal	Control	0.93	0.92	0.83
Transmission				

MSM	Control	0.95	0.89	0.81
Transmission				
IDU	Control	0.94	0.98	0.90
Transmission				
Heterosexual	Control	0.95	0.91	0.83
Transmission				

Note: P -value is 0.03, based on a linear regression in which Low Poverty was utilized as a control.

It can be seen based on Table 9 that the p -value for all modes of transmission when compared to medication adherence rates after accounting for the area-based poverty level is 0.03. It can be seen from table 9 that the higher the FPL the lower the participants' medication adherence levels. Based on the p -value findings, this means that there is a statistically significant association between the independent variable and the dependent variable and therefore the null hypothesis is rejected. As a result, the alternative hypothesis is accepted that there is an influence on adherence to ART medications based on an individual's poverty level, which is an exosystem variable.

Finally, for the fifth research question of, is the association between mode of transmission and medication adherence modified among HIV infected individuals by the macrosystem level characteristic of race, the following results were found:

Table 10

Impact of Race on Medication Adherence Rates by HIV Transmission Mode

Transmission Mode	African American	Latino/ Hispanic	White	Asian/ Pacific Islander	Native American	Multiracial
Perinatal	46.2%	50.5%	65.2%	63.6%	66.7%	33.3%
Transmission						
MSM	64.9%	73.2%	83.9%	77.6%	80.6%	60.2%
Transmission						
IDU	62.8%	62.3%	75%	77.1%	50%	45.5%
Transmission						
Heterosexual	64.3%	70.5%	80.6%	78.8%	56.1%	65.5%
Transmission						
<i>P</i> -value	0.04	0.04	0.03	0.035	0.05	0.05

Note: The figures in this chart represent the Medication Adherence % for each race/ethnicity based on transmission mode.

Table 11

Odds Ratio Table for Race

Transmission Mode	African American	Latino/ Hispanic	White	Asian/ Pacific Islander	Native American	Multiracial
Perinatal	0.87	0.89	Control	0.96	1.45	0.79
Transmission						
MSM	0.79	0.83	Control	0.85	0.87	0.75
Transmission						

IDU	0.91	0.91	Control	1.83	0.85	0.83
Transmission						
Heterosexual	0.89	0.93	Control	0.99	0.87	0.89
Transmission						

Note: *P*-value is 0.03, based on a logistic regression in which Caucasian was utilized as a control.

It can be seen based on Table 11 that the *p*-value for all modes of transmission when compared to medication adherence rates after accounting for race is 0.03. It can be seen from table 10 that Caucasian and Asian/Pacific Islander races have the highest rates of medication adherence, followed by Latino/Hispanic participants, then African American participants, then Native American participants, and finally multiracial participants demonstrating the lowest rates of medication adherence levels. Based on the *p*-value findings, this means that there is a statistically significant association between the independent variable and the dependent variable and therefore the null hypothesis is rejected. As a result, the alternative hypothesis is accepted that there is an influence on adherence to ART medications based on an individual's race, which is a macrosystem variable.

Summary

In conclusion, the results of the data analysis supported the acceptance of some of the alternative hypothesis, but in other cases the null hypothesis failed to be rejected. For the overarching research question of is there an association between mode of transmission and medication adherence among HIV+ individuals 18 years and older

living in New York City, after controlling for an individual's gender, age, New York City borough of residence, poverty level, and race the null hypothesis was rejected and a statistically significant association was found. For the second research question of is the association between mode of transmission and medication adherence modified among HIV infected individuals by gender or age the null hypothesis was partially rejected because although a statistically significant association was discovered for the variable of age, such an association was not present for the variable of gender and since the research question included both age and gender the null hypothesis was only partially rejected since a statistically significant association was not present for both variables.

For the third research question of is the association between mode of transmission and medication adherence modified among HIV infected individuals by the microsystem level characteristic of NYC Borough of residence the null hypothesis could not be rejected since a statistically significant association was not discovered. For the fourth research question of is the association between mode of transmission and medication adherence modified among HIV infected individuals by the exosystem level characteristic of poverty level the null hypothesis was rejected since a statistically significant association was discovered in the analysis. Finally, in the fifth research question of is the association between mode of transmission and medication adherence modified among HIV infected individuals by the macrosystem level characteristic of race the null hypothesis was rejected since a statistically significant association was discovered in the analysis. Further analysis and context for the findings will be provided in Chapter 5.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this research was to test the relationships between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in New York City, after controlling for an individual's gender, age, NYC borough of residence, poverty level, and race. This study was a quantitative study and explored the variables to determine if any association existed. The independent variable was the HIV transmission mode of the individual and the dependent variable was the rate of ART medication adherence.

The findings of this research were that the results of the data analysis supported the acceptance of some alternative hypotheses but in other cases the null hypotheses could not be rejected. The research findings demonstrated that there was an association between mode of transmission and medication adherence rates; that there was an association between the age of a person and medication adherence rates; that there was not an association between the gender of a person and medication adherence rates; that there was not an association between the New York City borough of residence and medication adherence rates; that there was an association between poverty level and medication adherence rates; and that there was an association between race and medication adherence rates.

Interpretation of Findings

In Chapter 2, the published literature available was present for some of the variables of interest but not for every variable. For example, for the primary research

question of “is there a statistically significant relationship between mode of transmission and medication adherence among HIV+ individuals 18 years and older living in New York City, after controlling for an individual’s gender, race/ethnicity, age, New York City Borough of residence, and poverty level?” there was no published data available for the literature review. Therefore, this research question was innovative because there was not any existing published literature that discussed or had previously researched whether the mode of transmission for HIV was related to the individual’s rate of medication adherence.

Based on the results of this research it was determined that an association did exist between the mode of transmission and the rate of an individual’s medication adherence. From the data analysis, it could be seen that heterosexual and men who have sexual intercourse with men (MSM) transmission modes had the highest rates of medication adherence at 67.5% and 74.1%, respectively. IV drug use (IDU) rates of medication adherence were found to be 63.8%, and perinatal transmission had the lowest rate of medication adherence at 48.9%. It is worth noting that the sample size of those with perinatal transmission was significantly smaller, at 1,547 participants, when compared to other transmission groups, such as MSM transmission which has 30,162 participants. Table 1 set forth the medication adherence rates for each transmission mode in the data set. Table 1 utilized perinatal transmission as a control and compared the other modes of transmission against perinatal transmission medication adherence rates. The odds ratios for each mode of transmission indicate that the odds of medication adherence of MSM transmission, IDU transmission, and heterosexual transmission are 1.915, 1.879,

and 1.938, respectively, when compared to perinatal transmission medication adherence rates. Further research should be conducted to examine why differences in medication adherence rates appear based on an individual's HIV mode of transmission.

For the second data question of “is the association between mode of transmission and medication adherence modified among HIV infected individuals by gender or age” the literature review included studies with results that indicated that older age was associated with higher rates of ART medication adherence, and that older patients were three times more likely to be classified as ‘good adherers’ (defined as > 95% adherent) than their younger counterparts (Hinkin et al., 2015). In addition, Barclay et al. found that the rates of ‘poor adherence’ (defined as 85% or less adherent) were twice as high amongst younger participants (those under 30 years) when compared to older participants (those over 30 years) with 68% and 33% rates of poor adherence, respectively (Barclay et al., 2014). Finally, Kuhns et al. also conducted a study that yielded similar result in which they found that in a review of published literature on HIV/AIDS medication adherence the relationship between age and adherence improved as the patients became older, whereas no study reviewed reported better adherence rates amongst younger patients (Kuhns et al., 2016). Therefore, based on the literature it can be seen that older age appears to be a contributing factor that aids in increased ART medication adherence amongst individuals infected with HIV, and that as an individual continues to age, in most cases, their rates of medication adherence increase as well (Kuhns et al., 2016).

The findings of this study supported the published literature and demonstrated that increased age across all transmission modes was associated with higher rates of

medication adherence. Perinatal transmission mode had the lowest rates of medication adherence across all age groups, as demonstrated in Table 4. In addition, with the exception of perinatal transmission it could be seen in Table 4 that MSM transmission, IDU transmission, and heterosexual transmission modes all had increasing rates of medication adherence as the age of the patient increased. In fact, there were no participants older than 65 years for the perinatal transmission group, and a downward shift appeared in medication adherence in the 20 to 29 years range across modes of transmission, which could require further research to determine if this is an anomaly in these data or a trend across all ages. This is also indicated in Table 5 where it can be seen that the odds of medication adherence increased for all modes of transmission as the participant's age increased.

With regards to the variable of gender, previous authors found that gender differences, or the difference between male and female, impacted many health conditions, susceptibility, and the development of a condition (CDC, 2016). This was true for HIV, as Avni Amin discovered that gender inequalities impacted women's susceptibility for attaining the HIV virus, and the authors point to the physical strength differentiation between women and men which could lead to violence and rape, in which instance women could then be infected with the HIV virus (Amin, 2015). The author also found that globally women constitute 50% of all individuals infected with HIV, and that globally women's lack of inheritance rights, limited access to employment, and increased rates of food insecurity all compromised their adherence to ART therapies because there

were simply more fundamental survival needs to be secured such as clean drinking water, food, and shelter (Amin, 2015).

Unlike some published literature, the author did not find a statistically significant association between gender and medication adherence in individuals living with HIV (Amin, 2015). It can be seen in Table 3 that the rate of medication adherence for men was 50.4% and for women it was 47.5% in perinatal transmission; rate of medication adherence for men was 74.1% and for women was not applicable for the MSM transmission; rate of medication adherence for men was 64.7% and for women it was 62.3% for the IDU transmission; and rate of medication adherence for men was 67.9% and for women it was 67.4% for heterosexual transmission. The odds ratio for men was 1.04 when compared to women as a control group, and the results of this study indicated no significant association between a patient's gender and their rates of medication adherence. Further research should be done on the independent variable of age to determine what aspects of increased age contributed to higher rates of medication adherence in HIV positive individuals. Additionally, further research should be done on gender to see if there is in fact a definitive association between gender and medication adherence rates as the literature indicated, and to determine whether the results of this study were an outlier.

For the third research question of "is the association between mode of transmission and medication adherence modified among HIV infected individuals by the microsystem level characteristic of New York City Borough of residence" there were no published data on the topic available. In this research study's findings, Table 6 appeared

to indicate a higher percent of medication adherence participants living in Manhattan. Table 7 indicated that the odds of medication adherence for all NYC boroughs by transmission mode ranged from .80 to 1.40 with all but 3 ratios below 1 when compared to the control group of Manhattan, and that the p-value was found to be 0.08. However, no statistically significant results were found indicating that the New York City borough of residence in which an individual lives had no association with their medication adherence rate.

For the fourth research question of “is the association between mode of transmission and medication adherence modified among HIV infected individuals by the exosystem level characteristic of poverty level” the existing literature was strong in support of an association between the two variables (Falagas et al., 2017). Much of the published literature concluded a statistically significant association between income and ART adherence (Falagas et al., 2017). Table 8 demonstrated that the rates of medication adherence decrease as the rates of poverty increase. This is also demonstrated in Table 9 in which the odds of medication adherence in all transmission modes decreased as the rate of federal poverty level increased. One anomaly exists in the data set in which for IDU transmission the high poverty rate of medication is higher than the medium poverty rate at 67.5% and 64.5%, respectively. Additional research should be done to determine if this is an anomaly in these data or a pattern nationally. The results of this study bolster the findings in the literature because the results were able to demonstrate that a statistically significant association between poverty level and ART medication adherence

exists based on the p-value of 0.03, and that the higher the FPL the lower the participants' medication adherence levels.

For the fifth and final research question of “is the association between mode of transmission and medication adherence modified among HIV infected individuals by the macrosystem level characteristic of race” there was published literature available in the literature review that suggested an association between the two variables (Waldrop-Valverde et al., 2015). One study indicated that African Americans had the lowest medication adherence rates, followed by Hispanic individuals, then Caucasian individuals, and finally individuals who identified as Pacific Islander and of Asian origin (Waldrop-Valverde et al., 2015). Waldrop-Valverde et al. (2015) reported that the lowest medication adherence rates were found amongst African American women and that medication adherence may be the significant root cause for health disparities in African Americans with HIV/AIDS.

The results of this study support the prior literature because the results showed that there is a statistically significant association between race and medication adherence in HIV positive individuals, as indicated by a p-value of 0.03 in Table 11. The findings in Table 10 also indicated that Caucasian and Asian/Pacific Islander races have the highest rates of medication adherence, followed by Latino/Hispanic participants, then African American participants, then Native American participants, and finally multiracial participants demonstrating the lowest rates of medication adherence levels.

Limitations of the Study

The limitations of this study are that the study is limited geographically to New

York City and therefore may not be representative of other areas of the United States (Gourlay et al., 2013). For example, this study demonstrates results in urban areas but may not be as representative of rural areas (Gourlay et al., 2013). In addition, since the United States is a developed nation there is access to many medications to limit the transmission of HIV from mother to child resulting in this sample size being the smallest of the three subpopulations, and therefore it may not be as representative as the IV drug users and sexual intercourse subpopulations (Gourlay et al., 2013).

Additionally, there may be other confounding variables unknown to researchers and therefore unexamined in this study that could influence the study's results (Gourlay et al., 2013). Measures to address these limitations have been taken by addressing the most prominent covariates and by collecting as large a sample size of mother to child transmission as was available to address these limitations. Finally, there are no known biases that could influence the study's outcomes, as the information obtained from the state Medicaid agency was collected using a double-blind reporting methodology to ensure bias did not influence the results.

Recommendations

The results confirmed some of the published literature available as well as established new areas of research for further investigation. Future researchers should utilize the findings of this research to examine what attributes of each mode of transmission contribute to or against medication adherence rates. This future research should be used to determine what aspects of each mode of transmission positively or negatively impact ART medication adherence rates. In addition, further research should

be done on the independent variable of age to determine what aspects of increased age contributed to higher rates of medication adherence in HIV positive individuals.

Similarly, future researchers should investigate what aspects of race positively or negatively impacted an individual's ART medication adherence rate. Finally, future researchers should investigate what aspects of poverty negatively impacted an individual's ART medication adherence rate. The findings of this future research could build off the findings of this research, and further contribute to the published literature and HIV knowledge.

Implications

This research contributed to filling a literature gap that existed in the HIV field since no published literature to date had examined the association between transmission mode and ART medication adherence. As a result, the content and findings of this study are original contributions to the field of HIV research. This research could support professional practice in the HIV field by allowing health care workers to identify populations most at risk for medication adherence lapses and non-adherence and provide them with additional resources to aid them with ART medication adherence. Finally, this study's findings could lead to positive social change by allowing those in the HIV field to identify the varying needs of populations based on transmission mode, which could be crucial in further examining how to help individuals achieve long lasting medication adherence which in turn may result in longer lives for those with HIV/AIDS.

Conclusion

In conclusion, this study has been successful in identifying aspects that have an association with medication adherence rates and has contributed new research to the HIV field. The results of this study indicated that transmission mode, age, race, and poverty level all have statistically significant associations with the dependent variable of medication adherence. By identifying these areas as ones that contribute to medication adherence rates, individual, family, organizational, and societal changes can be implemented by local public health organizations, individuals, advocates, and governments to aid HIV positive individuals in achieving higher rates of medication adherence. By identifying areas that contribute to an individual's medication adherence success or failures HIV researchers and public health practitioners can tailor programs, information, and outreach efforts more effectively with the goal of helping those with HIV/AIDS achieve higher rates of medication adherence and live longer, complication free lives in the process.

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