EXAMINING THE IMPACT OF CASE MANAGEMENT ON HEALTH OUTCOMES
AMONG PEOPLE LIVING WITH HIV

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ABSTRACT

Case management can play an important role in facilitating linkage to and retention in care for people living with HIV (PLWH), yet many PLWH do not receive these services and the national data shows that only about 30% of PLWH are able to successfully link to medical treatment to achieve viral suppression, the gold standard of HIV care (CDC, 2011). To gain a better understanding of the use of case management services within a suburban and rural population, this study applied the Andersen Behavioral Model for Health Service Use as a framework to identify factors associated within case management practice among a sample of 704 patients who received HIV medical services from a HIV clinic in south central Pennsylvania. The study also incorporated the International Classification of Function, Disability, and Health (ICF) framework to examine the association between use of case management and PLWH’s five-year longitudinal health outcomes (CD4 percentages and retention in care).

The results of the retrospective longitudinal analyses indicate racial/ethnic minority status and lack of retention in HIV medical care were associated with case management use and that case management services was positively associated with significant gains in CD4 percentage over time. Additionally, racial/ethnic minority patients and those who are younger were less likely to be remained in care, despite receipt of case management services. Due to the rural nature of the sample, African American and Hispanic populations living with HIV are underrepresented compared to the overall demographics of PLWH in the United States. Despite the benefits of case management, only small proportion of the sample used case management services. Implications for case managers and rehabilitation counseling professionals and recommendations for future research are provided.
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CHAPTER 1: INTRODUCTION

The Human Immunodeficiency Virus (HIV), including its more advanced stage of Acquired Immunodeficiency Syndrome (AIDS), epidemic has received national and global attention since the mid-1980s. To date, because of the advent of medical treatment, people living with HIV (PLWH) now live a longer life since the introduction of antiretroviral therapy (ART) and other advanced treatment in late-1990s (Brooks et al., 2004). The definition of HIV/AIDS had shifted from an acute disease to a chronic illness (Conyers et al., 2014; Swendeman, Ingram & Rotheram-Borus, 2009), and the treatment focus is now moving from crisis management to retention in care. National research studies show that 72% to 82% of PLWH who received treatment achieved successful viral load suppression (Fleishman et al., 2012; NY DOH, 2011). Therefore, helping PLWH achieve long-term engagement in treatment has become an important priority in HIV treatment and prevention.

Significant psychosocial barriers (housing, transportation, employment, and health insurance needs) exist that contribute to substantial gaps in the extent to which PLWH link to and retain engagement in HIV care. Research studies also show that PLWH are less likely to access to psychosocial and rehabilitation services, including vocational rehabilitation services and counseling services (Gardner et al., 2005; Jung et al., 2010). The National HIV/AIDS Strategy was issued in 2010 by President Obama (NHAS; White House, 2010) as the first national strategic plan to address the domestic HIV epidemic. The NHAS includes three primary goals: (1) reducing new HIV infections, (2) increasing access to care and optimizing health outcomes, and (3) reducing HIV-related health disparities and inequities (NHAS; White House, 2010). The HIV Care Continuum tracks these three goals and highlights the role that HIV/AIDS service provision contributes to achieving the NHAS goals. The recent updates to the NHAS in July
2015, underscore the importance of integrating non-medical psychosocial services to combat the HIV epidemic (White House, 2015).

Many studies have demonstrated the effectiveness of an integrative approach that provides comprehensive psychosocial services to PLWH; some outcomes include increased retention in care, reduced psychotic symptoms and substance abuse behaviors (Penner & Leone, 2007; Sweeney et al., 2012). Service integration can also (a) improve the efficiency in delivering services with limited resources, (b) increase the ability to track client outcomes, and (c) enhance collaborative partnerships among service providers (Rogers et al., 2013). Comprehensive integrated services often include HIV testing, medical care, case management services, housing services, HIV education, employment services, counseling services, legal assistance, childcare, and financial assistance. Recent studies have shown that PLWH who received integrated services achieved better health outcomes than those who only received medical services (Hoang et al., 2009; Rogers et al., 2013).

Case Management (CM) services play a major role within an integrative approach and have been identified as one of the key interventions in facilitating linkage to and retention in care (Gardner et al., 2005). Case managers act as bridges between clients, medical, and non-medical service providers by providing key services such as counseling, HIV education, case management, and community outreach activities. Case management has been identified as an essential HIV service by Health Resources and Services Administration HIV/AIDS Programs (HRSA, 2013), which provides Ryan White Care Act funds to AIDS organizations and other community-based organizations to provide either medical or non-medical case management services. Nevertheless, there is a lack of longitudinal empirical studies examining the association of CM service utilization and client health outcomes. Gaining a better understanding the impact
of CM service utilization on retention in care and health outcomes will allow service organizations, stakeholders, and professionals to better provide quality care to PLWH. Rehabilitation counseling professionals can play an important role in facilitating retention in care, as case management has been identified as an essential skill of rehabilitation counselor (Leahy, 2012). Rehabilitation counseling professionals can also contribute in facilitating the goals of HIV Care Continuum by providing a wide range of psychosocial services such as counseling, vocational rehabilitation services, and disability management and planning services.

**Statement of the Problem**

The HIV Care Continuum current framework developed by Center for Disease Control (CDC; 2011) for monitoring the progress PLWH take from initial diagnosis towards successful viral suppression. Among the estimated 1.2 million individuals living with HIV in the U.S., 86% discovered their HIV status, 40% were engaged in medical services, 37% were prescribed ART, and only 30% had HIV virus under control through viral suppression (CDC, 2011). A further analysis of the 2011 data reveals that among the 840,000 individuals who did not achieve viral suppression, 66% were diagnosed with HIV but were not engaged in regular treatment and 10% were prescribed ART but not yet achieved viral suppression (CDC, 2012). The statistics show that many PLWH did not remain in treatment after discovering their diagnoses and few PLWH achieved long-term viral suppression.

Linkage to and retention in HIV medical care are critical in improving PLWH’s health status and in reducing transmission and mortality (Horstmann, 2010). The ultimate HIV treatment goal is to help PLWH achieve viral suppression, meaning that the level of HIV present in the blood is undetectable or negligible. Successfully decreasing viral load also lower the HIV transmission risk (Gross et al., 2006). Failure to achieve optimal viral suppression is usually
attributed to lack of linkage to and retention in HIV care to monitor consistent access and adherence to HIV medications.

Currently, substantial gaps exist in the extent to which PLWH connect with and sustain access to HIV care and many have noted that significant psychosocial barriers exist that contribute to lack of engagement in care (Gardner et al., 2005). Establishing long-term treatment is challenging for PLWH; studies show that six percent to 11% of PLWH never had a second medical visit after the initial appointment (Giordano et al., 2005; Torian & Wiewel, 2011). As recommended by the Health Resource and Service Administration (HRSA, 2010), PLWH need to be tested every 6 months; however, many PLWH do not visit their medical service providers regularly. Marks et al. (2010) reviewed 12 studies and found that only 47% to 68% PLWH had more than three medical visits during 12-24 months. Similarly, Fleishman et al. (2012) conducted an eight-year multi-site longitudinal study to examine retention rate among PLWH and found that only 20.4% of the total participants engaged in HIV care after the initial medical visit for more than 12 months.

The HIV epidemic is still most prevalent in urban areas, especially large metropolitan areas with populations greater than 500,000 (CDC, 2008). Recently, the incidence of new HIV diagnosis has been increased in non-metropolitan semi-rural areas; by the end of 2010, 7.5% of the newly diagnosed PLWH reside in these areas (CDC, 2014). PLWH who live in semi-rural areas experience unique challenges in remaining in medical and psychosocial services due to lack of access to accessible and affordable healthcare as well as other social resources (Cesnales, 2012). To date, the majority of the large-scale longitudinal outcome studies focusing on PLWH were conducted in metropolitan areas (e.g. ARTAS study); thus, the strategies may not be applicable to PLWH live in semi-rural areas. The National Rural Health Association (NRHA,
2010) recommends researchers and practitioners to investigate needs of the specific rural/ semi-rural areas and to develop effective strategies to address issues related to HIV Care Continuum.

Other barriers to retention in care include younger age, racial/ethnic minorities, poor health status, lack of insurance, work scheduling conflicts, forgetfulness, housing stability, motivation, and injection drug use (Mugavero et al., 2009). Kempf et al. (2010) conducted a qualitative study to explore the barriers and facilitators to retention in care among women with HIV in rural southeastern regions of the U.S. Participants reported that quality of patient-provider relationship, health-related concerns, HIV-related stigma, transportation, and healthcare facility location, are the primary barriers to retention in care. These findings illustrate how both personal and contextual factors are important in the continuum of care.

Case management (CM) is an essential component of integrated services. CM has also become an essential service in HIV/AIDS care as the Ryan White HIV/AIDS Treatment Modernization Act (2006) defined Medical CM as a core service and allows other CM models to be funded under support services. CM is a key strategy in responding to the National HIV/AIDS Strategy (NHAS, 2010). To achieve the second goal of NHAS: increasing access to care and improve health outcomes for PLWH, one of the recommended steps is to establish seamless systems to link individuals who are newly diagnosed with HIV to care and to support retention in care to achieve viral suppression. Research studies show that CM services increase the likelihood of early linkage and long-term engagement in HIV medical care, as well as psychosocial services (Craw et al., 2008; Gardner et al., 2005). On the other hand, lack of access to CM services is one of the barriers to linkage to HIV treatment (Terra, 2008). Little research work has been done to examine the association between use of case management services on PLWH’s biological health and retention in care outcomes. In addition, Craw et al. (2008) and Metsch et al. (2015) found
that CM is effective during the initial stage but not sustainable over time. It could be important to examine the long-term effect of CM services on client outcomes.

**Purpose of the Study**

The objectives of this study were two-folds. The first goal is to understand the characteristics of PLWH who live in south central Pennsylvania and the patterns of retention in care and use of CM, as well as factors associated with use of CM. Many PLWH do not receive CM services or only engage for a short time period. Despite the numerous benefits of CM services and available public funding for CM services, there is a paucity/dearth of research that investigates predictors of case management use, which could help us to better understand the driving factors of case management use. For this study, Anderson’s Behavioral Model of Health Services Use (Andersen, 1968; Andersen, 1995; Andersen & Davidson, 2001; Andersen, 2008) provides a conceptual framework to examine the association of predisposing factors, enabling resources, and need factors associated with CM utilization.

The second objective is to identify predictors of PLWH’s longitudinal health outcomes (CD4 percentages and retention in care). The primary research interest is to examine the association of use of CM and health outcomes. Understanding the impact of CM on PLWH’s health outcomes can help healthcare and rehabilitation professionals design integrated services to facilitate linkage to and retention in care. The International Classification of Functioning, Disability, and Health (ICF) will be used to conceptualize the impact of service provision on individual health outcomes. The ICF is a bio-psycho-social framework (WHO, 2001) that can be used to understand the importance of service provision for PLWH. Researchers suggest that understanding the interactions among each component of the ICF would help professionals develop context-sensitive rehabilitation interventions for specific populations (Myezwa et al.,
2009; Nixon & Renwick, 2003). Although results of the previous studies demonstrate the association among contextual factors and health outcomes among individuals with disabilities (Chapireau, 2009; Heinmann, 2005), there is a paucity of literature that explores the impact of service provision on client outcomes, especially in the HIV field.

**Procedures**

This study uses a secondary de-identified dataset of 704 PLWA who received medical services from a HIV clinic in south central Pennsylvania. As this secondary dataset was completely de-identified, no university IRB was required to conduct this study. A retrospective longitudinal research design was chosen to analyze the five years (2012-2016) of repeated measures data on PLWH who were seen at the HIV clinic and its satellite sites at least once during January 2014 to December 2015.

Inclusion criteria were individuals who were (a) at least 18-year-old in 2010, (b) currently alive, and (c) who were not incarcerated during this five-year measurement period. Generalized Estimated Equations (GEE) were used to investigate the relationship between repeated measured binary outcome variable (retention in care and use of CM), controlling for client-level demographic and psychosocial variables. Repeated Measures General Linear Mixed Models (GLMM) was used for the repeated measured continuous outcome variable (CD4%).

**Significance of the Study**

This study aims to examine the association between use of CM and client outcomes as well as to identify factors that are associated with use of CM. The results of the study will help us understand how current CM practice in the field of HIV care contributes to optimal client outcomes and inform how to establish an effective practice framework. Identifying barriers that
prevent individuals from receiving CM services will help public health officials have a better understanding of how to address those barriers to link PLWH with case management services.

This study also provides a conceptual foundation for rehabilitation counselors who would like to work in the HIV workforce or who could work with PLWH in a variety of settings, including the state-federal vocational rehabilitation systems, private rehabilitation sectors, and mental health organizations. The concept of continuum of care is consistent with the goal of rehabilitation counseling. Rehabilitation is a process of enabling individuals with disabilities to access and to function in the society; thus, the rehabilitation process should be continuous to facilitate a smooth transition into the specific context that individuals live (McAnaney, 2003). Rehabilitation counselors are trained to work with individuals with disabilities in different settings; however, there are still very few rehabilitation professionals work in the field of HIV/AIDS. Understanding how rehabilitation professionals could contribute in meeting the goals of HIV Care Continuum will help practitioners and educators understand the unique strengths and importance of rehabilitation counselors in this field.

Additionally, this study informs key policy decisions such as establishment of HIV/AIDS case management qualifications and standards in Pennsylvania such as credentials and training requirements (eg. annual continuing education hours) of HIV/AIDS case management staff. Ultimately, the significance of the current study is to better understand the impact of HIV/AIDS case management services in order to meet the desirable treatment and prevention outcomes outlined in the National HIV/AIDS Strategy. This study will also provide directions for future research such as the training needs among case managers, including their current educational backgrounds, credentials, and knowledge about medical and non-medical needs of PLWH.
Limitations

One of the major limitations of the current study is the targeted population. The dataset provided this study was provided by one HIV clinic in south central Pennsylvania. Results of this study may not generalize to PLWH in other states. Secondly, this study is not a randomized controlled study; thus individuals were not randomly assigned into CM service group or control group. The third limitation is the completeness of the client data. CM services data is not complete for PLWH who receive services at satellite sites. It is also possible that some clients received CM services from other service providers that were not documented in this dataset. However, to minimize this risk, current clinic director verified that the data provided a good reflection of the patient population. Finally, there is no standardized form to document CM services. Case managers often documented their meetings with PLWH using different format. Therefore, only CM services dates are used in the current analysis. A qualitative approach may be applied in the follow-up study to analyze the CM service notes and plans.
CHAPTER 2: REVIEW OF THE LITERATURE

This review of the literature provides a framework of current focus areas in HIV/AIDS care, HIV case management (CM) services, and the association of use of CM and client health outcomes. This chapter also presents two theoretical frameworks that guide this study, including the International Classification of Function, Disability, and Health (ICF; WHO, 2002) and the Andersen’s Behavioral Model of Health Service Use (Andersen, 1968; Andersen, 1995; Andersen & Davidson, 2001; Andersen, 2008).

Overview of HIV/AIDS Care in the U.S.

In 1983, Barre-Sinoussi et al. identified the Human Immunodeficiency Virus (HIV) as the cause of Acquired Immunodeficiency Syndrome (AIDS), and the HIV antibody test soon became available in 1985 (Krieger, 1986). Many medical and community groups were established to provide AIDS care, advocacy, and social services in the middle of 1980s (Merson et al., 2008). Before the early 1990s, an HIV/AIDS diagnosis was a death sentence. Starting in the middle 1990s, highly active antiretroviral treatment (HARRT) was found to be effective to slow the progress of the virus, and then other advanced treatment methods were soon introduced (Vetter & Donnelly, 2005). In 1990, the U.S. Congress released the Ryan White Comprehensive AIDS Resource Emergency (CARE) Act of 1990, which was the first act to provide federal funds for community-based HIV treatment that is managed by the U.S. Health Resources and Services Administration (HRSA). The reauthorized Ryan White CARE Act of 1996 is now the primary legislation that aims to improve the availability and quality of medical and support services to PLWH.
The Advent of HIV Medical Treatment

The first antiretroviral medication, AZT (Zidovudine) was approved in 1987 but had many limitations as a singular drug. In 1996, a much more effective combination antiretroviral protocol, Highly Active Antiretroviral Therapy (HARRT), was introduced, which required taking three or more antiretroviral drugs at the same time (Sanders et al., 2005). The AIDS mortality rates significantly declined with the implementation of HARRT. For example, the CDC (2011) reported that since 1995, the HIV-related death rate has decreased almost 70%. McDavid et al. (2010) used the national surveillance data from 25 states to investigate life expectancy among PLWH and found that the average life expectancy after HIV diagnosis increased from 10.5 years in 1996 to 22.5 years in 2005. To date, PLWH who receive ART treatment could have a relatively normal life expectancy (Samji et al., 2013).

Considering the increasing average life expectancy of PLWH who adhere to their prescribed HIV medication protocol, Swendeman, Ingram and Rotheram-Borus (2009) point out that HIV self-management strategies, including symptom monitoring and protected sex behaviors are critical components in HIV/AIDS care. There is also an increased attention on PLWH’s psychosocial needs as individuals experience multiple life challenges as they live a longer life.

The HIV Care Continuum

The HIV Care Continuum is the current public health framework that tracks key indicators of engagement in HIV care at the population level (CDC, 2014). These indicators include HIV diagnosis, linkage to HIV treatment, retention in care, and viral suppression. Viral suppression is defined as an undetectable or very low amount of HIV in one’s body, which significantly improves health outcomes and reduces the risk of onward HIV transmission: the ultimate goals of HIV treatment and the public health response to this pandemic.
The Centers for Disease Control (2011) applies two statistical models to monitor the HIV care continuum: the prevalence-based HIV Care Continuum and the diagnosed-based HIV Care Continuum. The prevalence-based HIV Care Continuum model includes estimates of all people believed to be living with HIV (those who have been diagnosed and those who are infected but are not aware of their diagnosis). The national HIV surveillance data from 2011 indicate that just 86% of the total prevalence (estimated) were actually diagnosed, and only 40% of those diagnosed were linked to treatment, 37% of whom were prescribed ART. Ultimately, only 30% achieved optimal viral suppression (CDC, 2011). The second statistical model, the Diagnosis-Based HIV Care Continuum reports data for each indicator of the continuum as a percentage of the number of PLWH who have been diagnosed using the same data. Among the 882,993 people who were diagnosed with HIV, 53.9% received HIV medical services, 50% were prescribed ARV medications, and 41.7% achieved viral suppression. Therefore, although the advance medical treatment have become available, there are still many PLWH did not engage in treatment. Lack of long-term engagement in HIV medical care results in a range of negative outcomes including: poor medication adherence, unstable health status, increased risk behaviors, and increased inpatient and emergency room visits (Brennan-Ing et al., 2012).

Additional research findings demonstrate similar concerns about poor linkage and retention in care among different samples of PLWH. Fleishman et al. (2012) conducted a multi-site longitudinal study that included 22,984 adults living with HIV/AIDS who enrolled at one of the sites from 2001 to 2008. Across the eight-year period, approximately 22% of the sample never established HIV care (made at least one medical visit after initial enrollment for longer than six months). To address the low rates of engagement in long-term HIV treatment, President Obama released an executive order in 2013 establishing the HIV Care Continuum Initiative as the next
step in the NHAS (2010). This initiative focuses on addressing drop-offs along the continuum of care and increasing successful viral suppression.

In sum, these research findings reveal that only a small proportion of PLWH achieve successful treatment outcomes, reflecting a dire need for a more comprehensive response to end the epidemic. Consequently, the non-medical HIV workforce is increasingly thought to be an essential resource in facilitating continuous engagement in care. Given their unique training on both the medical and psychosocial aspects of chronic illness and disability, rehabilitation counseling professionals can play an important role in HIV Care Continuum Initiative to provide important services such as counseling, HIV education, case management, and community outreach activities.

**Barriers and Facilitators to Meeting the Goals of the HIV Care Continuum**

There are many barriers to achieve successful service linkage, retention in care, and viral suppression, including age, racial minority status, lack of insurance, work scheduling conflicts, forgetfulness, housing instability, lack of motivation, and current injection drug use (Mugavero et al., 2009). In Fleishman et al. (2012)’s longitudinal study, just 42.6% of participants remained in care (two or more outpatient medical visits separated by at least 90 days during a 12-month period), and only 20.4% of the entire sample achieved more than 12 months retention. In terms of demographic predictors, older participants, men who have sex with men, and individuals with Medicare coverage were more likely to achieve retention in care.

Sevelius, Keatley, and Johnson (2013) interviewed 20 transgender women with HIV to identify barriers and facilitators to retention in HIV care and found that approximately 50% of the participants reported that welcoming and respectful professionals and clinic environment are facilitators of retention in care. Other factors of retention in care include stigma, medication
adherence, drug and alcohol use, social support, mental health services and housing. Kempf et al. (2010) conducted a qualitative study to explore the barriers and facilitators to retention in care among women with HIV in rural southeastern U.S. The researchers explored common themes in data from focus groups and identified six facilitators to retention in care: quality of client-provider relationship, appointment reminders, transportation, illness concerns, clinic hours, and empathy with peers. They also identified 11 barriers to retention in care, including lack of family support, work schedule, health care facilities, illness concerns, length of clinic appointments, distance to clinic, treatment by health care providers, HIV stigma, financial situation, conflict with law, and transportation. Interestingly, most of the barriers and facilitators are associated with environmental factors, including service provision. Thus, access to quality service providers is essential in linkage-to and retention in care.

**Case Management Services in The HIV Care Continuum**

Case management (CM) is defined as the coordination of services across service providers and systems (Fleisher & Henrickson, 2002). Similar to CM services for other vulnerable populations, CM services are often viewed as a set of multi-step services for individuals and families that intend to facilitate timely access to medical and psychosocial services. CM services for PLWH often focus on clients’ medical and psychosocial needs related to their HIV diagnosis (eg. apply for public insurance, access to substance abuse treatment).

**Overview of HIV Case Management Services in the U.S.**

In responding to the fast growing HIV epidemic in the 1980s, HIV CM services were first developed within inpatient hospitals providing service planning and coordination (Rapp & Chamberlin, 1985). The first national act that mandated CM services for individuals receiving Medicaid, including PLWH was the Omnibus Budget Reconciliation Act of 1981 (HHS, 2008).
About ten years later the U.S. Congress issued the Ryan White CARE Act Amendments of 1990, which provides specific federal funding for community-based HIV medical treatment through the Health Resources and Services Administration, HIV/AIDS Bureau (HRSA/HAB). The Ryan White CARE Act Amendments of 1996 requires programs that receive Ryan White funding to conduct evaluations to demonstrate outcome effectiveness of interventions and the Amendments of 2000 added a new section establishing requirements for quality case management services and directed grantees to conduct ongoing evaluation of client outcomes of case management services (HRSA, 2010). The Ryan White CARE Act Title I Manual defines case management for Title I and Title II programs as:

“A range of client centered services that link clients with health care, psychosocial and other services to insure timely, coordinated access to medically appropriate levels of health and support services, continuity of care, on-going assessment of the client’s and other family members’ needs and personal support systems, and inpatient case management services that prevent unnecessary hospitalization or that expedite discharge, as medically appropriate, from inpatient facilities. Key activities include: initial comprehensive assessment of the client’s needs and personal support systems; development of a comprehensive, individualized service plan; coordination of the services required to implement the plan; client monitoring to assess the efficacy of the plan; and periodic re-evaluation and revision of the plan as necessary over the life of the client. May include client-specific advocacy and/or review of utilization of services” (HRSA, 2008, pp6.)

To date, the Health Resources and Service Administration (HRSA, 2007) provides funding through Ryan White HIV/AIDS program, which is organized by several sections of grants from part A through part D. Part B grants fund HIV medical services and support services, including
medical and non-medical CM services. Given the large amount of federal funding spent on CM services, it is critical to evaluate the impact of CM services on client outcomes.

**Role of Case Managers in HIV Care Continuum**

Case management is essential in HIV care, as PLWH often face various challenges, including homelessness, chronic illness, substance abuse, and financial instability. Case managers help individuals navigate the complex social service and healthcare system to meet their medical, and psychosocial needs (Shelton et al., 2006). Service providers need to note that HIV is not the only issue to deal with. Individuals may be financially disadvantaged, having mental health or substance use problems, or be experiencing homelessness; all those issues can negatively affect their engagement in HIV medical care (Brennan-Ing et al., 2012). Case managers often provide service coordination, functioning as a central service stop that bridge HIV medical care, non-HIV medical care, and other psychosocial services.

Facilitating linkage to and retention in care for PLWH is important not only for their health outcomes, but also for public health benefits. According to National HIV/AIDS Strategy (White House, 2010), successful viral suppression of PLWH result in lower community viral loads and overall HIV prevalence. Therefore, case managers play an essential role in the National HIV Care Continuum Initiative.

Case managers who serve PLWH may work in varied settings and carry different job titles. AIDS organizations often have case managers who work specifically with PLWH, while some community-based organizations may have case managers who work with various client populations. Job titles could be HIV case manager, support services staff, service coordinator, or counselor.
HIV Case Management Approaches

There are different approaches to HIV case management services. HIV case management varies across target client populations, service organizations, and geographic locations. Recently, HIV case management has two main categories: medical vs. non-medical HIV case management services. This author applies the definitions provided by the Ryan White HIV/AIDS Program.

Medical Case Management (Comprehensive Case Management Approach). Medical case management is a proactive and long-term approach aimed to address PLWH’s complex health and psychosocial needs (e.g. housing, nutrition, and employment needs) (NYDOH, 2006). The target population is PLWH who have multiple complex psychosocial and medical needs and those who need more intensive case management services. Service planning is an essential component of the medical case management approach.

Medical case managers provide and coordinate access to medically appropriate health and support services. HIV medical CM aims to provide centralized coordination of resources and referrals for medical and social services. Five key services that medical case managers perform include a) conducting initial comprehensive psychosocial and health assessments, b) developing comprehensive case management plans, c) coordinating services that are required to meet clients’ needs, d) monitoring client performance, and e) reassessing clients’ psychosocial and medical needs. Other activities may include client advocacy, supportive counseling, education, and crisis intervention (HRSA, 2013).

According to HIV/AIDS Bureau Performance Measures recommended by HRSA (2013), the quality-of-care indicators for medical case management services are a) the percentage of PLWH who have at two or more medical case management plan developed/updated during the measurement year and b) percentage of PLWH who have at least one medical visit in each six-
month period with a minimum 60 days apart during a 24-month measurement period. We can conclude that the most important component of medical CM services is to have ongoing service plans for PLWH and to facilitate retention in care.

**Non-Medical Case Management (Supportive Case Management Approach).** The supportive approach is designed to meet PLWH’s immediate needs. This model is usually applied to individuals with discrete needs that can be met in the short term. This model is also appropriate for individuals who have been provided comprehensive case management services but still need periodic support from case managers. Case managers would follow up with clients to ensure the arranged services have been received and to determine whether further services would be needed (NYDOH, 2006). Individuals who experience repeated cycles of similar crises should be encouraged to transition to medical case management services.

Non-medical case management services include advice and assistance in obtaining medical, legal, financial, and social services. Initial comprehensive assessments are not required in the non-medical CM model, as the intent of the model is to provide immediate and short-term services; however, brief screening and reassessments are encouraged.

**Effect of Case Management Services on Client Outcomes**

HIV case managers act as a bridge that contributes to reduction in barrier to achieve outcomes along the HIV Care Continuum. Research studies have demonstrated associations of CM services with different aspects of client outcomes, including positive biological health outcomes, improved linkage to and retention in HIV care, and psychosocial services, reduced risk behaviors, and improved medication adherence; however, some studies have indirect or mixed findings.
**Biological Health Outcomes.** The most critical biological markers of health status are viral load and CD4 counts. CD4 cells is also called T cells, are the white cells that help defend the immune system fight off the virus. Viral load is the amount of HIV in human bodies. The CDC funded Antiretroviral Treatment Access Study (ARTAS) is a randomized, controlled study that compared the outcomes of a short-term strength-based case management intervention (intervention group) and a referral only CM services (control group) among newly diagnosed PLWH (Gardner et al., 2005). Case managers at each AIDS organization were trained using a standardized manual; CM services were limited for up to five sessions within 90 days. Outcome indicators are viral load and retention in care (Gardner et al., 2005). When measuring viral load at 12-month follow-up among participants who were linked to care within the first six months, the majority of participants achieved significant reduction in viral load; there was no significant differences among the CM group and control group.

Kushel et al. (2006) conducted a prospective observational cohort study to examine the impact of CM services on antiretroviral therapy adherence and CD4 counts among 280 PLWH who were homeless or marginally housed. The finding showed that individuals who received CM services achieved better antiretroviral therapy adherence and more gains in CD4 counts, compared with those who did not received CM services. This study did not find significant association between CM services utilization and viral suppression (Kushel et al., 2006), while other studies did find significant association between viral suppression and use of CM services (Javanbakht et al., 2006).

Brennan-Ing et al. (2016) examined the effect of the Comprehensive Case Management Medicaid Program, also known as Targeted Case Manage (TCM) in New York State, which is a comprehensive HIV case management services program that targets Medicaid-eligible PLWH.
Among the 2072 PLWH in the database, individuals who were enrolled in TCM had significant improvement in their CD4 count over time, compared to those who never enrolled, although the changes in CD4 count did not vary significantly by the frequencies of TCM services utilization (Brennan-Ing et al., 2016). Therefore, the above studies showed mixed findings on the effect of CM services on CD4 counts and viral suppression.

**Linkage to and Retention in HIV Medical Care.** Results from a number of studies show that CM services increase the likelihood of linkage and long-term engagement in HIV medical care. Magnus et al. (2001) found that HIV-positive women who had at least one contact with case managers per month achieved better retention in care (at least one visit in every six-month). The Antiretroviral Treatment Access Study (ARTAS) defined linkage-to-care as having at least one HIV medical visits during the first six months of case manager contacts and retention in care as having least one visits in each of the six-month period within the year after receiving the short-term CM services. Results showed that 78% of PLWH who received CM services were linked to HIV medical care within six months, compared to 60% of those who received standard referral services; 64% of those who received CM services met the criteria of retention in care, while 49% of those who were in the controlled group (Gardner et al., 2005).

Craw et al. (2008) conducted a follow-up study named ARTAS-II using the same standards; unlike ARTAS-I recruited university-affiliated clinical research clinics, ARTAS-II was implemented in health departments in collaboration with community-based organizations. Similar to the previous study, 79% of PLWH who were in the CM group successfully linked to HIV medical care within the first six months. This study also found that PLWH who spent more time with their case managers were more likely to be linked to care. The authors suggested this
intensive model to be used specifically for newly diagnosed PLWH as this study demonstrated the effectiveness of a short-term CM model on rapid linkage-to-care (Craw et al., 2008).

In Brennan-Ing et al., (2016)’s study, PLWH who were enrolled in the TCM program were categories as four different groups based on the intensity and duration of CM services utilization. The low-intensity individuals had higher risk of use emergency room and inpatient treatment and less mental health and HIV medical care visits; therefore, lack of engagement in CM services is associated with higher risk of crisis and falling out of care.

**Linkage to Non-HIV Medical and Psychosocial Services.** Engaging in HIV medical treatment is essential for any individual diagnosed with HIV; nevertheless, it is also important to facilitate access to non-HIV medical and psychosocial services, such as oral health, mental health services, employment services, and other support services. Earlier studies show that PLWH who receive case management services are more likely to access to psychosocial services, such as mental health services and benefits counseling (Fleishman & Piette, 1991; Wight, LeBlanc, & Aneshensel, 1995). The national HIV Cost and Services Utilization Study revealed that PLWH’s unmet needs for oral health services were two times higher than the general population (Heslin et al., 2001). Mitchell & Linsk (2001) assessed the effect of case management services on PLWH’s unmet needs for medical care and supportive services and found that individuals who received CM services had decreased unmet needs for medical and psychosocial services.

Metsch et al. (2015) conducted a randomized controlled study based on Project SMILE, an intervention that applied CM services to facilitate access to oral health services. The percentage of PLWH who use oral health services in the first six months was significant higher in the CM group than the control group; however, there was no significant difference at 18-month follow-
up. Metsch et al. (2015) concluded that CM is effective during the initial stage but not sustainable over time. Similarly, Katz et al. (2001) conducted a longitudinal outcome and found that 56.5% of the 2,437 PLWH them received case management services during the first six months. Result indicated that case management services utilization was associated with decreased unmet needs for support services, especially health insurance, income assistance, home health care, and mental health counseling; however, there was no significant effect for long-term outcomes.

**Health-Related Quality of Life.** Health-Related Quality of Life (HRQoL) is defined as individuals’ subjective perception and satisfaction of their own health status (Wilson, 2004). HRQoL often includes various assessment domains, such as mental health, physical health, and social well-being.

In the national HIV Cost and Services Utilization Study (HCSUS), HRQoL is one of the primary outcome indicators measured by physical functioning, emotional well-being, general health perceptions, and social functioning (Cunningham et al., 2008). The findings showed that there were no significant changes in overall scores among PLWH who received CM services; however, case manager contact is a mediator factor of physical functioning (Cunningham et al., 2008).

Pugh (2009) examined the association between use of CM services and HRQoL among 78 PLWH who received CM services in a small AIDS program over a six-month period. There were mixed results on the effect of CM services on HRQoL; PLWH had demonstrated positive changes in some domains (i.e. mental health) but negative outcomes in others (i.e. cognitive functioning) (Pugh, 2009). Cesnales (2012) conducted a study assessing HRQoL among 97 PLWH who received CM services in rural Florida and found that the participants reported mild
functional impairment and mild symptom burden, but low overall quality of life. Cesnales (2012) argued that HRQoL is a complex concept and PLWH often face multiple changes in life; therefore, there could be factors affecting their HRQoL other than HIV diagnosis.

Among the above studies, CM services have varied definitions and different criteria. Most of the studies did not define the CM models and the extent of the services. Due to the limited amount and the mixed quality of the studies, it is critical to evaluate the effect of CM services using a more thorough and systematic definitions in an outcome study.

**Case Management Services Use**

To date, many PLWH are not using CM services although there have been evidence of benefits of CM services. In Kushel et al. (2006)’s study, 52.9% of the 411 PLWH reported having at least one case manager during the five quarters of the measurement period, 41.4% had no or rare CM services, and 34.7% were categorized as having consistent CM services. The researchers concluded that the percentages were similar to the data in of the participants in Ryan White Care programs nationally.

Johnson et al. (2010) explored psychosocial factors associated with linkage to a CM agency within six weeks among 2315 PLWH who did not have primary care physicians and were referred by AIDS Coordination Office of the Philadelphia Department of Public Health. The result showed that approximately 30% of the referred PLWH did not link to CM services within six weeks. The researchers found that individuals who were in any type of support group and those who request basic assistance were more likely to successfully transition to CM services in time (Johnson et al., 2010). Other factors influencing PLWH’s use of CM services include demographic background, insurance, drug use, and housing status (Freedman, 2003, Brennan-Ingl et al., 2016). There is still little research on factors associated with use of CM among PLWH.
This study applies Andersen’s Behavioral Model of Health Service Use (Andersen, 1968; Andersen, 1995; Andersen & Davidson, 2001; Andersen, 2008) to explore client-level factors associated with long-term engagement of CM services.

**Theoretical Framework**

This study applies the Andersen’s Behavioral Model of Health Service Utilization (Andersen, 1968; Andersen, 1995; Andersen & Davidson, 2001; Andersen, 2008) to provide an understanding of factors associated with CM utilization. The International Classification of Function, Disability, and Health (ICF; WHO, 2002) is used to conceptualize the association between use of CM services and biological health outcomes and retention in care outcomes among PLWH.

**Andersen’s Behavioral Model of Health Service Use**

Andersen’s Behavioral Model of Health Service Use (Andersen, 1968; Andersen, 1995; Andersen & Davidson, 2001; Andersen, 2008) has been through many revisions over the past forty years. The initial model was developed to conceptualize reasons why certain families use healthcare services and to advocate public policies for equal access (Andersen, 1968). Andersen (1995) highlights three factors determining individual’s service utilization: 1) predisposing factors are demographic characteristics and social factors (e.g. race/ethnicity, disability, education, health beliefs), 2) enabling factors refer to personal resources (e.g. health insurance, income), and 3) need factors means self-perceived needs (how individuals view their own illness/disabilities and needs for health services) and objective needs (professional assessments of individuals’ health status and need for health services). As shown in Figure 1, the most updated version of the model places an emphasis in understanding the influences of contextual and personal determinants on health services use (Andersen, 2008). As the three individual
determinants, contextual factors can be categorized into those determinants: predisposing factor (e.g. neighborhood structure), enabling factors (available healthcare facilities), and need factors (prevalence of an illness). Andersen’s Behavioral Model also recognize individual health behaviors as important factors of health services utilization, such as exercise and sex risk behaviors (Andersen, 1995).

**Figure 1. Andersen’s Behavioral Model of Health Service Use** (Andersen, 2008)

This model has been widely used as a theoretical framework for understanding why individuals use health services and an organizational framework for explaining individuals and contextual determinants of health services utilization for a specific population or a disability/illness/disease (Brennan et al., 2015). Babitsch, Gohl, and Lengerke (2012) had done a systematic review of studies use the Anderson’s Behavioral Model and found that there were 328 studies in PubMed during 1998 to 2011. The authors did a meta-analysis on 16 selected studies to identify the most common factors associated with health services utilization: predisposing factors include age, marital status, gender/sex, education, race/ethnicity, and employment status; enabling factors include income, health insurance, primary care physician, social support,
accessibility to healthcare, and socioeconomic structure of the community (Babitsch, Gohl, & Lengerke, 2012).

As there is increasing attention on psychosocial needs of PLWH, Andersen’s model can also be applied to examine factors associated with psychosocial services utilization. Datti and Conyers (2010) applied Andersen’s model to examine factors that impact the use of state VR services among Latino men living with HIV/AIDS. A predisposing factor (ethnicity), two enabling factors (receipt of public benefits and knowledge of VR services), and two need factors (general health perception and confidence in maintaining jobs) were found as significant predictors of the use of VR services (Datti & Conyers, 2010). Thus, Andersen’s model is applicable in predicting factors associated with inequitable access to VR services. Datti and Conyers (2010) suggest that VR counselors should recognize those factors that impact the use of VR services among Latino clients living with HIV/AIDS and facilitate more equitable services. Therefore, Andersen’s model is applicable in identifying factors associated with CM utilization among PLWH.

**Applying Andersen’s Model to Examine Factors Associated with Use of CM.** As far as CM services utilization, there are not many studies examining factors associated with PLWH’s use of CM services and none of the studies apply the Andersen’s model. This author reviewed some studies that examine the factors associated with CM services utilization and categorized factors into predisposing, enabling, and needs factors. Some of these factors are selected as independent variables in the study.

**Predisposing Factors: Gender, Age, Race/Ethnicity.** Freedman (2003) found that PLWH who were women, racial/ethnic minorities, or heterosexual were more likely to have a HIV case manager. Similarly, Brennan-Ing et al. (2016) also found that individuals who were enrolled in
the Targeted Case Management (TCM) in New York State were those who were older, and women. In a long-term outcome study examined the effectiveness of CM services, Craw et al. (2008) found that clients who had the following characteristics were more likely to be linked to CM services: 26 years of age or older, Hispanic (compared to non-Hispanic). These findings indicate that individuals who were in the more disadvantaged status are more likely to need CM services.

**Enabling Factors: Social Support, Health Insurance, Education, Income, Drug Use.**

Johnson et al. (2010) conducted a study to identify psychosocial factors associated with successful linkage to CM services within the first six months among 2315 PLWH who did not have primary care physicians. Participants who were in any type of support group were twice likely to be linked to CM services. As social stigma is strongly associated with the HIV diagnosis, social support could help alleviate the fear and avoidance of receiving HIV-related health services, including CM services. Freedman (2003) found that individuals who receive case management services are those who are uninsured or publicly insured, have lower education levels and incomes, and have a history of drug use.

**Need Factors: Medical and Psychosocial Services Needs.** Unmet HIV medical and psychosocial services needs could be an important factor that PLWH choose to receive CM services. Johnson et al. (2010) found that PLWH who had higher possibility to be linked to CM services within the first six months were those who requested assistance for basic needs (eg. food and transportation assistance) after controlling for demographic factors. This study also revealed that PLWH who expressed more need for medical care and substance abuse treatment were less likely to transition to CM service providers. Johnson et al. (2010) explained that many PLWH who did not have primary care physicians usually experience other challenges, such as barriers to
attend medical appointments due to physical problems or lack of transportation; these challenges also affect their abilities to engage in CM services. As far as substance abuse issues, barriers to CM services could be that illegal drug use inhibit the motivation to seek psychosocial services; cognitive and psychological functioning due to substance abuse also affect individuals’ decision-making abilities (DiClemente et al., 2008).

On the other hand, Craw et al. (2008) found that PLWH were more likely to have a case manager when they received services from sites that CM services and medical care were at the same locations. This could because that in-house comprehensive services resolve people’s needs for transportation and reduce the burden of seeking different service providers. This is consistent with the finding in Kurtz et al. (2005)’s study on barriers to social services among sex workers.

**The International Classification of Function, Disability, and Health (ICF)**

The International Classification of Function, Disability, and Health (ICF) was developed by the World Health Organization (WHO) in 1980 and updated in 2002 to provide a universal framework and classification for health-related states. The ICF is complementary with ICD-10 (the International Classification of Disease and Related Health Problems). ICD-10 provides an etiological framework of diagnosis, disorder, diseases, and other health conditions (WHO, 2008). The major difference is that the ICD-10-classifies causes of health conditions, and the ICF classifies impacts of health conditions and health related outcomes.

The ICF provide a conceptual framework and common language for people to understand the impacts of a disability and the interactions among different domains (Hwang & Nochajski, 2003). It has been used widely among healthcare, rehabilitation, and human service professionals, individuals with disabilities, and the public. The comprehensive coding system consists with 34 one-digit level codes and 362 two-level items which add up with a serious of
over 1,800 four-level codes of each specific context specific conditions (Hwang & Nochajski, 2003). The classification is to provide comparable data across disciplines, clinical settings, and geographic areas (Myezwa et al., 2011). There are some instruments designed based on the ICF, such as the ICF Checklist (WHO, 2003) and Pepper Assessment Tool for Disability (PAT-D; Rejeski et al., 2008).

The ICF places an emphasis on one’s health and functioning, rather than disability. The ICF recognizes disability, disorder, and illness as universal experiences that every person may encounter throughout one’s life (WHO, 2002). As shown in Figure 2, individual functioning are viewed as outcomes of interactions between one’s health conditions (e.g. disorder, disease, injuries) and contextual factors (environmental factors and personal factors). The three domains of functioning in the ICF are body structure/body function, activity, and participation. Body structure refers to anatomical parts of body, including limbs and organs; body function means psychological and physiological function of one’s body systems. Activity refers to the execution of a task or activity, and activity limitation means the difficulties one experiences in executing a specific activity. Participation refers to one’s level of involvement in life situations.
The ICF has also been applied among the HIV population, as understanding individual conditions on the wide spectrum of HIV became a critical component in rehabilitation, health care, and disability policies (Hwang & Nochajski, 2003). HIV is considered a complex health condition that can be associated with a disability status. HIV affects individual’ level of functioning in the domains of body structure (the immune system), body function (physiological functioning), activity, and participation. Hwang and Nochajski (2003) provides an example of the interaction of participation and environmental factors: a person with HIV may not have any physical impairment or activity limitations but may still experience job loss due to employers’ negative attitudes and misconceptions toward HIV/AIDS.
**Case Management Services as an Environmental Factor.** The ICF addresses the role of environmental factors in altering, mediating, and enhancing one’s functioning (Chapireau, 2009). Environmental factors (e.g. social attitudes, legal system) can have significant influences on one’s quality of life. Service provision is considered one of the environmental factors, as it impact PLWH at person-in-context levels. WHO (2002) suggests that ICF can be applied in the area of service provision at three levels: the individual level, the institutional level, and the social level. At the individual level, consumers and professionals and use the ICF to understand the person’s level of functioning, to develop treatment plans, to examine treatment outcomes, and to communicate with other service providers. At the institutional level, the ICF can be used for training and educational purpose; the institute/organization can examine the effectiveness of the services by identifying indicator for quality assurance and cost-effective services. At the social level, the ICF can be applied in understanding the eligibility criteria for service entitlement (e.g. social security benefits), in conducting needs assessments for individuals and for professionals (WHO, 2002).

Medical and psychosocial services systems and public/private resources are also considered as environmental factors. For example, Social Security Disability Benefits and Medicaid provide financial assistance to PLWH; AIDS Drug Assistance Programs (ADAP) provide HIV medications and other treatment for PLWH who are uninsured and those who meet the eligibility criteria. Policies and legislations also play a critical role in ensuring that PLWH access to necessary services. For example, the Ryan White Comprehensive AIDS Resources Emergency (CARE) Act provides funding to state and local services providers in providing HIV medical treatment and CM services. The role of case managers and CM services should be taken into consideration when evaluating the effect of environmental factors on PLWH’s outcomes.
Applying the ICF to Measure Retention in care Outcomes. Retention in care often viewed as an indicator of the level of participation in treatment, which is directly related to quality of life (CDC, 2016). Since retention in care is an important indicator of PLWH’s treatment adherence, which is directly influence one’s functional levels. Numerous studies have underscored the importance of HIV treatment adherence in PLWH’s overall health status (MacKellar et al., 2010; Paterson et al., 2000)

HIV medical visit is often used as an indicator of successful retention suggested by HIV/AIDS Bureau Performance Measures (HRSA, 2013). The criterion is having at least one medical service visit in each 6-month period of the 24-month measurement period with a minimum of 60 days between each visit. This study will use a 12-month measurement period, considering some case manager may not work with the same individual for more than 12 months due to the high turnover rate among case manager. Thus, the outcome variable is “whether a client had at least one medical service visit in each 6-month period of the 12-month measurement period with a minimum of 60 days between each visit”. The medical visits record can be found in the existing client database.

Applying the ICF to Measure Biological Health Outcomes. In the field of rehabilitation counseling, outcome evaluation is essential in examining the effectiveness of services and in developing quality services. Donabedian (2005) stated that the three components of health care quality management are structure, process, and outcomes. Structure refers to an organization’s facilities, personnel, and administration; process is defined as the service procedure, service planning, and treatment delivery; outcomes are the desirable benefits of healthcare effort (Donabedian, 1996). The ICF can be used to measure the desirable benefits of services/healthcare, that are changes in the three functioning domains: body function/structure, activity,
and participation. Researchers have applied the ICF in examining client functioning and treatment outcomes. For example, Rejeski et al. (2008) conducted an 18-month randomized clinical trial to examine mobility functioning among 1388 older adults and found that people who received a lifestyle intervention for weight loss achieved greater improvement in mobility functioning. Evaluating client biological outcomes on a regular basis allows professionals to document the results of interventions, to further assess unmet needs, and to guide clinical decisions (Heinmann, 2005).

Viral load, CD4 count, and CD4 % are usually the most critical biological outcome measures of HIV health status. When HIV attacks a person’s immune system, CD4 cells, often called T cells, would be destroyed and the body could not fight for infections and diseases. The number of CD4 cells would be reduced when the person remains untreated. Thus, a major treatment goal is to preserve and improve CD4 cells in order to remain healthy immune system (CDC, 2016). CD4 count and CD4% are often used as indicators of disease progression. CD4 count is a lab test that measures the number of CD4 cells in a sample of an individual’s blood. CD4 count of an uninfected adult ranges from 500 cell/mm³ to 1,200 cell/mm³. When an individual’s CD4 count becomes lower than 200 cell/mm³, the person meets the criteria of AIDS diagnosis (AIDS.Gov, 2016). The CD4% is the percentage of CD4 cells of the total white blood cells. For adults who are HIV negative, the CD4% ranging from 24-64% with an average of 45%. CD4% is often viewed as a better indicator for PLWH who have CD4 counts above 200 cells/mm³. Improved or maintained CD4 count or CD4% is a key outcome indicator (HRSA, 2013).

Viral suppression is another critical indicator of HIV treatment outcomes. Viral load refers to the amount of HIV in a sample of human blood. Optimal viral suppression means undetectable
viral load in a person’s blood; although HIV may still exists in semen, vaginal fluids, and other body parts, the transmission risks become very low (CDC, 2015). National research studies show that 72% to 82% of PLWH who received treatment achieved successful viral load suppression (Fleishman et al., 2012; NY DOH, 2011). Therefore, Viral suppression is not included as an outcome measure in this study, since the majority of the individuals in the sample achieved optimal viral suppression after receiving ARV treatment over time.

**Examining the Influences of Personal and Environmental Factors on Health**

**Outcomes.** The ICF emphasize the interaction between contextual factors (personal and environmental factors) and individuals’ levels of functioning (i.e. health outcomes). Environmental factors include social attitudes, architectural structures, legislations and policies, and service provision. Personal factors are race/ethnicity, gender, education level, family, and other personal characteristics that could influence one’s experience of a health condition (WHO, 2002). Understanding the influences of contextual factors on PLWH’s level of functioning allow professionals better assess individual and structural barriers that may prevent optimal health outcomes.

Research has identified many personal factors that are associated with HIV treatment outcomes, including biological health outcomes, ARV medication adherence, retention in care, and overall health status. Demographic factors (i.e. age, race/ethnicity, gender) have been identified as predictors of treatment outcomes among international studies; however, research show mixed findings on the effect of different factors. Lourenco et al (2016) found that men were more likely to remain in care, compared to women and those age between 30-49 were more likely to remain in care, compared to those who were younger than 30 and older than 50. Contrary to these findings, Fleishman et al. (2012) found that women had more HIV medical
visits than men and Syed et al. (2016) found that among PLWH who received ARV treatment, women and those who age between 41-50 had highest level of CD4 count. Tshikuka et al. (2014) identified that socioeconomic status among PLWH is associated with life expectancy in developing countries.

Paterson et al. (2000) found that active mental illness is a critical factor that impact treatment adherence rate. Younger age has also been identified as a risk factor of falling out of care (Fleishman et al., 2012). Mizuno et al. (2014) examined the associations between psychosocial factors and retention in care outcomes and found that types of psychosocial problems are significantly associated with HIV treatment adherence. Individuals who experienced more psychosocial problems (eg. psychological distress, experience of abuse, lack of social support) were less likely to remain in HIV care (Mizuno et al., 2014). Spirituality is also an important predictor of health outcomes across different client populations. Trevino et al (2007) found that spiritual coping behaviors (i.e. seeking spiritual support) were significantly associated with positive health outcomes among PLWH, including biological health outcomes, psychological status, and quality of life.

Myezwa et al. (2011) reviewed four international studies that applied the ICF to examine the interaction between environmental factors and functional limitations among PLWH. Environmental factors associated with client functional limitations included support from family, support from health-care professionals, attitudes, and products and technology (Myezwa et al., 2011). Hwang & Nochajski (2003) also reviewed studies on functional limitations among PLWH and provides the systematic ICF codes (WHO, 2001) on the empirical findings. The ICF codes show that the impacts of environmental factors on PLWH include attitudes, service, and systems and policies. Attitudes include individual attitudes of strangers, individual attitudes of health
professionals, attitudes of health-related professionals, societal attitudes, and societal norms, practices and ideologies. Service for PLWH may include medical, psychological, and social services.

In summary, the ICF can be applied to conceptualize the interaction between health outcomes and environmental factors among individuals with disabilities, including PLWH. This study use ICF to measure the association between environmental factors (CM services and others) and client outcomes (CD4 percentage and retention in care) and to identify personal and environmental factors associated with retention in care status and biological health outcome.

**Summary of the Literature Review**

This review of the literature reveals that the focus areas of HIV/AIDS care are shifting from pure medical care to an integrated service approach, where CM services play an important role in facilitating outcomes along the HIV Care Continuum. There have been many studies focusing on medical and prevention services for PLWH; however, there is still limited research done on the effect of CM services on PLWH’s health outcomes.

While several studies demonstrated positive associations between use of CM services and PLWH’s biological health outcomes, linkage-to and retention in care outcomes, and health-related quality of life, the limited numbers and the varying findings of these studies leave researchers doubt about the effect of CM services on client outcomes. In addition, only very few studies looking at PLWH’s longitudinal changes in health status and retention in care over a significant period of time. As the findings from the ARTAS-I and ARTAS-II studies, CM services have been shown effectiveness in successful short-term linkage-to-care, but not long-term engagement in HIV treatment (Craw et al., 2008; Gardner et al., 2005), it is important to use
a multi-year longitudinal approach to examine the association of CM services utilization and long-term outcomes.

There are still a large proportion of PLWH do not use HIV CM services, although CM services have been recognized as an essential component in HIV/AIDS care and receive large among of federal Ryan White funding. Factors associated with use of CM services remain under-researched. Andersen’s Behavioral Model of Health Service Use (Andersen, 1968; Andersen, 1995; Andersen & Davidson, 2001; Andersen, 2008) provides a framework to select other factors associated with CM utilization. Identifying factors associated with PLWH’s use of CM services will allow service providers to better address barriers to retention in care and to better design effective CM services.

This author also applies the International Classification of Function, Disability, and Health (ICF; WHO, 2002) to conceptualize the association between use of CM services and PLWH’s longitudinal health outcomes. CM service is considered as an environmental factor that contribute to PLWH’s health conditions (biological health outcomes) and participation (retention in care). Outcome measures are biological health outcome (CD4 Counts) and retention in care outcomes (at least one medical visit in every six month).

**Research Questions**

Based on the review of literature, this study is designed to answer the following research questions:

1. **Demographic Characteristics and Use of CM**

   a. What are the characteristics of PLWH who receive medical services from a HIV clinic in south central PA?
b. What are the factors associated with use of CM (at least one CM visit every six month) over time?

2. Retention in Care Outcomes

To what extent do personal and environmental factors and use of CM predict PLWH’s retention in care (at least one HIV medical visit every six month) over time?

3. Biological Health Outcomes

To what extent do personal and environmental factors and use of CM predict PLWH’s CD4 percent over time?
CHAPTER 3: METHODOLOGY

This chapter presents the methodology of the current study. Research design, participants, procedures, and data analytic plans are discussed. Because this is a secondary analysis of a de-identified dataset, neither university Institutional Review Board application nor client consents were needed.

Research Design and Procedures

A retrospective longitudinal study design was implemented to examine the association of use of case management (CM) on the changes in PLWH’s health outcomes and to identify factors associated with client utilization of case management services. To conduct analyses, the author used a secondary de-identified patient outcomes dataset provided by the medical director of a HIV clinic in south central Pennsylvania.

This HIV clinic is a part of the department of infectious disease within a major medical center, which is one of the largest Ryan White Part C HIV treatment sites in PA. This clinic is located in a semi-rural area where is close to an urban area in south central PA; therefore, the clinic serves both urban populations and rural populations. A large proportion of the client population is scattered throughout the six primarily rural counties in south central PA, including Dauphin, Cumberland, Perry, York, Adams, Franklin, Fulton, Juniata, Lancaster, Lebanon, Huntingdon, Mifflin, Snyder, and portions of schuylkill and Northumberland counties. To serve these rural clients, the clinics have set up seven satellite sites of HIV care; these satellite sites are 15 to 145 miles away from the main treatment site. All the satellite sites use the same medical record database as the main treatment site.

To create the study data set, data was extracted from the clinic database based upon those who received medical services at the HIV clinic and its satellite sites during January 2014 to
March 2016. The dataset included selected assessment records (i.e., HIV test results, treatments, psychosocial assessments, prevention assessments, financial assessments, and demographic information) for each of these patients for every medical visit from the date they first visited the clinic for HIV medical care. The dataset includes key assessment records dating back to January 2012 to create a five-year period for the study (January 2012 to March 2016). The primary reason of the time period selected was to examine more current case management practices. According to clinical staff at the HIV clinic, case management services were provided through outside service providers prior to the year of 2009 and more individuals begin to enroll in CM during 2010-2012; therefore selecting the year of 2012 could improve the consistency and quality of the CM data.

Study selection criteria that included a subset of patients who were over 18 by January 2010, who remain alive throughout the study period, and who were not incarcerated. Children and youth who are diagnosed with HIV may not be enrolled in HIV medical care and/or CM voluntarily. Instead, they may be brought to the HIV clinic by their parents, guardians, or social workers. As this study is intent to examine PLWH’s outcomes based on individual choices, those who were under age of 18 was excluded. Individuals who were deceased during this time period were excluded in order to ensure the accuracy of outcome measures. Incarceration is often an important factor of retention in care, as prisoners may fail to attend medical treatment once they were incarcerated or they may receive retreatment at correctional facilitates and were not documented in the database.

There are 704 individuals in the dataset for the current analysis. Characteristics of the sample and baseline measures will be reported in Chapter four. To ensure confidentiality, a random
number (RndRecNum) was generated as a unique patient identifier and other key identifying information was removed (e.g., name, medical record number, date of birth).

Selection of Variables

There are three outcome variables (use of CM, retention in care, and CD4 percentage) in this study. Plans to select independent variables (predictors) are also discussed in this section.

Dependent Variables

Use of Case Management (RQ1). To answer the first research question “to what extent do personal and contextual factors predict CM utilization (at least one CM visit every six month) over time”, use of CM at each measurement point is used as a dependent variable. According to Health Resources and Services Administration (HRSA), one of the quality-of-care indicators is having an updated case management plan two or more times a year (HRSA, 2013). Although there were no case management plan record in the current dataset, there are dates of case management visits and brief notes. This author also coded the CM visit dates into quarter-year format and consider the criteria being met when an individual had at least one CM visit during the specific quarter-year. This is a binary variable coded as “1” and “0” for each quarter-year.

Retention in Care Status (RQ2). According to Health Resources and Services Administration (HRSA, 2013), the definition of retention in HIV care is “whether a client had at least one medical service visit in each 6-month period of the 12-month measurement period with a minimum of 90 days between each visit.” In other words, if a client does not have medical visit for more than six months, he/she is considered “lost to care.” In the current study, antiviral test dates and weight measurement dates will be used as dates of medical visits. Between-visit date will be calculated for dates between each medical appointment. If the between-visit date is larger than 180 days, that the individual is coded as lost-to-follow-up in the specific quarter-year;
otherwise, the individual will be coded as retention in care. This is a binary variable coded as “1” and “0” for each quarter-year.

**Biological Health Outcome: CD4 Percentage (RQ3).** This dataset includes CD4 count, CD4%, and viral load. Since most of the individuals in the sample were those who received HIV medical treatment, the majority of them had achieved viral suppression; therefore, viral load is not used as an outcome indicator. This author examined the distribution of the CD4 count variable and found the adjusted residuals did not meet the assumption of the Linear Mixed Model; thus, CD4 count is not a good outcome variable for modeling the changes in biological health outcomes.

CD4 percentage is used as an outcome variable in this study as the distribution of the residuals is relatively normal, compared to CD4 count. As defined in Chapter 2, the CD4% is the percentage of CD4 cells of the total white blood cells. For adults who are HIV negative, the CD4% ranging from 24-64% with an average of 45%. CD4% is often viewed as a better indicator for PLWH who have CD4 counts above 200 cells/mm³.

**Independent Variables**

**Use of Case Management.** Use of CM at each time point is considered an independent variable in the first set of research question. The coding mechanism is the same as the dependent variable.

**Use ARV Medications.** Use of ARV medications is selected to present the HIV treatment status, as it indicates whether the individual was using any type of antiviral medication at the measurement time point. Use of ARV medications is a binary variable, in which individuals who were on ARV medication at each time point are coded as “1” and those who were not on medication are coded as “0”.
Covariates

There are three sets of covariates that will be potential predictors of the models: Demographics, Financial, and Psychosocial. This author will first conduct cross-sectional Logistic Regression and Generalized Linear Models to select appropriate predictors in the longitudinal analyses.

**Demographics Variables.** **Race** is a categorical variable consisting of the following categories: White, African American, and Asians or other. There were only four individuals reported as Asians or Others; they are excluded from this analysis for a more balanced design. **Ethnicity** is a binary variable categorized as Hispanic/Latino and Non-Hispanic/Non-Latino. **Gender** is a categorical variable that has three levels: Male, Female, and Transgender. There are three individuals identified themselves as transgender: male to female. To represent self-identified gender, they are categorized into female. **Age** is a continuous variable that is documented in the dataset as the age at the last medical visit date. This author calculated age as a time-variant variable based on the age at each quarter-year. **Treatment site** is a categorical variable represents the most recent sites that the individuals visited. The categories are Hershey, Harrisburg, and Other. Other than the main site at Hershey, other satellite sites are relatively small except the Harrisburg site; therefore, this author only specify the Harrisburg site and other sites. In the current dataset, the records only show individuals’ first and last-seen sites. According to the medical director, the last seen site is able to represent where individuals receive HIV treatment over time.

**Psychosocial Variables.** **Mental Health Diagnosis** is a time-variant binary variable that consider any current mental health diagnosis as “Yes” and “No” for those who do not have any documented mental health diagnosis during the quarter-year. **Current Mental Health Treatment** is a time-variant binary variable that coded “Yes” for those who were receiving any
mental health treatment at the measurement time point. **Drug Use** is a time-variant binary variable that coded “Yes” for those who were using any drug at the measurement time point.

**Alcohol Use** is a time-variant binary variable that coded “Yes” for those who were using alcohol at the measurement time point. The full list of variables is presented in Table 1.

**Table 1: List of Variables**

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Type</th>
<th>Coding/Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of CM</td>
<td>Binary</td>
<td>Yes, No (Whether or not use CM in the quarter-year)</td>
</tr>
<tr>
<td>Retention in Care</td>
<td>Binary</td>
<td>Yes, No (between visit dates&lt;180 days)</td>
</tr>
<tr>
<td>CD4%</td>
<td>Continuous</td>
<td>0-77</td>
</tr>
<tr>
<td><strong>Predictors (Time-invariant)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td>Categorical</td>
<td>White, Black, Other (Only 4 Asians, so excluded the cases)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Binary</td>
<td>Hispanic, Non-Hispanic</td>
</tr>
<tr>
<td>Gender</td>
<td>Categorical</td>
<td>Male, Female, Transgender (only 2 trans M to F: categorized as female)</td>
</tr>
<tr>
<td>Treatment Site</td>
<td>Categorical</td>
<td>Hershey, Harrisburg, Other</td>
</tr>
<tr>
<td><strong>Predictors (Time-variant)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>Continuous</td>
<td>18-80</td>
</tr>
<tr>
<td>Use ARV Medications</td>
<td>Binary</td>
<td>Yes, No (Whether or not use ARV Meds in the quarter-year)</td>
</tr>
<tr>
<td>Mental Health Diagnosis</td>
<td>Binary</td>
<td>Yes, No (Whether or not had MH diagnosis in the quarter-year)</td>
</tr>
<tr>
<td>Current Mental Health Treatment</td>
<td>Binary</td>
<td>Yes, No (Whether or not received MH treatment in the quarter-year)</td>
</tr>
<tr>
<td>Drug Use</td>
<td>Binary</td>
<td>Yes, No (Whether or not use drug in the quarter-year)</td>
</tr>
<tr>
<td>Alcohol Use</td>
<td>Binary</td>
<td>Yes, No (Whether or not use alcohol in the quarter-year)</td>
</tr>
</tbody>
</table>

**Data Analysis**

This author uses SAS Studio (University Edition) to manage and to conduct the secondary data analysis. Six excel files that contains different variables were provided by the medical director at the HIV clinic. This author coded the assessment dates in each file into a semi-year
format and merged into a central dataset. Individuals who did not meet the criteria of this study were excluded from the current analysis.

**Data Management and Missing Data**

This author, together with Dr. Boomer conducted data management activities using SAS Studio. The original Excel files provided by HMC contains assessment dates when clients received medical treatment, ARV tests, psychosocial, financial, and case management assessments. This author coded the “last seen dates” into “quarter-year” meaning that all of the visit dates in each quarter of the year will only be coded once. For example, visits during January to June of 2012 will all fall into the first quarter of 2012. Since each individual were assessed at different time points, the Quarter-Year codes allow this author to group the dates in quarters and to merge into a large dataset. Random Record Number and Quarter-Year were used to sort the multiple datasets and to combine into a united dataset.

There are many missing values in this large dataset, since individuals may missed certain assessment results at some time points or they were not assessed in every quarter. In order to conduct analysis for the incomplete longitudinal dataset, this author use the Last Observation Carried Forward (LOCF) approach to impute the most recent observation as the current observation (Cao, Li, & Fine, 2016); that is filling in the missing values using the last observed values for each individual. This approach has been widely used in longitudinal studies; however, it could be biased as individual’s status may change between visits; however, it is typical to assume individual’s status remain no change when there’s no changes on medical records. Another source of missing values is when individuals entered treatment after the specific measurement time point of the dataset. For example, a person may attend his/her first appointment in the first quarter of 2013 then the values in the time point of the previous quarters
of would be missing. In this case, this author set the missing values as “missing”, so that it would not interfere the longitudinal analysis where all time points are taken into account.

Finally, this author created another dataset based on the sample exclusion criteria: younger than 18 in the year of 2010, incarcerated during any time point in the measurement period, and those who were deceased. The final dataset includes 704 individuals.

**Selection of Independent Variables**

As an exploratory study, it is important to pre-screen independent variables that are included in the statistical models. Cross-sectional analyses were conducted at the single time point (the last quarter of 2015) to select variables for each model. Logistic regression was used to select independent variables for two binary outcome variables: retention in care status and use of CM, while Generalized Linear Modeling was used to select variables for the continuous outcome variable: CD4%. Backwards model selection approach was applied: a significance level of 0.2 is required to enter a variable into the models. Some of the time-variant variables did not meet the significance criteria but are included in the final model, because those variables change from time to time and would be important to be included in longitudinal analyses.

**Longitudinal Analysis**

Generalized Estimated Equations (GEE) and the Repeated Measures General Linear Mixed Model (LMM) will be used for the longitudinal analysis. Both GEE and the Mixed Model are the extensions of Generalized Linear Models. This author used GEE to understand the relationships between repeated measured binary outcome variables (retention in care, use of CM) and explanatory variables and used the General Linear Mixed Models (GLMM) to analyze the repeated measured continuous outcome variable: CD4%.
**Generalized Estimated Equations (GEE).** GEE is a widely used approach for handling discrete, binary, or continuous outcome variables that are correlated. Correlated outcomes often happen when individuals are repeatedly measured over time or when there’s a relationship among units (e.g. treatment sites). GEE was first introduced by Liang and Zeger (1986) and Zeger and Liang (1986) as an approach to handle correlated outcome variables.

GEE expands the traditional Generalized Linear Models (GLM) to estimate more efficient and unbiased regression parameters as GEE permits specification of a working correlation matrix that accounts for the form of ordinal, binary, or continuous within-subject outcome responses. To date, GEE is often used in longitudinal research as it can provide a population-average interpretation while addressing correlations between discrete and continuous variables. GEE was developed based on the quasi-likelihood theory and the assumption of the response observation distribution is fairly flexible. GEE can estimate model parameters by specifying one of the working correlation matrix structures (i.e. independence, unstructured, exchangeable, autoregressive) to account for the within-person correlations based on the quasi-likelihood distributional assumptions (Smith, 2006). The primary assumptions of the GEE model includes: a) the responses are correlated or clustered, meaning that each observation is not independent, b) the homogeneity of variance does not need to be meet, and c) covariates can be power terms or independent variables, or interaction terms (Smith, 2006).

In the current study, GEE with a logic link function will be used to analyze the binary outcome variables while controlling for other covariates.

**Repeated Measures General Linear Mixed Model.** The repeated measures general linear mixed model (GLM) approach will be used to analyze the repeated measured continuous outcome variable: CD4%. Repeated measures are the same measures on the same units over
time. Since observations for same individuals are correlated, LLM has a unique strength in detecting both fixed and random effects. The repeated-measured factors is often referred as within-subject factors, which is time in this study.

Fixed effect can be viewed as population mean, while random effect can be seen as individual level means.

The general model formula is usually written as \( y = X\beta + Z\gamma + \epsilon \), where \( Y \) is the vector of the repeated measured responses, \( \beta \) is the unknown fixed effect parameter vector, \( X \) is the matrix of a single predictor, and \( \epsilon \) is the unobserved vector of random errors, \( y \) represents the vector of unknown random effect parameter, and \( Z \) is the matrix of the random effect.

**Statistical Models for Research questions**

Statistical analysis procedures will be described for each research question.

**R1. Demographic Characteristics and CM Utilization:**

*a. What are the characteristics of PLWH who receive medical services from a HIV clinic in South Central PA?*

Descriptive statistics will be used to describe the characteristics of the sample. Frequencies, means, medians, and standard deviation will be reported for each variable. Baseline demographic information that was captured at intake assessment will be reported as time-invariant variables. Variables that were measured repeatedly will be reported at the first and last measurement time period, including drug use and mental health diagnosis.

*b. What are the patterns of use of CM among this sample?*

Descriptive statistics will be used to describe the percentages and numbers of those who use CM at each measurement time period.

*c. What are the factors associated with use of CM (at least one CM visit every six month)?*
Logistic Generalized Estimating Equations (GEE) with an autoregressive working correlation structure is performed to identify factors associated with use of CM. This model will describe the probability of an event (use of CM) happening as a function of a certain predictor (Age). Predictors will be selected based on the results of the cross-sectional analysis on predictors of Logit (use of CM) at a single time point.

Model:
\[
\text{Logit (use of CM)} = \beta_0 + \beta_1 \text{(Race)} + \beta_2 \text{(Ethnicity)} + \beta_3 \text{(Gender)} + \ldots
\]

\[g(\mu_{ij}) = X^T_{it} \beta\]

**R2. Retention in Care Outcomes:** *To what extent do personal and environmental factors and CM utilization predict PLWH’s retention in care (at least one HIV medical visit every six month) over time?*

Logistic Generalized Estimating Equations (GEE) with an autoregressive working correlation structure was performed to identify factors that are associated with retention in care status. This model will describe the probability of an event (retention in care) happening as a function of a certain predictor (CM utilization). Predictors will be selected based on the results of the cross-sectional analysis on predictors of Logit (retention in care) at a single time point.

Model:
\[
\text{Logit (Retention in care)} = \beta_0 + \beta_1 \text{(Use of CM)} + \beta_2 \text{(Use of ARV Medications)} + \\
\beta_3 \text{(Race)} + \beta_4 \text{(Ethnicity)} + \ldots
\]

\[g(\mu_{ij}) = X^T_{it} \beta\]

**R3. Biological Health Outcomes:** *To what extent do personal and environmental factors and CM utilization predict PLWH’s CD4 percent over time?*
GLMM with repeated measure approach will be used examine factors associated with changes in CD4% over time. The outcome variable will be the highest CD4% measured at each Quarter-year. The primary independent variable for the research interest is use of CM; other variables include retention in care status, client-level factors, and time. Time is used as a continuous variable to capture the changes over time. Selection of variables is based on the results of the GLM analysis.

Model:

$$CD4Count_{it} = \beta_0 \text{(random effect)} + \beta_1 \text{(Use of CM)} + \beta_2 \text{(In Care)} + \beta_3 \text{(Race)} + \ldots$$
CHAPTER 4: RESULTS

This chapter presents the results of the analyses for the three sets of research questions. Tables are graphs are included to present the findings.

RQ1. Demographic Characteristics and Patterns of Use of CM

a. What are the characteristics of PLWH who receive medical services from a HIV clinic in South Central PA?

Descriptive Statistics for the Sample

Based on the data of PLWH who were seen at the HIV clinic during January 1, 2014 to March 10, 2016, all records dating back to January 2012 were used in the current analysis. The enrollment numbers and percentages during the first quarter of each year are shown in Table 2. After selecting individuals based on the selection criteria (age older than 18 at the year of 2010, remain alive during the measurement period, and were not incarcerated during the measurement period), there are total 704 individuals in the dataset for the current analysis.

Table 2. Enrollment by Year (n=704)

<table>
<thead>
<tr>
<th>Enrollment</th>
<th>2012 First Quarter</th>
<th>2013 First Quarter</th>
<th>2014 First Quarter</th>
<th>2015 First Quarter</th>
<th>2016 First Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency (n)</td>
<td>545</td>
<td>589</td>
<td>627</td>
<td>667</td>
<td>704</td>
</tr>
<tr>
<td>Percent (%)</td>
<td>77%</td>
<td>84%</td>
<td>89%</td>
<td>95%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 3 shows the baseline demographic information that was recorded at intake assessments. In this sample, the majority of the individuals are White (76.14%, n=536), male (71.59%, n=504), and non-Hispanic (88.78%, n=625). The age at the intake assessment ranged from 3 to 71 years with a mean of 40.25 years (SD=11.18) and a median of 40. The average age when individual were first diagnosed with HIV is 34.48 years (median=34, SD=10.91), and the
average age when individual received AIDS diagnosis is 40.06 years (median=40, SD=10.44). Selected individuals’ age in the first quarter of 2012 ranged from 18 to 80, with an average of 45.88 (median=47, SD=11.27).

The HIV exposure category (transmission group) documented at intake assessments include men who have sex with men (MSM; 50.99%, n=359), heterosexual contact (34.38%, n=242), injection drug use (IDU; 10.94%, n=77), perinatal transmission (0.85%, n=6), others (i.e. hemophilia, coagulation disorders, and receipt of blood transfusion; 2.41%, n=17), and there were 6.39% (n=45) of the sample did not report. Please note that individuals who were younger than 18 in the year of 2010 were removed from this dataset; therefore, the percentage of individuals in the perinatal transmission category became lower from the original numbers enrolled in the clinic. Since the information of educational background was only recorded at intake, individuals may have changed their educational status over time, especially those who were at young age when they first entered treatment. Therefore, educational background is not used in the current analysis to avoid any biases.

This HIV clinic has multiple satellite sites across south central PA. The majority of the individuals were first seen at the main site in Hershey (58.81%, n=414), whereas 27.84% (n=196) were seen at Harrisburg satellite sites and 13.35% (n=94) at other satellite sites (Altoona, Carlisle, Lancaster, Lebanon, and Lewistown). Treatment sites that were documented in the dataset indicate the most recent sites that individuals were seen. According to the medical director, although some individuals changed to different sites throughout the years, the majority of individuals remained at the same sites.
Table 3. Baseline Demographic Information for the Sample (n=704)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Frequency (n)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race</td>
<td>White</td>
<td>536</td>
<td>76.14%</td>
</tr>
<tr>
<td></td>
<td>Black/African American</td>
<td>166</td>
<td>23.58%</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>2</td>
<td>0.28%</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Hispanic</td>
<td>79</td>
<td>11.22%</td>
</tr>
<tr>
<td></td>
<td>Non-Hispanic</td>
<td>625</td>
<td>88.78%</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>504</td>
<td>71.59%</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>200</td>
<td>28.41%</td>
</tr>
<tr>
<td>Site</td>
<td>Hershey</td>
<td>414</td>
<td>58.81%</td>
</tr>
<tr>
<td></td>
<td>Harrisburg</td>
<td>196</td>
<td>27.84%</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>94</td>
<td>13.35%</td>
</tr>
<tr>
<td>Exposure Category</td>
<td>MSM</td>
<td>343</td>
<td>49.64%</td>
</tr>
<tr>
<td></td>
<td>Heterosexual Contact</td>
<td>232</td>
<td>33.57%</td>
</tr>
<tr>
<td></td>
<td>IDU</td>
<td>51</td>
<td>7.38%</td>
</tr>
<tr>
<td></td>
<td>Perinatal</td>
<td>6</td>
<td>0.87%</td>
</tr>
<tr>
<td></td>
<td>Not Reported</td>
<td>49</td>
<td>7.09%</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>10</td>
<td>1.45%</td>
</tr>
</tbody>
</table>

Table 4 shows the descriptive statistics of other time-variant variables that were measured repeatedly. Numbers and percentages of each variable in the first time point (first quarter of 2012) and the last (first quarter of 2016) were presented in this table.
Table 4. Descriptive Statistics of Categorical Time-Variant Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>First Quarter, 2012 n=545</th>
<th>First Quarter, 2016 n=704</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency (n)</td>
<td>Percent (%)</td>
<td>Frequency (n)</td>
</tr>
<tr>
<td>Drug Use</td>
<td>Yes</td>
<td>81</td>
<td>14.86%</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>464</td>
<td>85.14%</td>
</tr>
<tr>
<td>Alcohol Use</td>
<td>Yes</td>
<td>305</td>
<td>55.96%</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>240</td>
<td>44.04%</td>
</tr>
<tr>
<td>ARV Medication</td>
<td>Yes</td>
<td>515</td>
<td>94.50%</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>30</td>
<td>5.50%</td>
</tr>
<tr>
<td>Mental Health Diagnosis</td>
<td>Yes</td>
<td>141</td>
<td>25.87%</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>240</td>
<td>44.04%</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>164</td>
<td>30.09%</td>
</tr>
<tr>
<td>Current Mental Health Treatment</td>
<td>Yes</td>
<td>94</td>
<td>17.25%</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>451</td>
<td>82.75%</td>
</tr>
</tbody>
</table>

b. What are the patterns of use of CM among this sample?

Numbers and percentages of individuals who used CM each year are shown in Table 5. 17.61% (n=96) of the sample used CM in the first quarter of 2012. The percentages gradually increased each year, whereas 36.36% (n=256) of the sample used CM in the first quarter of 2016. This finding shows that the majority of the sample did not use CM across the five years.
Table 5. Use of CM by Year

<table>
<thead>
<tr>
<th>CM</th>
<th>2012 First Quarter</th>
<th>2013 First Quarter</th>
<th>2014 First Quarter</th>
<th>2015 First Quarter</th>
<th>2016 First Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>96</td>
<td>146</td>
<td>244</td>
<td>272</td>
<td>256</td>
</tr>
<tr>
<td></td>
<td>17.61%</td>
<td>24.79%</td>
<td>38.92%</td>
<td>40.78%</td>
<td>36.36%</td>
</tr>
<tr>
<td>No</td>
<td>449</td>
<td>443</td>
<td>383</td>
<td>395</td>
<td>448</td>
</tr>
<tr>
<td></td>
<td>82.39%</td>
<td>75.21%</td>
<td>61.08%</td>
<td>59.22%</td>
<td>63.64%</td>
</tr>
<tr>
<td>Total</td>
<td>545</td>
<td>589</td>
<td>627</td>
<td>667</td>
<td>704</td>
</tr>
</tbody>
</table>

c. What are the factors associated with use of CM (at least one CM visit every six month)?

Logistic Generalized Estimating Equations (GEE) with an autoregressive working correlation structure was performed to identify client-level factors that are associated with the repeated measured binary outcome, use of CM. Backwards elimination was used to select the final model. The predictors of the final GEE model are shown in Table 6. The results show that CM utilization is significantly associated with treatment site, race, ethnicity, retention in care status, and use of ARV medication.

Table 7 demonstrates the adjusted odds ratio for the contrasts chosen in the estimate statements. After controlling for correlated outcome data and other covariates, individuals who are Black/African American were 23% more likely to be receiving CM services than those who are White, on the odds scale (95% CI= 1.03- 1.47, p<0.05). Individuals who were Hispanic were 53% more likely to use CM, compared to those who were non-Hispanic (95% OR CI= 1.22-1.92, p<0.001). Individuals who were remained in care were 0.83% less likely to use CM, compared to those fell out of care (95% CI= 1.27- 1.60; p< .0001). Individuals who were on ARV medication were 73% more likely to use CM, compared to those who were not (95% CI= 1.22-1.92, p<0.001).
Individuals who were treated at the Hershey site were 7.56 times more likely to use CM, compared to those who were seen at Harrisburg site (95% CI=6.05, 9.44, and 90% more likely than those who were seen at other satellite sites (95% CI=1.47, 2.46). Those who were seen at Harrisburg site were 53% less likely to use CM, compared to those who were seen at other satellite sites (95% CI=0.410.68). Although drug use and alcohol use are not significantly associated with use of CM, the odds ratios suggest that individuals who did not use drug and alcohol were more likely to be receiving CM services.

**Table 6. CM Utilization GEE Model**

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>Chi-Square</th>
<th>Pr &gt; ChiSq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site</td>
<td>2</td>
<td>223.98</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Race</td>
<td>1</td>
<td>4.81</td>
<td>0.0284</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>1</td>
<td>12.38</td>
<td>0.0004</td>
</tr>
<tr>
<td>In Care</td>
<td>1</td>
<td>23.30</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Drug Use</td>
<td>1</td>
<td>3.67</td>
<td>0.0553</td>
</tr>
<tr>
<td>Alcohol Use</td>
<td>1</td>
<td>2.99</td>
<td>0.0836</td>
</tr>
<tr>
<td>ARV Med</td>
<td>1</td>
<td>8.90</td>
<td>0.0029</td>
</tr>
<tr>
<td></td>
<td>Log Odds (Std Err)</td>
<td>Odds Ratio (Std Err)</td>
<td>95% CI for Odds Ratio</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------</td>
<td>----------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td><strong>Race</strong> (African-Americans vs. whites)</td>
<td>0.21 (0.093)</td>
<td>1.23 (0.114)</td>
<td>(1.03, 1.47)</td>
</tr>
<tr>
<td><strong>Ethnicity</strong> (Hispanic vs. non-Hispanic)</td>
<td>0.43 (0.116)</td>
<td>1.53 (0.178)</td>
<td>(1.22, 1.92)</td>
</tr>
<tr>
<td><strong>In Care</strong> (no vs. yes)</td>
<td>0.35 (0.059)</td>
<td>1.43 (0.085)</td>
<td>(1.27, 1.60)</td>
</tr>
<tr>
<td><strong>Alcohol Use</strong> (no vs. yes)</td>
<td>0.12 (0.072)</td>
<td>1.13 (0.082)</td>
<td>(0.98, 1.30)</td>
</tr>
<tr>
<td><strong>Drug Use</strong> (no vs. yes)</td>
<td>0.20 (0.103)</td>
<td>1.22 (0.125)</td>
<td>(0.998, 1.49)</td>
</tr>
<tr>
<td><strong>ARV Medication</strong> (yes vs. no)</td>
<td>0.55 (0.167)</td>
<td>1.73 (0.289)</td>
<td>(1.25, 2.40)</td>
</tr>
<tr>
<td><strong>Site</strong> (Hershey vs. Harrisburg)</td>
<td>2.02 (0.113)</td>
<td>7.56 (0.857)</td>
<td>(6.05, 9.44)</td>
</tr>
<tr>
<td><strong>Site</strong> (Hershey vs. Other)</td>
<td>0.64 (0.131)</td>
<td>1.90 (0.249)</td>
<td>(1.47, 2.46)</td>
</tr>
<tr>
<td><strong>Site</strong> (Harrisburg vs. Other)</td>
<td>-0.64 (0.131)</td>
<td>0.53 (0.069)</td>
<td>(0.41, 0.68)</td>
</tr>
</tbody>
</table>

**RQ2. Retention in Care Outcomes:** *To what extent do personal and environmental factors and use of CM predict PLWH’s retention in care (at least one HIV medical visit every six month)?*

The retention rates each year for the sample are presented in Table 8. The percentage of individuals who met the criteria of retention in care (at least one medical visit every six month) in the first quarter of 2012 is 78.17% (n=426) and gradually decreased by year; 64.91% (n=457) of the sample remained in care in the first quarter of 2016.
Logistic Generalized Estimating Equations (GEE) with an autoregressive working correlation structure was performed to identify client-level factors that are associated with the repeated measured binary outcome, retention in care. Backwards elimination was used to select the final model. The predictors of the final GEE model are shown in Table 9. Factors that are significantly associated with retention in care over time include treatment site, age, CM utilization, and use of ARV medication.

After controlling for correlated outcome data and other covariates, individuals who used CM were 81% less likely to remain in care, compared to those did not use CM, on the odds scale (95% CI= 1.47, 1.83; p< .0001). Individuals who were on ARV medications were 3.46 times more likely to remain in care, compared to those who did not (95% CI=2.44, 4.89; p< .0001). Age is a continuous variable that is positively associated with retention in care status; for one year increase in age, the odds of remaining in care increased by 2% and for 10 years increase in age, odds increased by 26% (p<0.005). Treatment site is also a significant factor. Individual who received treatment at the Harrisburg site were more likely to remain in care, compared to those who received treatment at the Hershey site (53% more on a odds scale; p<0.0001) and other satellite sites (57% more on a odds scale; p<0.0001). There is no significant difference between the Hershey site and others.

<table>
<thead>
<tr>
<th>In Care</th>
<th>2012 First Quarter</th>
<th>2013 First Quarter</th>
<th>2014 First Quarter</th>
<th>2015 First Quarter</th>
<th>2016 First Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>426 78.17%</td>
<td>441 74.87%</td>
<td>450 71.77%</td>
<td>428 64.17%</td>
<td>457 64.91%</td>
</tr>
<tr>
<td>No</td>
<td>119 21.83%</td>
<td>148 25.13%</td>
<td>177 28.23%</td>
<td>239 35.83%</td>
<td>247 35.09%</td>
</tr>
<tr>
<td>Total</td>
<td>545</td>
<td>589</td>
<td>627</td>
<td>667</td>
<td>704</td>
</tr>
</tbody>
</table>
Table 9. GEE Model for Retention in Care

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>Chi-Square</th>
<th>Pr &gt; ChiSq</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM</td>
<td>1</td>
<td>45.65</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Site</td>
<td>2</td>
<td>16.92</td>
<td>0.0002</td>
</tr>
<tr>
<td>Age</td>
<td>1</td>
<td>9.85</td>
<td>0.0017</td>
</tr>
<tr>
<td>Gender</td>
<td>1</td>
<td>2.04</td>
<td>0.1528</td>
</tr>
<tr>
<td>Drug Use</td>
<td>1</td>
<td>0.98</td>
<td>0.3220</td>
</tr>
<tr>
<td>Alcohol Use</td>
<td>1</td>
<td>1.73</td>
<td>0.1885</td>
</tr>
<tr>
<td>ARV Med</td>
<td>1</td>
<td>31.69</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

Table 10. Significant Adjusted Odds Ratio

<table>
<thead>
<tr>
<th></th>
<th>Log Odds (Std Err)</th>
<th>Odds Ratio (Std Err)</th>
<th>95% CI for Odds Ratio</th>
<th>Chi-Square</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CM</strong></td>
<td>0.50 (0.057)</td>
<td>1.64 (0.093)</td>
<td>(1.47, 1.83)</td>
<td>77.19</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td><strong>ARV Med</strong></td>
<td>1.24 (0.177)</td>
<td>3.46 (0.613)</td>
<td>(2.44, 4.89)</td>
<td>48.86</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td><strong>Site</strong> (Harrisburg vs. Hershey)</td>
<td>0.42 (0.106)</td>
<td>1.53 (0.164)</td>
<td>(1.24, 1.89)</td>
<td>15.57</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td><strong>Site</strong> (Hershey vs. Other)</td>
<td>0.45 (0.152)</td>
<td>1.57 (0.239)</td>
<td>(1.17, 2.12)</td>
<td>8.77</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td><strong>Site</strong> (Harrisburg vs. Other)</td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
<td>0.04</td>
<td>0.8329</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>0.02 (0.004)</td>
<td>1.02 (0.004)</td>
<td>(1.01, 1.02)</td>
<td>10.45</td>
<td>0.0012</td>
</tr>
</tbody>
</table>

**RQ3. Biological Health Outcomes:** To what extent do personal and environmental factors and use of CM predict PLWH’s CD4 percent?

Table 11 presents the CD4% of the sample each year categorized by those who used CM during that time and those who did not. The final model for the General Linear Mixed Model is
presented in Table 12. The significant factors associated with changes in CD4% are retention in care status (p<0.01), race (p<0.005), gender (p<0.005), ethnicity (p<0.001), mental health diagnosis (p<0.05), ARV Medication (p<.001), time (p<0.001), and the interaction of CM and time (p<0.05).

When comparing the least squares means shown in Table 11, individuals who were remained in care achieved more gains in CD4%, compared to those who did not remain in care. In terms of demographic backgrounds, individuals who are white, non-Hispanic, and female had more gains in CD4%. In addition, individuals who had at least one mental health diagnosis had more gains in CD4%.

**Table 11. Mixed Model for CD4 Percentage**

<table>
<thead>
<tr>
<th>Effect</th>
<th>Num DF</th>
<th>Den DF</th>
<th>F Value</th>
<th>Pr &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Care</td>
<td>1</td>
<td>513</td>
<td>7.46</td>
<td>0.0065</td>
</tr>
<tr>
<td>Time</td>
<td>1</td>
<td>4015</td>
<td>38.21</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>CM</td>
<td>1</td>
<td>486</td>
<td>5.22</td>
<td>0.0228</td>
</tr>
<tr>
<td>Time*CM</td>
<td>1</td>
<td>4015</td>
<td>5.00</td>
<td>0.0253</td>
</tr>
<tr>
<td>Race</td>
<td>1</td>
<td>696</td>
<td>14.89</td>
<td>0.0001</td>
</tr>
<tr>
<td>Gender</td>
<td>1</td>
<td>696</td>
<td>8.83</td>
<td>0.0031</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>1</td>
<td>696</td>
<td>12.70</td>
<td>0.0004</td>
</tr>
<tr>
<td>Drug Use</td>
<td>1</td>
<td>109</td>
<td>2.45</td>
<td>0.1205</td>
</tr>
<tr>
<td>MH Diagnosis</td>
<td>1</td>
<td>144</td>
<td>4.13</td>
<td>0.0440</td>
</tr>
<tr>
<td>ARV Med</td>
<td>1</td>
<td>81</td>
<td>68.11</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cov Parm</th>
<th>Subject</th>
<th>Estimate</th>
<th>Standard Error</th>
<th>Z Value</th>
<th>Pr Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR(1)</td>
<td>RndRecNum</td>
<td>0.95</td>
<td>0.002</td>
<td>408.03</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Residual</td>
<td></td>
<td>128.96</td>
<td>5.504</td>
<td>23.43</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>
Table 12. Least Squares Means of the Mixed Model for CD4 Percentage

<table>
<thead>
<tr>
<th>Effect</th>
<th>Mean CD4 Percent</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>In care (No)</td>
<td>26.72</td>
<td>0.708</td>
</tr>
<tr>
<td>In care (Yes)</td>
<td>27.08</td>
<td>0.713</td>
</tr>
<tr>
<td>CM (No)</td>
<td>26.99</td>
<td>0.710</td>
</tr>
<tr>
<td>CM (Yes)</td>
<td>26.76</td>
<td>0.710</td>
</tr>
<tr>
<td>Race (AA)</td>
<td>25.13</td>
<td>0.970</td>
</tr>
<tr>
<td>Race (White)</td>
<td>28.62</td>
<td>0.684</td>
</tr>
<tr>
<td>Gender (Female)</td>
<td>28.14</td>
<td>0.870</td>
</tr>
<tr>
<td>Gender (Male)</td>
<td>25.61</td>
<td>0.777</td>
</tr>
<tr>
<td>Ethnicity (Hispanic)</td>
<td>24.72</td>
<td>1.197</td>
</tr>
<tr>
<td>Ethnicity (Non-Hispanic)</td>
<td>29.02</td>
<td>0.543</td>
</tr>
<tr>
<td>Drug Use (No)</td>
<td>27.18</td>
<td>0.702</td>
</tr>
<tr>
<td>Drug Use (Yes)</td>
<td>26.56</td>
<td>0.708</td>
</tr>
<tr>
<td>MH Diagnosis (No)</td>
<td>26.53</td>
<td>0.708</td>
</tr>
<tr>
<td>MH Diagnosis (Yes)</td>
<td>27.23</td>
<td>0.746</td>
</tr>
<tr>
<td>ARV Med (No)</td>
<td>25.07</td>
<td>0.794</td>
</tr>
<tr>
<td>ARV Med (Yes)</td>
<td>28.68</td>
<td>0.682</td>
</tr>
</tbody>
</table>

The interaction between CM and time is significant, meaning that individuals’ CM utilization status each year is significantly associated with the changes in CD4% over time. Table 13 shows the means of CD4% in the first quarter of each year. Both CM group and non-CM group had increased means of CD4% over time. When looking at the differences between least square means of the CD4% among CM group and non-CM group in Table 13, there are significant differences between two groups in 2012 and 2013. Individuals who did not use CM in 2012 and 2013 had a significant higher means of CD4% than those who used CM (p<0.005); however, the difference decreases over time and there are no significant differences in CD4% in 2014 through 2016. Figure 1 shows that the slope is larger for those who use CM, compared to those who did not. We conclude that there is a greater gain in CD4% for those who use CM.
Table 13. Mean of CD4 Percentages by Year

<table>
<thead>
<tr>
<th>CD4% Mean /Year</th>
<th>Year</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CM (Yes)</td>
<td>24.87%</td>
<td>25.83%</td>
<td>26.79%</td>
<td>27.75%</td>
<td>28.70%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CM (No)</td>
<td>25.62%</td>
<td>26.32%</td>
<td>27.01%</td>
<td>27.70%</td>
<td>28.40%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 14. Difference of Least Squares Means (CM*Time)

| CM*Time | Difference of CD4% means | Standard Error | DF  | t Value | Pr > |t| |
|---------|--------------------------|----------------|-----|---------|-------|---|
| CM*2012 | 0.76                     | 0.241          | 486 | 3.14    | 0.0018 |
| CM*2013 | 0.49                     | 0.156          | 486 | 3.15    | 0.0018 |
| CM*2014 | 0.22                     | 0.136          | 486 | 1.64    | 0.1007 |
| CM*2015 | -0.041                   | 0.203          | 486 | -0.20   | 0.8388 |
| CM*2016 | -0.31                    | 0.303          | 486 | -1.01   | 0.3119 |

Figure 3. Change in Mean CD4 Percentages Over Time

*Significant differences between No CM services group and CM services group in 2012 and 2013.
Summary of the Findings

Among 704 individuals who received HIV medical services from a HIV clinic in south central PA during January 2012 to March 2016, the majority participants are white, non-Hispanic, male. The percentage of individual who used CM each year ranges from 17.61% to 40.78%. Individuals who are African American, non-Hispanic, who were treated at the main treatment site, who were falling out of care, and those who used ARV medications were more likely to use CM.

The second and the third research questions focusing on identifying predictors associated with PLWH’s retention in care status (R2) and longitudinal change in CD4% (R3). The retention rate of each year gradually decreased from 78.17% to 64.91%. Individuals who did not used CM, who were older, and who used ARV medication, and who were treated at the Harrisburg site were more likely to remain in treatment. When looking at the gains of CD4%, individuals who are White, female, non-Hispanic, who remained in care, who did not use drug, who used ARV medications, and who had a mental health diagnosis achieved more gains in CD4%. Use of CM is also significantly associated with changes in CD4% over time.
CHAPTER 5: DISCUSSION

This chapter presents a discussion of the findings provided in Chapter four. A discussion of results corresponding to three sets of research questions will be presented including characteristics of the sample, and the impact of use of CM and other personal and environmental factors on health outcomes (CD4 percentage and retention in care) over time. Implications for practice and research will also be discussed.

**Characteristics of PLWH who Live in South Central Pennsylvania**

The first research question of this study aims to understand the characteristics of PLWH who receive care at a prominent HIV clinic in south central PA, including demographic characteristics and psychosocial factors. The author compares the sample characteristics with the latest national statistics of CDC (2015) and statewide and regional demographics according to the PA HIV Surveillance Report (PA DOH, 2014). The author also consulted the HIV clinic staff regarding the population they serve.

**Demographic Background**

A comparison of demographic data of the sample, the U.S., and PA, and south central PA is reported in Table 14. According to CDC (2015), the national data shows that the largest HIV diagnosis demographic groups are African American (prevalence rate=49.4/100,000; 44% of total PLWH), whites (prevalence rate=6.1/100,000; 27% of total PLWH), and Hispanics/Latinos (prevalence rate=18.4/100,000; 23% of total PLWH). African American and Hispanic populations account for smaller proportion of the entire general population in the U.S., but have higher prevalence rate, compared to the whites (CDC, 2015). Among the total PLWH in PA, the largest demographic groups are non-Hispanic African Americans (46%), followed by non-Hispanic Whites (38%), and Hispanics (13%). Statewide, the HIV prevalence among the non-
Hispanic African American population was 32 times higher than those who are non-Hispanic White (PA DOH, 2014). However, in the study sample, the African American and Hispanic populations are relatively small (less than 25%) compared to the state and national demographic profiles, which highlights the unique characteristics of this particular semi-rural sample in southwest PA. When compared to the regional demographics of south central PA, the Hispanic population is relatively small (11.22%). The clinic staff stated that this could because they serve a mostly rural population with few ethnic minorities. In addition, racial and ethnic minority populations may be more likely to receive treatment in ethnically diverse urban areas where there are two other healthcare systems that provide HIV care.

Table 15. Comparison of Demographic Data of PLWH

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Sample (%)</th>
<th>SC PA (%)</th>
<th>PA (%)</th>
<th>U.S. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race</td>
<td>White</td>
<td>76.14</td>
<td>48.02</td>
<td>31</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Black/African American</td>
<td>23.58</td>
<td>26.81</td>
<td>49</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>NA</td>
<td>25.17</td>
<td>20</td>
<td>39</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Hispanic</td>
<td>11.22</td>
<td>20.05</td>
<td>15</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Non-Hispanic</td>
<td>88.78</td>
<td>79.95</td>
<td>85</td>
<td>77</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>71.59</td>
<td>71</td>
<td>72</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>28.41</td>
<td>29</td>
<td>28</td>
<td>25</td>
</tr>
<tr>
<td>Exposure Category</td>
<td>MSM</td>
<td>49.64</td>
<td>37</td>
<td>37</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>Heterosexual Contact</td>
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<td>26</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>IDU</td>
<td>7.38</td>
<td>20</td>
<td>26</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>9.41</td>
<td>17</td>
<td>12</td>
<td>2</td>
</tr>
</tbody>
</table>

*Data in PA and south central PA represents total living PLWH by Dec 2014 (PA DOH, 2014)
*Data in U.S represents HIV total HIV diagnosis by Dec 2014 (CDC, 2014)

With respect to gender distribution, nationally, men account for the majority of newly diagnosed PLWH (80%) and 75% of all PLWH are men. Women constitute approximately 20% of the new HIV diagnoses each year and 25% of all PLWH are women (CDC, 2015).
Information regarding transgender individuals diagnosed with HIV was not collected through the national databases; thus, there is no exact number of transgender PLWH (CDC, 2016). In a meta-analysis, the estimated HIV prevalence rate among transgender women was 0.28/100,100 (Baral et al., 2013). In the state of PA, the gender distribution of men is 75% and 25% for women (PA DOH, 2014). The proportion of men (71.59%) and women (28.41%) in the study sample is fairly consistent with the nationwide and statewide demographic profile of PLWH.

Nationally, there is no uniform data on age distribution of PLWH. In PA, the majority of PLWH are between age 30-35 (35%), followed by 20-29 (24%), and 40-49 (24%). In this study, participants’ age in the first quarter of 2012 ranged from 18 to 80, with an average of 45.88, with the majority of individuals in the 30-35 age group. Thus, the age distribution of the sample is consistent with the age distribution on the state level.

Among all the newly diagnosed PLWH in the U.S., the largest HIV transmission categories are men who have sex with men (MSM; 67%), heterosexual contact (25%), and injection drug use (IDU; 6%; CDC, 2015). In PA, the largest transmission group is MSM (37%), followed by heterosexual contact (25%), and IDU (26%; PA DOH, 2014). In this study, the HIV transmission type documented at intake assessments include men who have sex with men (MSM; 49.64%, n=359), heterosexual contact (33.57%, n=242), injection drug use (IDU; 10.94%, n=77), perinatal transmission (0.85%, n=6), others (i.e. hemophilia, coagulation disorders, and receipt of blood transfusion; 2.41%, n=17), and 6.39% (n=45) unknown. The clinic staff reported that since the majority of the patient population is white males, MSM is the most common transmission type. Furthermore, the prevalence of IDU is relatively low in the rural community compared to national and statewide incidence. As individuals who were younger than 18 in the year of 2010
were removed from this dataset, these percentages do not represent the entire clinic population. Overall, however, the proportion of each group is consistent with the national and statewide data.

**Psychosocial Status**

The CDC (2012) states that drug and alcohol use can reduce PLWH’s inhibitions and increase risks of engaging in health-risk behaviors and risk of falling out of care. Substance abuse can also impact HIV treatment and worsen the progression of HIV. It is important to assess PLWH’s drug and alcohol use consistently, in order to identify risk factors that may prevent positive treatment outcomes. Approximately half of the sample reported alcohol use (55.97%), whereas the percentage of reported drug use is relatively low during the same time period (17.05%). There are no statewide statistics of percentages of PLWH who use drugs and alcohol. From earlier research, approximately 53% of PLWH report alcohol use and 8% are categorized as heavy drinkers (Galvan et al., 2002). Injection drug use (IDU) is one of the most substantial HIV transmission risk factors.

Mental health plays an important role in engagement in HIV treatment and care (Pence, 2009). Within this study, 20.03% to 25.43% of the sample identified as having one or more mental health diagnoses within each time interval, and between 13.35% and 17.61% were receiving mental health treatment. Currently, there is no PA statewide data relating to (a) the proportion of PLWH with co-morbid mental health diagnosis and (b) the number of PLWH receiving mental health treatment. In the U.S. approximately 20% to 40% of PLWH report having a mental illness, which is twice more than the general population (USDVA, 2014). The most common diagnoses are depression, PTSD, and anxiety disorder; these diagnoses could be viewed as HIV and mental illness comorbidity (Pence, 2009). Although it is difficult to compare the study participants’ mental health status to others in PA due to lack of available data, the study
sample’s levels of reported mental health concerns appears to be within the lower range of prior research on the national level.

**HIV Treatment Status**

The national data estimates that only 37% of the entire population of PLWH was prescribed ARV (CDC, 2011) and only 30% of PLWH adhere to their ARV medication. In this study, 75.15% of the participants were using ARV medications during the first quarter of 2012, and almost all were continuing on treatment during the first quarter of 2016 (98.15%). This statistic is much higher than that reported in the HIV Continuum of Care statistics (CDC, 2011). The higher percentage of use of ARV medications in this sample may because of the sample selection criteria. First, the sample is drawn from individuals who were already linked to medical care. Second, to be eligible for the study, participants had to be seen at least once within a relatively restricted time frame: January 2014 to March 2016. Therefore, clinic patients who did not use ARV medications may not been seen at all during this time period.

Retention rate in longitudinal studies ranges varied from 42.6% to 75% (Marks et al., 2010; Rebeiro et al., 2013). The variation noted in these studies can be explained by using different retention measures and varied observation periods. Some studies calculated the percentages of individuals who remained in treatment during a 12-month period while some counted the differences of percentages of those who remained in treatment. The most common retention criteria used in studies was the duration between each medical visit. Applying the HRSA standards, if an individual in this study had a medical visit within 180 days (6-month) then he or she was considered to have remained in care. In addition, the current study is not a cohort study and, as a result, this author did not track the retention rate for a specific group. Instead, the retention rate in the current study reflects the percentages of PLWH who remain in care within
the observed time frame. The retention rate in this study gradually dropped from 78.17% in 2012 to 64.91% in 2016. This sample may not capture those who had fallen out of care before the study period. As a result, the true retention rate of PLWH who live in south central PA may be lower than 64.91%.

Use of Case Management

According to the limited available studies, the rates of CM services use among PLWH range from 52.9% to 70% (Johnson et al., 2010; Kushel et al., 2006). However, the criteria of measuring use of CM vary across studies explaining the wide range of outcomes. This study captures individuals who used CM in each quarter-year during the measurement period. CM service use rates were defined as the percentage of individuals who used CM in each quarter-year. The results show that CM services use rates in this study range from 17.61% to 40.78% each quarter-year, representing a relatively small proportion of PLWH seen at this HIV clinic located in south central PA. The clinic staff reported that one potential reason for the small percentage of individuals who used CM could occur because of the referral mechanism. The clinic staff usually refers PLWH to other CM service providers based on individual needs and preferences. Another reason is that many satellite sites do not have HIV case managers onsite so individuals need to be referred to other local service providers. In addition, clinic staff at the satellite sites may not keep the CM records as regularly as the staff at the main site; therefore, it could be difficult to compare the service utilization rate across sites. In conclusion, this study may underestimate the percentage of PLWH who use CM.

Predictors of Use of Case Management

The Research Question 1.c for this study investigated the extent to which personal and contextual factors predicted use of CM services. Having an understanding of who is most likely
to use case management services helps rehabilitation counseling professionals and public health officials to be better able to target effective interventions to improve both retention in care and individual health outcomes. This study shows that individuals who are African American, Hispanic, who were treated at the main treatment site, who did not remain in care, and those who used ARV medications were more likely to use CM. In this section, each of these factors is discussed within the context of the Andersen’s Behavioral Model of Health Services Use.

**Predisposing Factors**

Andersen (1995) defines predisposing factors as conditions individuals are born or live with that are relatively immutable. In this study, predisposing factors that are found significantly associated with use of CM are race and ethnicity. PLWH who are African American and Hispanic were more likely to use CM in this study. Since use of CM is voluntary at the HIV clinic, people who see a case manager are often those who have more service needs. The case manager at the clinic confirmed that this is consistent with his observations. The underlying reason could be related to health disparities among racial minorities. For example, people who are minorities are less likely to access to health insurance and social service programs (NRHA, 2014). Therefore, addressing unique challenges among the racial minority groups could be essential in improving treatment outcomes and retention in care.

Research has shown that there are gender differences of help-seeking behaviors, although the differences vary across cultures. Doherty and Kartalova-O’Doherty (2010) found that women were more likely to seek help from general health practitioner compared to men. There is no significant association between gender and use of CM; however, we can see from percentages that a higher proportion of women used CM (34.18%), compared to men (28.77%). When looking at the association between age and service utilization, Fleishman et al (2012) found that
those aged 40 or older were more likely to use HIV health services versus those aged between 18-29. This study did not demonstrate a statistically significant association between age and use of CM. Similarly, Johnson et al. (2009) did not find any significant association between age and linkage to CM agencies.

**Enabling Factors**

Significant enabling factors associated with use of CM in this study include use of ARV medications and treatment sites. Access to affordable ARV medications continuously could be challenging for many PLWH due to lack of health insurance. In PA, the AIDS Drug Assistance Program (ADAP) is called Special Pharmaceutical Benefits Program (SPBP). PLWH who have an annual income of less than 500% of federal poverty line are eligible to apply for SPBP (HRSA, 2016). Case managers often help PLWH apply for SPBP or other public health insurances. This outcome is consistent with the findings by Freedman (2003) who found that individuals who receive case management services were more likely to be uninsured or publicly insured. In the current study, PLWH who used ARV medications were also more likely to use CM. This result may be because they were more in need in getting access to the SPBP or other insurance payers.

Geographic locations of the treatment site or the types of services provided within the treatment site have been identified as a factor associated with people’s health service utilization. Craw et al. (2008) found that PLWH who received services at the organizations that have HIV clinicians and CM service providers located in the same site were more likely to use CM. This study reveals that PLWH who received services at the main treatment site were also more likely to use CM, compared to other satellite sites. This could because that there is a full time case manager focusing on the HIV population at the main treatment site, and there is usually no case
manager or a shared case manager at other satellite sites. However, the clinic staff suggested that
treatment site is not a good predictor for use of CM in this study since the clinic records may not
be consistent across sites.

Neither drug use or alcohol use are significantly associated with use of CM in this study,
although from the proportion of the population we can tell that those who used drug and alcohol
were less likely to use CM. The clinic staff stated that individuals who have substance abuse
issues might want to avoid confrontation and choose not to use CM services. Johnson et al.
(2010) also found that PLWH who experienced substance abuse issues were less likely to use
CM. It could be easier for people to request assistance for basic needs, such as food and health
insurance, but it could be embarrassing to express needs of substance abuse issues. On the other
hand, PLWH who had severe substance abuse symptoms may experience challenges that prevent
them from seeking help. DiClemente et al. (2008) argue that illegal drug use could prevent
individuals’ use of counseling and other psychosocial services.

**Needs Factors**

Johnson et al. (2010) pointed out that PLWH who are in a disadvantaged status and who
express more basic needs are more likely to request CM services. A Needs factor that is
significantly associated with use of CM in this study is individuals’ retention in care status.
Participants in this study who remained in care were less likely to use CM. This may because
those who were falling out of care often experience more psychosocial needs. The findings in
this study did not show significant effect of mental health diagnosis and mental health treatment
on CM utilization. The results indicate that PLWH who were racial/ethnic minorities and who
were experiencing higher risks of falling out of care were more likely to use CM.
Use of Case Management and Client Outcomes

The second and third set of research questions for this study examined the association between use of CM and client outcomes, including retention in care status and biological health outcomes within the context of the ICF framework. PLWH’s personal and environmental factors that are associated with health outcomes are discussed.

Retention in Care

Retention in care can be seen as “participation” within the ICF framework, as the level of involvement in medical treatment is directly associated with one’s health conditions. According to the ICF, personal and environmental factors influence an individual’s level of participation in certain life areas. The associations of use of CM and other personal and environmental factors and retention in care status found in this study will be discussed.

Use of Case Management and Retention in Care. This study aims to evaluate the association between use of CM and PLWH’s retention in care status. Contrary to the study hypotheses, the results of this study indicate that the use of CM is negatively associated with PLWH’s retention in care status; that is, individuals who did not use CM were more likely to remain in care. This outcome makes sense given the factors associated with use of CM. PLWH who used CM were those who experienced more risks of discontinuing medical treatment, that might be a result of lack of insurance and or other financial crisis. The clinic staff confirmed that PLWH who did not use CM are usually those who had better health status and more stable life conditions; therefore these individuals are more likely to remain in treatment. Another potential reason for the negative association between use of CM and one’s retention in care status is health perception. Individuals who have positive health perceptions may not actively seek help. They may still visit the physician regularly but not the case manager, as they perceived an improved
health status. This dataset does not have self-report information on health perception and psychosocial needs. It could be beneficial to gather information from client perspectives in the future.

Even though helping PLWH remain in care is a primary goal of HIV case management, many CM approaches focus on facilitating rapid linkage to care, as case managers often help PLWH remove barriers that prevent their access to medical treatment. In previous studies, use of CM is significantly associated with short-term linkage to care outcomes but not long-term retention in care (Craw et al., 2008; Metsch et al., 2015). Therefore, the effect of CM could be more salient when looking at short-term effects.

**Influences of Personal and Environmental Factors on Retention in Care.** The ICF emphasizes the impact of personal and environmental factors on one’s health conditions. Professionals need to understand the extent of each factor impacts PLWH’s retention in care status, in order to facilitate optimal long-term outcomes. The factors that are discussed in this section include age, gender, use of ARV medications, use of drug and alcohol, treatment site, and mental health diagnosis. Age is an important factor to consider when looking at one’s engagement in treatment. Fleishman et al. (2005) found that PLWH who were older were more likely to use HIV medical services, and Rebeiro et al. (2013) found that older PLWH had a higher retention rates. When comparing the age groups, Craw et al. (2008) found that PLWH who were 26 to 39 years old and those 40 and older were twice likely to receive HIV medical services, compared to those who were 18 to 25 years old. The results of the current study also show that individuals at older age were more likely to remain in treatment. This result confirms earlier research findings by Craw et al. (2008) who found that young adults experience more risks of falling out of care due to the unstable life conditions, immaturity, and other challenges.
When considering gender differences in retention in care, research studies show different outcomes. Some studies found that males were more likely to engage in HIV treatment (68-74%) (Cook et al., 2009; Fleishman et al., 2012; Howe et al., 2010), whereas Fleishman et al. (2012) found that successful establishment in HIV treatment was more likely to happen for women versus men. Although there is no significant association between gender and retention in care status in this study, women are slightly more likely to remain in treatment (71.1%), compared to men (70.6%). These results are consistent with the finding of use of CM discussed earlier; gender could play a role in help-seeking behaviors and have an impact on participation in treatment activities.

Use of ARV is an important indicator of treatment status. Research shows that PLWH who were actively on ARV treatment also had higher levels of engagement in HIV treatment (Howe et al., 2010; Wilson et al., 2011). The results from this study are consistent with previous research outcomes underscoring that individuals who use ARV medications are more likely to remain in treatment, as medication adherence is an indicator of retention in care.

Drug and alcohol use are often referred to collectively as substance use, which has an impact on individuals’ health outcomes. Rebeiro et al. (2013) found that individuals infected with HIV through IDU had a higher rate of falling out of care compared to other risk groups. Craw et al (2008) found that individuals who did not use non-injection drugs (i.e. cocaine, crack) were more likely to receive medical services in the past three months, compared to those who use injection drugs. Neither drug use nor alcohol use are significantly associated with biological health outcome and retention in care status in the current study. One of the possible reasons is that there were many missing data in the drug and alcohol variable at different time points or individuals did not report their status consistently at each assessment. Many earlier studies found
substance abuse was a significant factor in retention in care (Mugavero et al., 2009; Park et al., 2008). PLWH who received treatment at the more urban satellite site were more likely to remain in care, compared to those who were seen at the main more rural site and other satellite sites. This could because the different geographic location of each satellite site. According to Wilson et al. (2011), individuals who reside in rural or semi-rural areas have lower HIV medical service utilization rate, compared to those in urban areas. The urban satellite site is known to be one of the most urbanized areas in south central PA. Many PLWH may access public transportation to attend their medical appointments. However, those who live in rural areas may lack of access to affordable transportation and then experience greater risk of falling out of care.

As far as the association of mental health diagnoses and health outcomes, studies show different outcomes based on the outcome measures they used. Mellins et al. (2004) conducted a longitudinal study on impact of psychosocial factors on HIV medical treatment outcomes among mothers living with HIV. The results show that those who had psychiatric disorders were more likely to miss HIV medical appointments. Two other studies reveal significant association between psychological distress and retention in care among adolescents living with HIV; those who experienced higher level of psychosocial distress (e.g., psychological distress, experience of abuse, lack of social support) had higher rate of falling out of care (Mizuno et al., 2014; Mutumba et al., 2016). The findings in this study did not show a statistically significant effect of mental health diagnosis and mental health treatment on retention in care status. The clinic staff stated that this may not be an accurate predictor as many individuals did not report their mental health diagnoses at intake or individuals may not receive official diagnoses although they might experience some psychosocial stress. There is still limited research on the association of mental health status and HIV treatment outcomes.
Biological Health Outcomes

Many of the studies that applied the ICF framework used biological indicators to measure client outcomes. In this study, PLWH’s biological health outcome is measured by CD4%, which is the percentage of CD4 cells in one’s blood. From the descriptive statistics, we can see that PLWH’s mean of CD4% gradually increased over the five-year study period. The impact of CM utilization and other factors are discussed in this section.

Use of Case Management and Biological Health Outcomes. This author is also investigated the impact of use of CM on individuals longitudinal changes in CD4%. There are mixed findings in the past research on the association of use of CM on PLWH’s biological health outcomes. For example, Kushel et al. (2006) identified that individuals who used CM consistently achieved more positive improvement of CD4 count over time, while another study by Gardner et al. (2005) did not find any significant difference in changes in viral load between CM group and the control group.

The results of this study show that there is a significant interaction between use of CM and time. In the beginning of the study period (2012 and 2013), those who did not use CM had significantly better health status (higher mean of CD4%), compared to those who used CM. Throughout the five-year study period, the differences of the means of CD4% between those who used and who did not use CM decrease, and by the end of the study, there was no significant difference in the mean CD4 percentage between those who did and did not use CM. Thus, we can say that individuals who used CM had more gains in CD4% over time. This finding shows that the reason why some individuals did not use CM in the beginning may because of their positive health status, which is consistent with the finding discussed earlier. Individuals who
used CM may have been those who had more psychosocial needs and poor initial status; however, they achieved better gains over time when receiving CM services.

In sum, use of CM is negatively associated with PLWH’s retention in care status; however, it is significantly associated with gains in CD4% over time. This may due to those who used CM experienced more risks of falling out of care, but when some of them used CM services, they achieved positive outcomes in CD4%. Therefore CM can be seen as an important component in HIV medical services. The following section describes the client-level factors associated with use of CM, retention in care status, and biological health outcomes.

**Influences of Personal and Environmental Factors on Biological Health Outcomes.**

According to the ICF, both personal and environmental factors could have great impacts on one’s health conditions, including biological health outcomes. Factors that are discussed here include race/ethnicity, gender, use of ARV, retention in care status, and mental health diagnosis.

As discussed earlier, racial/ethnic disparities often contribute to health inequities due to structural barriers, perceived and objective discrimination. Cook et al. (2009) found that PLWH who are African American and Hispanic had fewer HIV medical visits, compared to those who are White. Race and ethnicity are both significant predictors that are associated with the biological health outcome (CD4%) in the current study. Individuals who are White and non-Hispanic achieved more gains of CD4%. This finding shows that PLWH who belong to racial minority groups experience more challenges in treatment adherence, although there is no significant association between race/ethnicity and retention in care in this study. This result is also consistent with the finding related to use of CM: Those who are racial/ethnic minorities were more likely to use CM. Therefore, these participants were experiencing more challenges and less likely to achieve optimal treatment outcomes.
Gender has been identified as a significant predictor of biological outcomes in many studies. In Puskas et al. (2011)’s literature review, 68.2% of the studies that compared HIV treatment adherence by gender found that women were less adherent to treatment than men. Reasons include depressive symptoms, interpersonal relationship, pregnancy, and HIV stigma. The results of the study show that women had more gains in CD4% than men, on average (Puskas et al., 2011). As discussed earlier, women were more likely to remain in care and more likely to use CM due to higher levels of help-seeking behaviors. Therefore, we can say that women achieved overall better health outcomes compared to men in this study.

Similar to the relationship between use of ARV and retention in care, use of ARV medications is also significantly associated with positive biological health outcome. The clinic staff confirmed that it is not surprising that those who used ARV medications achieved more gains in CD4%, as the primary treatment goal of using ARV medications is to increase CD4 count and to reduce viral load.

Retention in care status could be viewed as an outcome indicator and a predictor or biological health outcome. Individuals who remained in care achieved significant gains in CD4%, which indicates that retention in care is a key factor of treatment outcomes, same as use of ARV medications. This is consistent with many earlier studies that demonstrate the effect of retention in care on viral suppression and gains in CD4 count and CD4% (National HIVQUAL, 2011, HIV Research Network, 2012).

Earlier studies identified the negative impacts of mental health diagnosis and substance abuse disorders on biological outcomes with decreased ARV treatment adherence and higher mortality rates (DeLorenze et al., 2011; Stoff et al., 2004). The results of this study are not consistent with these earlier findings; the study shows that those who had a mental health
diagnosis had more gains in CD4%. The clinic staff stated that this could be because those who had mental health diagnoses may be more involved in treatment, including psychiatric treatment and HIV treatment; however, as mentioned earlier, the mental health variable may not be as accurate as the data collection limitations. The staff suggested this author to include the treatment types and level of intensity in the future.

**Practical Implications for Service Providers**

Results of this study can be used to inform best practice for professionals, including case managers, HIV clinicians, and rehabilitation counseling professionals. Recommendations for establishing case manager standards and training requirements, strategies to enhance level collaboration, and implications for rehabilitation counselors are also discussed.

**Case Management as an Essential Service in HIV Care**

As the Health Resources and Service Administration (HRSA, 2013) provides large amount of funding to grantees provide CM to PLWH, it is important to evaluate CM outcomes. In the current study, the positive association between use of CM and long-term biological health outcomes underscores the importance of CM in facilitating desirable outcomes to meet the goals of HIV Care Continuum. As noted in the updated National HIV/AIDS Strategy (NHAS, 2015), providing ongoing CM is identified as a strategy to support comprehensive and person-centered care by addressing PLWH’s basic needs and psychosocial barriers, including housing and domestic violence.

AIDS organizations and community-based organizations should prioritize CM as an essential service when working with PLWH. Many organizations do not have case managers within their HIV clinic or may outsource CM services to other services providers. As the results shown in this study indicate, individuals who received treatment at the main treatment site were
more likely to use CM; thus, providers should consider integrating case managers into their HIV treatment teams and provide in-house CM services.

**Case Manager Qualifications and Training Needs**

The Ryan White Care Act mandates each state to initiate HIV CM services to facilitate service coordination, but left the CM standards to each state. Thus, there is no universal HIV/AIDS case manager credentials or qualifications. Some states (California, New York) and District of Columbia have developed their own standards for case managers who work at organizations that receive Ryan White funding or the state funding. Some of the states establish personnel training requirements and credential/qualification standards for HIV case managers, while some other states do not. The standards often include guidelines for service monitoring and service planning.

There is a growing international movement on the development of case manager standards and accreditations. Establishing required qualifications for HIV case managers is important, as education level and credentialing are also important factors of one’s work performance. The primary purpose of credentialing and certification is to provide assurance to service recipient that service will be delivered by qualified professionals (Chan et al., 2004). Research studies in the field of vocational rehabilitation, nursing, and mental health counseling have shown that level of education and credentialing of professionals have a significant impact on client outcomes (Leahy, 2003). State health departments may establish continuing education requirements for case managers and provide regular training courses in the field.

This study revealed that PLWH who use CM were those who experienced more risks of falling out of care. In addition, PLWH who belong to minority groups were more likely to fall out of care. Therefore, it is important for case managers to assess needs of the diverse
populations and to address those needs using a multicultural approach. In the updated National HIV/AIDS Strategy, one of the recommended strategies to ensure linkage to and retention in care is to strengthen capacity to provide innovative and culturally appropriate interventions to deliver care along the HIV Care Continuum (NHAS, 2015). Reif, Smith, and Golin (2003) noted that adequate training is essential given that many case managers are already providing service coordination to clients with HIV but not properly trained to provide quality services. Shelton et al (2006) conducted HIV case manager focus groups to understand the experiences, challenges, and perceived roles in working with clients with HIV; case managers reported that major challenges included the complexity of client issues, lack of reimbursement for their time spent with clients, and lack of training in the HIV field (Shelton et al., 2006). Copeland et al. (2014) evaluated HIV knowledge and attitudes among 2,166 non-medical HIV professionals using a survey instrument consisting of questions about HIV medical knowledge, transmission risks, and treatment approaches. Copeland et al. (2014) conclude that low knowledge levels among non-medical professionals indicate that HIV/AIDS training and technical assistance are needed. Consequently, case managers need substantial training to address the complex needs of PLWH and each state should establish comprehensive training requirements and guidelines for HIV case managers. Credentialing and standardized practice will enhance the quality of care and facilitate a more systematic HIV/AIDS case management approach.

**Need for an Integrated Service Approach and System Level Collaboration**

Other than the HIV diagnosis, PLWH experience multiple challenges. In the current study, approximately 26% of the sample had a mental health diagnosis, 17% used drug, and 56% used alcohol. Although we do not know the exact numbers of PLWH who had a substance abuse disorder diagnosis, it is likely that the percentage is higher than the general population as shown
in other studies. Other barriers include lack of health insurance, unstable housing status, and unemployment. The data for these variables were incomplete in this study; however, those are all factors attribute to higher risk of falling out of care. An integrated service approach is needed to address these complex issues.

Traditionally, HIV clinics only provide medical services and refer PLWH to other service providers for psychosocial services. To date, an integrated approach is recognized in many disciplines, including mental health services and HIV/AIDS care. Comprehensive integrated services often include HIV testing, medical care, case management services, housing services, HIV education, employment services, counseling services, legal assistance, childcare, and financial assistance. Recent studies have shown that PLWH who received integrated services achieved better outcomes that those who only received medical services (Hoang et al., 2009). Rogers et al. (2013) developed a Service Integration (SI) instrument to test levels of SI among ASOs and the effect of SI scores on client outcomes. The findings show that PWH served by ASOs with higher level of SI were more knowledgeable of HIV, had positive changes in clinical outcomes (CD4 and viral load), and more positive perceived health status (Rogers et al., 2013).

At the system level, lack of collaboration among state and local health departments, correctional facilities, and community-based organizations could result in delayed referrals, increased risk of lost to care, and overlapping service responsibilities. Systematic referral management systems could help monitor the retention in care status of PLWH and facilitate rapid follow-up when individuals are lost to care. Moreover, public systems across disciplines should also collaborate in this effort of addressing multiple needs of PLWH. For example, the state-federal Vocational Rehabilitation system, housing authorities (i.e. Housing Opportunities
for Person with AIDS), and mental health systems should establish local and state level networks to provide better service delivery.

**Implications for Rehabilitation Counseling Professionals**

Rehabilitation counselors are those with graduate level training related to medical and psychosocial aspect of disability, clinical counseling skills, disability policies, and vocational rehabilitation. Unlike other counseling professionals, rehabilitation counselors are trained specifically to work with people with different types of disabilities across lifespan, including physical disabilities, developmental disabilities, mental illness, and chronic illness. As HIV/AIDS is now recognized as a disability and chronic illness rather than a terminal illness, rehabilitation counselors could work with PLWH in many areas, such as employment services, disability management, and health education. PLWH often experience multiple life challenges, and counseling services should be considered as one of the essential services. Gerbert et al. (2006) stated that counseling is one of the most powerful services to address the psychosocial aspects of HIV, which include mental health counseling, risk counseling, medication adherence counseling, and social support.

Rehabilitation counseling professionals could contribute in this workforce as they are trained to work with people with disabilities. Chan et al. (2004) identified seven major functions of rehabilitation counseling professionals: counseling intervention, vocational counseling and consultation, community-based rehabilitation service activities, case management, applied research, assessment, and professional advocacy. Leahy et al. (2010) also identified knowledge and skills domains that rehabilitation counselors need to have, including counseling skills, medical, functional, and environmental applications of disability, and case management. Therefore, rehabilitation counselors can suitably fit into the HIV workforce.
In addition, employment needs and barriers of PLWHA have received greater research interest in the past decade (Belline, 2010; Brooks & Klosinski, 1999; Conyers, 2004; Glenn et al., 2003; Martin et al., 2008). Jung, Schaller, and Belline (2010) found that PLWHA are four to six times less likely to apply for state vocational rehabilitation services, comparing to other people with disabilities. Braveman et al. (2006) stated that the employment needs of PLWHA often include financial, physical and mental health, and training needs. Stable employment has been proved as an important factor that helps improve PLWHA’s physical health and mental health status, the use of substance, and healthy behaviors (Shamburger-Rousseau, 2013). Use of employment services also has an impact on PLWHA’s access to healthcare, job confidence, and reduced HIV stigma (Conyers & Boomer, 2014). Therefore, assisting PLWH to achieve their employment goals is also contributing to the overall health outcomes along the HIV Continuum of Care. Rehabilitation counseling professionals can also apply the ICF framework to identify PLWHA’s barriers and facilitators to employment by considering person and contextual factors. Person factors that could impact career development of PLWHA include HIV status, gender, sexual orientation, and socioeconomic status; contextual factors are environmental influences that impact one’s career development process, such as support systems and gender roles in particular society (Trujillo, 2010). Consequently, graduates from clinical rehabilitation counseling master's program could pursue employment opportunities serving persons with HIV/AIDS and serve as a unique professional who could address complex needs of PLWH.

For rehabilitation counselor educators, it is critical to train prospective rehabilitation counselors with appropriate knowledge and clinical skills that can apply to a variety of populations with disabilities. In 2015, Council for Accreditation of Counseling and Related Educational Programs (CACREP) and Council on Rehabilitation Education (CORE) released the
2016 standards for Clinical Rehabilitation Counseling Master’s programs. These new standards require educators and students in Clinical Rehabilitation Counseling programs to be familiar with rehabilitation services within the continuum of care and to understand the diverse rehabilitation service delivery systems, including case management systems, housing programs, and vocational rehabilitation systems (CACREP, 2015). As a result, rehabilitation counselor educators could help students who are interested in working in the HIV field to become familiar with the service delivery system and how rehabilitation counselors can contribute to promote quality of life among PLWH. Not only educating perspective counselors, rehabilitation counselor educators can also act as consultants or trainers who can train case managers and other services providers in the areas of disability policies, vocational rehabilitation, and so on. In sum, rehabilitation counselors and rehabilitation counselor educators can play important roles in the HIV workforce and can facilitate optimal client outcomes.

Limitations and Implications for Future Research

The purpose is to understand characteristics of a semi-rural sample of PLWH who received services from an HIV clinic and to assess the impact of use of case management services on retention in care and health outcomes. There are several limitations to this study that are important to consider. Limitations of the study are discussed below along with implications for future research.

Statistical Limitations and Future Analytic Approaches

This study used a sample of PLWH who come from the six rural counties of south central PA and received medical services from only one HIV clinic. As a result, study findings cannot generalize beyond this population. African American and Hispanic populations were underrepresented in this sample when compared to state and national data. In addition, based on
statewide data from the PA Department of Health (PA DOH, 2015), other demographic data (i.e., gender, age, transmission group) does not match statewide demographics. The findings describe the unique characteristics and challenges of PLWH from rural counties in south central PA. To get a better understanding of the use and impact of case management services on a statewide level, it would be beneficial to recruit all Part C clinics to obtain data that is more representative of people living with HIV across the state. In addition, this study uses a sample of PLWH who received services during the last two years and analyzed their past five-year medical records retrospectively. As a result, this dataset did not include those who had already discontinued care before the beginning date of January 2012 and may not represent the retention rate of the entire population. Conducting a prospective longitudinal study or using a cohort of PLWH who entered services at the same time and using a survival analysis data analytic approach may help to better identify retention rates and factors associated with lost to care.

Additionally, this is an observational retrospective study using an existing dataset. As a result, PLWH were not randomly assigned into the CM group, but were voluntarily assessed and contacted by case managers. As there is no control group, this study is not designed to control other variables than CM utilization. Therefore, when examining the impact of CM on client outcomes, we could only explain the association between use of CM and outcomes. In future research, we could design a randomly controlled prospective study to investigate direct effect of CM services. Intervention groups could include those receiving basic CM services or intensive CM intervention to allow us to investigate more aspects of case management such as comparing the effectiveness these different CM approaches to make additional contributions to the research in this area.
Furthermore, many of the participants were engaged in CM services at a single time point and not using any CM service at another time. This study did not capture the patterns of PLWH who transitioned in and out of CM services, and the patterns of those who remained in care or fell out of care. To address this issues, future research could apply Latent Class Analysis (LCA) to categorize PLWH into different groups (consistent CM, intermittent CM, and no CM utilization groups) to examine the treatment outcomes among those groups (Kushel et al., 2006).

Finally, this study did to especially categorize types of CM services provided to PLWH. CM services provided in this study were very diverse. Some participants may only visit a case manager to complete initial intake assessments or when they need financial assistance while others visit case managers regularly for more intensive psychosocial needs. Furthermore some of the communications were done by phone, while some were conducted in person. In addition, this HIV clinic does not use any standardized intake assessment for CM services. Therefore, case management notes become the only source of CM in the record. Future research could include coding the CM notes and to quantify some of the qualitative data and incorporating qualitative data analysis of case management notes to provide a more in depth understanding of the quality and extent of services provided.

Future Research Areas

Additional gaps in case management research exist that are beyond the scope of this study. This study provides a foundation for future research relating to unmet needs of PLWH that prevent linkage to and retention in care, social determinants of health, and training needs of professionals.

Assessing Unmet Needs that Prevent Retention in Care. Results from this study reveal that many personal and environmental factors are barriers to retention in care, including
demographic background, CM utilization, and use of ARV medications. One of the limitations of this study is the incompleteness of the psychosocial data. PLWH’s educational background, poverty level, employment status were not complete in the current dataset as some variables were only assessed at intake. Assessing unmet needs that prevent PLWH from remaining in care can help professionals understand clients’ pressing needs and underlying risks of falling out of care. Unmet needs often include housing needs, financial needs, and employment needs; these need assessments are not typically included during regular medical visit.

Using a standardized unmet needs assessment instrument would benefit clinical practice and research. Currently, each HIV clinic uses its own medical record system and unmet needs assessment; this practice creates difficulties for communications, referrals, and research. HRSA (2013) mandates HIV clinics and other providers who receive Ryan White Part B funding to document PLWH’s CM plans in every six months. It would be beneficial for HIV clinics to incorporate the unmet needs assessment questionnaire into a six-months reassessment, as clinicians and case managers can quickly identify potential risks of each individual.

In future research, it would be important to assess these unmet needs repeatedly in order to capture their longitudinal influences on individuals’ health outcomes. For example, if an individual’s employment status was assessed every six months, researchers could identify patterns of the changes and examine the influences of the changes in employment status on health outcomes. Unmet needs assessment can also be used to identify the impact of social determinants of health on health service utilization. Client-level factors are categorized as predisposing, enabling, and needs factors based on Andersen’s Behavioral Model in this study. This model is primary used to conceptualize health service utilization; however, the predisposing factors can also be considered as social determinants of health. According to World Health
Organization (WHO, 2012), social determinants of health refer to individual conditions that could lead to health inequities. Assessing how each factor associated with use of health services individually or in relation to other factors could help service providers and policy makers understand how to reduce inequities.

**Assessing Professional Competencies and Training Needs.** Little research has been done to examine the outcome of HIV case management services, as well as competencies and training needs of case managers. A non-medical workforce survey shows that the levels of HIV knowledge among service providers are generally low (Copeland et al., 2015). Shelton et al. (2006) notes that case managers are well positioned to support retention in care, but need more training and education in the HIV field.

Levels of knowledge and self-efficacy can impact professionals’ quality of work in serving PLWH. According to the Social Cognitive Career Theory (SCCT; Lent, Brown, & Hackett, 1994), one’s vocational behaviors and work performance are influenced by his or her self-efficacy, cognitive ability, interests, outcome expectations, and contextual factors. Mitchell and Linsk (2001) stated that the levels of counselors’ self-efficacy have a significant impact on clients’ clinical outcomes. McCarlth (2013) also found that rehabilitation counselors’ levels of self-efficacy for counseling skills and case management skills are indicators of successful client outcomes. As a result, it is important to assess professionals’ current levels of competencies in order to understand their training needs and to provide adequate training.

In future research, researchers can apply SCCT to assess professionals’ level of competencies by assessing their self-efficacy, knowledge, and specific clinical skills (i.e. counseling skills and case management skills). Target populations can depend on the service contexts. Studies can be done in HIV clinics to assess case managers’ competencies in multiple
areas, including employment services and mental health services. This approach can also be used to assess level of competencies associated with working with PLWH among rehabilitation counselors who work for the state-federal vocational rehabilitation system. Understanding levels of competencies among professionals in different discipline could help researchers and stakeholders provide adequate trainings to professionals.

**Conclusion**

This retrospective five-year longitudinal study aims to a) understand the characteristics of PLWH who live in south central PA, including factors associated with CM utilization and b) use the Andersen’s model to identify factors associated with CM utilization, and c) apply the ICF framework to examine the associations between CM utilization and biological health outcomes and retention in care status. This study reveals that the African American and Hispanic populations living with HIV are underrepresented in this semi-rural area of south central PA. While only a small proportion of the PLWH used CM services, if used, there are positive outcomes associated with CM services. Individuals who are racial/ethnic minorities, and who did not remain in care were more likely to use CM. Results also show that CM utilization is negatively associated with retention in care status. These findings indicate that PLWH who experience higher risk of falling out of care need CM services. Case managers and rehabilitation professionals need to be trained to work with PLWH from disadvantaged groups using a multicultural counseling approach. Rehabilitation professionals, including undergraduate level professionals and graduate level rehabilitation counselors can contribute in the HIV workforce as they are trained to address medical and psychosocial issues of people with disabilities.

CM utilization is positively associated with optimal medical treatment outcomes. It is important for service providers to actively incorporate CM as an essential service in an integrated
treatment team in order to meet the goals of HIV Care Continuum. Personal and environmental factors associated with biological health outcomes and retention in care were also identified. Individuals who are younger and racial/ethnic minorities were less likely to engage in care. The Andersen Behavioral Model acknowledges that certain populations (e.g., racial minorities, homeless, people with mental illness) may face specific vulnerabilities and competing needs that may lead to significant barriers in accessing and maintaining medical services. Therefore, it is critical to provide training to case managers and rehabilitation professionals to meet PLWH’s complex needs.

Assessing levels of competencies and training needs among professionals could help to establish qualifications and training requirements for professionals who work with this population. System level collaboration and multidisciplinary approaches need to be applied to address the complex issues among PLWH. A standardized unmet needs assessment could be used in both practice and research to assess individual and structural barriers to retention in care. Practitioners and researchers should work closely to develop a systematic plan to assess individuals’ needs consistently, in order to understand the overall scope of service needs and to develop a better service framework for PLWH.
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