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Gaps in Ancillary Services among HIV-infected Substance Using Ryan-White Recipients in Los Angeles County

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Gaps in Ancillary Services among HIV-infected Substance Using Ryan-White Recipients

in Los Angeles County

A dissertation submitted in partial satisfaction of the

requirements for the degree Doctor of Philosophy

in Public Health

by

Rhodri David Dierst-Davies

2015

ABSTRACT OF THE DISSERTATION

Gaps in Ancillary Services among HIV-infected Substance Using Ryan-White Recipients

in Los Angeles County

by

Rhodri David Dierst-Davies

Doctor of Philosophy in Public Health

University of California, Los Angeles, 2015

Professor Linda Bourque, Chair

Substance use among HIV-infected individuals is strongly correlated with increased morbidity and mortality, with four out of ten AIDS deaths directly related to substance abuse nationally. Historically, lower income HIV-infected persons in the United States access needed services through programs funded by the Ryan White (RW) Care Act, which acts as the "payer of last resort" for primary medical and ancillary service needs. This study examines the effects of substance use on ancillary service gaps (calculated as the difference between needed and received services) among a representative sample of RW recipients in Los Angeles County, California. The four aims were to: 1) describe the socio-demographic and service utilization characteristics of the population, 2) describe the role substance use plays in predicting service gaps, 3) investigate the role both stimulant use, and increased number of substances used, played at predicting service gaps among substance users and 4) investigate if newly identified service gap clusters differed by substance use behavior. Data from the 2011 Los Angeles Coordinated HIV/AIDS Needs Assessment (LACHNA) was utilized. Applied

Individual levels weighting adjusted the effective sample size from 400 to 18,951 persons, similar to the 19,915 RW recipients in the system during the surveillance period. Among this sample 30% (119 unweighted, 5,743 weighted) reported recent substance use. Outcome measures of interest included the presence of service gaps (logistic regression) and the number of service gaps reported (Poisson regression). Comparisons of service utilization and socio-demographics characteristics between substance users and non-users revealed important differences in not only the number of gaps reported, but by age, gender and employment status as well. A series of logistic regression analysis revealed a consistent elevated risk of reporting a service gap (RR range: 2.87-3.45) among substance users. A secondary Poisson regression revealed risks among substance users for reporting an additional gap was less robust (RR range: 0.89-1.30). Among substance users those reporting both stimulant user (RR range: 1.54-1.75) and increased number of substances used (RR range: 1.32-1.56) were at similar increased risks for reporting additional service gaps. Substance users also reported increased needs for services related to secondary medical support (e.g., oral health and psychiatric services) as well as financial and housing assistance (e.g., section 8 housing and emergency shelter). Additionally, increased risks were also reported for those with current mental health conditions, female substance users and those reporting past lapses in care across multiple groups and models. These finding suggest that Ryan White providers should expand dissemination of available services system wide, as well as target interventions to specific populations not receiving adequate support services. This will ensure recipients are able to obtain the full spectrum of eligible services.

The dissertation of Rhodri David Dierst-Davies is approved.

Chandra Ford

Marjorie Kagawa-Singer

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University of California, Los Angeles

2015

This dissertation is dedicated to both my father Dr John Tudor Davies who I miss every day, and my husband Jeremy David Bailey whose enduring love and support are the source of my strength and confidence.

To my sisters, mother and extended family, who knew I could do it even when I didn't.

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ACKNOWLEDGEMENTS

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EDUCATION

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REPORTS

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CHAPTER 1: INTRODUCTION

Drug abuse continues to be a significant risk factor for HIV in the United States (NIH/NIDA, 2005). It is estimated that about one third of all HIV infections can be either directly or indirectly related to drug abuse both nationally and internationally (WHO, UNAIDS & UNICEF, 2011; NIH/NIDA, 2005). Additionally, four out of ten AIDS deaths can be directly related to substance abuse nationally (NIH/NIDA, 2005). Substance abuse is not only an important co-factor in both HIV risk behaviors, but has significant implications for those infected (WHO, UNAIDS & UNICEF, 2011). While a large body of research has investigated the role of substance use as a risk factor for HIV (Shoptaw, Montgomery, Williams, El-Bassel, Aramrattana, Metsch, 2013; Koblin, Husnik, Colfax, 2006), less has been dedicated to its role in disease sequelae (Hall, McDavid, Ling, Sloggett, 2006).

In July of 2010, four months after the Affordable Care Act was signed into law, the United States government issued its first-ever National HIV/AIDS Strategy and Implementation Plan (White House, 2010a, b), with Its three main goals being to:

1. Reduce new HIV infections;

2. Increase access to care and optimize health outcomes; and

3. Reduce HIV-related disparities and health inequities.

Research aimed at understanding barriers to achieving these goals has important implications in better realizing these goals.

Lower income HIV-infected persons in the United States access many services through programs funded by the Ryan White (RW) Care Act. RW acts as the "payer of last resort" nationally and supports all primary medical and ancillary service needs, including housing, nutritional support, substance abuse treatment and medication assistance. Originally this program was intended to fund direct medical services, but it

has been expanded to fund other forms of support services (Parham, Conviser, 2002).

The rationale for such an expansion was best described by Aday (2002) who stated;

> "…ancillary services (such as case management, substance abuse treatment, and housing or transportation assistance, for example) are essential to addressing the multi-problem non-medical or coordinative care needs of persons living with HIV/AIDS that might compromise the ability of HIV/AIDS patients to effectively initiate or remain in complex drug treatment regimens that may have serious associated side effects and require routinized medical monitoring and follow-up." (pg. S133-134)

Evidence has shown a positive association between receiving RW funded ancillary services and the use of primary medical care (Ashman, Conviser, Pounds, 2002; Chan, Absher, Sabatier, 2002; Conover & Whetten-Goldstein, 2002; Messeri, Abramson, Aidala, Lee, Lee, 2002; Sherer, Stieglitz, Narra, Jasek, Green, Moore, 2002; Shapiro, Morton, McCaffrey, Senterfitt, Fleishman, Perlman, 1999a). Specifically, individuals with provider-identified substance abuse/dependence receiving substance abuse treatment services had a 2.6 increased odds of obtaining primary medical care and a 50% increased odds of being retained in care compared to substance dependent individuals not receiving treatment (Ashman el al. 2002). Additionally, Chan et al. (2002) demonstrated Ryan White recipients receiving a high volume of ancillary service visits (mean=13.4) were significantly more likely to both attend and be retained in primary medical care compared to individuals who received fewer service visits (mean=8.2) during a 12 month period. Though there is no uniform definition of what exactly constitutes ancillary services, for the purposes of this investigation ancillary services are being broadly defined as any non-medical type of support service. This would encompass case management, food/transportation services and certain types of medical services such as oral health care and psychiatric services. A list of Ryan White funded services offered in Los Angeles County can be found in appendix A.

The purpose of this investigation is to better understand the central role that substance use has in predicting access to ancillary services among HIV-infected Ryan White recipients in Los Angeles County, California. How substance use characteristics affect the number of reported service gaps will also be explored. A service gap is identified when a participant reports needing a service but does not report they received it (Kahn, Janney, Franks, 2003). Finally, factor analysis was used to identify specific clusters of services that substance-using participants tend to report gaps for. A better understanding of the role substance use plays with respect to gaps of available ancillary social service is an important step in better realizing the goals of the National HIV/AIDS Strategy.

Four theoretical models and frameworks were used to support this work. Social Learning Theory (Bandura, 1963; 1971) has long been used to explain substance use behaviors and outcomes. The Information-Motivation-Behavior Change Theory (Fischer, Fischer, Bryan, Misovich, 1992) has been shown to effectively describe barriers to behavior change among substance users. Finally, theoretical frameworks describing health care utilization among marginalized populations are based on works by Ronald Andersen (Andersen, 1968; 1995) and Lilian Gelberg (Gelberg, Andersen, Leake, 2000). Combined, these theoretical perspectives will assist in a critical examination of both the analytical model and research results.

Social Learning Theory (SLC) posits that learning is a social process, as opposed to being exclusively reinforcement based, and can be used to explain both the development of, and modifications to, human behaviors (Bandura, 1963); or put another way,

> "...psychological functioning involves a continuous reciprocal interaction between behavior and its controlling conditions. Early attempts to incorporate both individual and environmental determinants in personality theory simply depicted behaviors as caused by these two sets of influences…In this two-way causal process the environment is

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just as influenceable as the behavior it controls." (Bandura, 1971, pg 39-40)

Aspects of SLC have long been used to explain multiple aspects of substance use behavior, including initiation/experimentation (Moos, 2007a; Akers, Lee, 1996; Akers, Krohn, Lanza-Kaduce, Radosevich, 1979), reinforcement (Akers, Krohn, Lanza-Kaduce, Radosevich,1979), and treatment outcomes (Moos, 2007a; Moos, 2007b, Akers, Krohn, Lanza-Kaduce, Radosevich, 1979; Bandura, 1997; Des Jarlais, Friedman, 1988).

Key aspects of SLC are incorporated in the Information Motivation Behavior Skills (IMBS) model, which posits that well-informed and motivated individuals with appropriate skills are more likely to engage in new behaviors (Fisher et al., 2002; Fisher & Fisher, 2000). Interventions based on IMBS principles have been shown to affect behaviors such as substance use (Kalichman, Malow, Devieux, Stein, Peidman, 2005), condom use (Song, Calsyn, Doyle, Dierst-Davies, Chen, Sorensen, 2009), sexual risk behaviors (Cornman, Schmiege, Bryan, Benziger, Fischer, 2007), as well as medication (Amico, Barta, Konkle-Parker, Fisher, Cornman, Shuper, Fisher, 2009) and primary care adherence (Konkle-Parker, Amico, Henderson, 2011) among both HIV-infected person and HIV substance users specifically.

Andersen (1968) developed the first widely accepted conceptual model of health care utilization, known as the *Behavioral Model of Health Service Use.* Since its development, it has been revised several times to accommodate both criticism and scientific advances in behavioral sciences (Andersen, 1995). Gelberg, Andersen & Leake (2000) expanded key aspects of this model to better account for and predict health utilization by vulnerable populations, specifically the homeless. Together, these two researchers have created models that attempt to explain how individual and structural factors (described as population characteristics) affect health care utilization (mostly primary medical care). These models have been widely used in research to

explain and predict health behaviors relative to clinical settings (Phillips, Morrison, Andersen, Aday,1998; Bradley, McGraw, Curry, Buckser, King, Kasl, Andersen, 2002; Burnam, Bing, Morton, Sherbourne, Fleishman, London, 2001; Evashwich, Rowe, Diehr, Branch, 1984).

Despite this extensive body of work, very little has been done to examine factors associated with ancillary service gaps independent of primary medical care utilization. This work will investigate the focal relationship between substance use and reporting a gap in ancillary social services among a sample of HIV-infected RW recipients in Los Angeles County (LAC). Specifically, the independent effects that substance use plays in reporting an ancillary service gap (herein know as service gaps) was explored. The main research questions to be examined are as follows.

1. Is substance use associated with a greater need for, but less utilization of, RW funded services; leading to substance users reporting more ancillary services gaps?

2. Does substance use independently predict reporting of social service gaps among HIV-infected RW recipients?

3. Among HIV-infected substance using RW recipients, is both the number of substances used and type of substance associated with an increased number of service gaps?

4. Among a sample of RW recipients, are there subgroups of services for which substance users are more likely to report gaps?

This proposed investigation will use data from the 2011 Los Angeles Coordinated HIV/AIDS Needs Assessment Care survey (LACHAN-Care; DHSP/LACC, 2011). This dataset consists of 400 HIV-infected LAC residents receiving RW funded services. The LAC Commission on HIV and the Los Angeles County Department of Public Health, Division of HIV and STD Programs conducted this survey between January and July,

2011. This study represents the fifth iteration of this needs assessment conducted by the LAC Commission on HIV. A probability based, two-stage proportional-to-size sampling method was used to identify a representative sample of RW recipients (Blair, McNaghten, Frazier, Skarbinski, Huang, Heffelfinger, 2007; McNaghten, Wolfe, Onorato, 2007). The Centers for Disease Control (CDC) assisted in the weighting of this sample. The addition of participant level weights transformed this dataset from 400 participants to 18,951 a fair approximation of the 19,915 HIV-infected RW recipients in LAC during the surveillance period (DHSP, 2013).

This investigation will use a combination of statistical techniques to conduct the analysis. Initially, descriptive statistics compared the socio-demographic and service utilization characteristics of the substance users and non-users within the sample of HIV-infected respondents. A combination of statistical tests (ANOVA, t-tests and risk ratios) will assist in a better understanding of the focal relationships between substance use (independent variable) and reporting a social service gap (dependent variable). Risk ratios derived from both logistic and Poission regression analyses of weighted data were used to explore the focal relationship (Barros, Hirakata, 2003; Greenland, 1987; Stromberg, 1994, 1995; Thompson, Myers, Kriebel, 1998). The effect of important control (predisposing characteristics and enabling resources) and rival independent variables will also be explored to better understand the strength of the focal relationship (Aneshensel, 2013).

To better understand the relationship between associated risks of reporting ancillary service gaps, the moderating effects of barrier type reported by recipients was explored. This will involve conducting stratified analysis. This will lead to a better understating of why certain groups may be associated with either increased or decreased risks of reporting gaps in services.

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Finally, exploratory factor analysis helps identify important clusters of service gaps reported by respondents (Afifi, Clark, May, 2004). Then, factor scores were used to determine if substance users have a higher likelihood of reporting gaps for specific clusters identified compared to non-substance users in the sample. Not only will these clusters yield important groupings of service gaps previously unidentified, but will reveal if substance users report similar types of service gaps compared to their non-substance using counterparts. Unless otherwise specified, standard cutoff values ($p<0.05$) were used to determine significance. Also, means are presented with variances and risk ratios are accompanied by 95% confidence limits to determine precision.

This work may have several positive implications. First, it will add to the body of existing literature by creating a better understanding of the central role that substance use plays in ancillary service gaps among RW recipients. It will increase our understanding of the factors that moderate this relationship among all respondents and a subsample of substance users specifically. Also, it may inform how future RW needs assessments may incorporate important theoretical elements into existing surveys, which would offer the potential for more explanatory analyses with respect to understanding important service delivery disparities. Finally, these results will allow researchers and policy makers to develop strategies for better streamlining, targeting and enhancing HIV health care and service delivery in the United States, a stated goal of the 2010 HIV Policy and Implementation Plan (White House, 2010). Also, as RW funding is changing with the implementation of the Affordable Care Act (ACA), this work offers an important baseline measure to which future needs assessments of service delivery mechanisms can be compared (Rosenbaum, 2010).

SECTION 2: OBJECTIVES, SPECIFIC AIMS AND RESEARCH QUESTIONS

The main objective of this dissertation is to explore the central role of substance use (amphetamine/methamphetamine, cocaine/crack, heroin and marijuana) and how it affects the likelihood of reporting ancillary service gaps among a sample of HIV-infected Ryan White (RW) recipients in Los Angeles County (LAC). This objective was achieved through the following specific aims and their related research questions:

Aim 1

To describe the socio-demographic and service utilization characteristics of Los Angeles Coordinated Needs Assessment Care study (LACHNA-Care) survey respondents.

To address this aim, the following research questions were identified:

1. How do socio-demographic characteristics of survey participants compare to the entire Ryan White population?

2. What are the service utilization characteristics of this sample, including respondents awareness of services, service needs, utilization of services, and the extent to which respondents reported needing services that they did not receive (i.e., service gaps).

3. What are the differences between LAHCAN respondents who report ancillary service gaps compared to those who don't?

4. Do both the aforementioned socio-demographic and service utilization characteristics differ between substance users and non-substance users?

This aim describes socio-demographic and service utilization characteristics of LACHNA respondents, and explores differences that may exist between substance users and non-substance users. First, socio-demographic characteristics were compared to the general RW population during the surveillance period to determine the representativeness of the sample (DHSP, 2013). In addition, service utilization characteristics (including awareness, need, utilization and service gaps) for all 47 Ryan White-funded services available to LAC residents were described. This descriptive analysis will provide insights into how services are utilized by respondents.

Once completed, the extent to which substance users differ from non-substance users with respect to the aforementioned socio-demographic and service utilization characteristics were explored. This approach helped identify if substance users were a unique subgroup within this sample and therefore in need of further study. Finally, a comparison of LACHNA participants who reported ancillary service gaps vs. those who didn't was undertaken. This question was used to justify if Poisson regression should also be undertaken, in addition to Logistic regression, to determine if certain factors are associated with the number of service gaps reported for both the entire LACHNA sample as well as among substance users specifically.

Aim 2

To examine whether substance use plays a central role relative to reporting an ancillary service gap among a representative sample of RW recipients in LAC.

To address this aim the following research questions were identified:

1. Is substance use associated with reporting a service gap among respondents?
2. Is the strength of this relationship altered with the introduction of other competing variables (potential confounders and rival independent variables)?

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3. Is this relationship moderated by the type of barriers a respondent reports?

This aim examines the main focal relationship between ancillary service gaps and substance use. Multiple methods (correlation analysis, logistic regression and Poisson regression) will examine how substance use (independent or predictor variables) influence service gaps, the dependent (outcome) variable of interest. Risk ratios derived from logistic and Poisson regression analyses are reported, as these results tend to be more stable than odds ratios when conducting analyses with weighted cross-sectional data (Stromberg, 1994, 1995; Thompson 1998).

Once this focal relationship was established, the strength of this relationship was tested with the addition of several control variables (e.g., potential confounders and other variables representing potential spuriousness), and rival independent variables (constructs previously shown to affect this outcome of interest from similar research).

Finally, the moderating effects of the type of barrier a respondent reporting was tested against the full model. A complete list of variables tested is discussed in section Five. This analysis would establish that substance use represents a unique and independent association with reported ancillary service gaps.

Two separate analyses were conducted to answer this question; logistic regression analysis will focus on factors associated with reporting any service gap, then Poisson regression to examine factors associated with reporting an increased number of gaps. Analysis was restricted to those who reported a gap to allow for analysis by the moderator (barrier type).

<u>**Aim 3**</u>

To analyze the effects that both type and number of substance use have on the number of reported service gaps among the subset of substance users.

This aim addresses the following research questions:

1. Does use of stimulants (vs. other substances) affect the number of service gaps reported among substance users specifically?

2. Does the number of substances used affect the number of service gaps reported?

This aim examined the effects of both the type of substance used (i.e., stimulants), and the number of substances used, had on the number of reported service gaps among the subset of substance users. This aim represented what has been described as a conditional relationship (Aneshensel, 2013), as it involved analyses on only substance users in the sample. Among HIV-infected substance users, stimulant use (methamphetamines specifically) are well documented as a driver of continued HIV risk and disease progression (Landovitz, Fletcher, Inzhakova, Lake, Shoptaw, Reback, 2012). A recent meta-analysis revealed that non-injection substance use increased disease progression indirectly by affecting ART adherence, immune function and deterioration in general health (Kipp, Desruisseau, Qian, 2011). Despite these results, the role that stimulants specifically play as a predictor of service gaps is unclear. Poisson regression was used to establish the association between stimulant use and the number of service gaps reported.

Additionally, the association between the number of substances respondents reported using (range: 1-5) and the number of service gaps reported was explored. This aim establishes whether factors such as type and number substances used plays an

important role in moderating the number of gaps reported by substance users.

Aim 4

To determine if substance users and non-users identify similar clusters of service gaps.

This aim addresses the following research questions:
1. Are there specific clusters of service gaps reported by respondents?
2. Do substance users have a greater probability of reporting gaps for certain clusters of services compared to non-substance users?

This aim examined if substance using respondents had a similar probability of reporting gaps for services compared to non-substance users. First, exploratory factor analysis was conducted to determine if naturally occurring groups (or clusters) of service gaps existed. Once established, factor scores were generated for each new cluster identified. These scores were used to determine of substance users (compared to non-users) had a greater likelihood of reporting gaps for newly identified clusters. This aim not only assists in understanding what types of services gaps are reported for by RW recipients generally, but also how these patterns may differ for substance user. It also has important policy implications for how services for substance users may be allocated to maximize benefit for recipients.

CHAPTER 3: BACKGROUND AND LITERATURE REVIEW

Epidemiology of HIV:

      Current figures estimate that there are 34 million HIV-infected persons worldwide (WHO, UNAIDS & UNICEF 2011). While the worldwide prevalence has risen over the past decade, the incidence of new cases has plateaued at 2.7 million since 2007 (WHO, UNAIDS & UNICEF 2011). Causes for the overall increase in cases despite a stable incidence rate is due to the increased global availability of antiretroviral (ART) medications leading to a decrease in death rates (WHO, UNAIDS & UNICEF 2011). In the United States, the CDC estimates that 1.2 million residents are HIV-infected (CDC, 2014).

      LAC is one of the largest counties in the U.S. It is also home to the second largest number of persons living with HIV/AIDS in an urban jurisdiction in the U.S. (CDC 2012; DHSP, 2013). As of December 2012, there are an estimated 45,474 HIV-infected persons living in LAC (DHSP 2012), with approximately 45% of these persons receiving some sort of RW funded service (N=19,195). In LAC, RW allocations fund a wide range of services that include oral health, HIV clinical care, psycho-social case management, residential care, transportation services, substance abuse treatment and nutritional support. In LAC, the population receiving RW services is predominantly male (85%), 40 years of age or older (66%), Latino(a) (48%), living at or below the federal poverty guidelines (66%) and report having no health insurance (62%) (DHSP 2012).

Epidemiology of Substance Abuse:

      Globally, among persons aged 15-64 years old, substance abuse (including alcohol) accounted for 5.4% of the annual disease burden (mostly among men), which translates to approximately 39 deaths per 100,000 (WHO, 2010; WHO, 2011). The most commonly abused substance globally is alcohol, which accounts for 35 of the 39 deaths per 100,000 with the remaining four deaths accounted for by all remaining illicit

substances combined. It is estimated that globally 4.3% to 6.3% of the global population used illicit substances in 2007 (WHO, 2010; WHO, 2011; UNODC, 2009). The most commonly used illicit substance globally is marijuana (annual prevalence rate of 2.8-4.5%) followed by amphetamine-type stimulants (0.3-1.3%), opiates (0.5-0.8%) and cocaine (0.3-0.5%; WHO, 2010; WHO, 2011; UNODC, 2009). According to the WHO, while the actual number of substance users has increased globally since the 1990's, the prevalence rate has remained relatively constant (~5%) for over a decade (WHO, 2011). They also estimate that the number of problem drug users is also relatively stable (0.4%) but admit there is no uniform definition for this category (WHO, 2011).

In the United States, 8.7% of the population is estimated to be drug dependent according to DSM-IV criteria (SAMHSA, 2011). As with results globally, the greatest burden for disease is from alcohol use. In the United States, 8.9% of persons over 12 years old reported using an illicit substance (i.e., marijuana, cocaine, heroin, hallucinogens, inhalants, non-medical prescription pain relievers[a], tranquilizers[a], stimulants[a], and sedatives[a]) in 2009 (CDC, 2011). The most commonly reported illicit substance of use was marijuana (6.9% of population) and rates of use have been increasing since 2007 (WHO, 2011; SAMHSA, 2011; CDC, 2011). Unlike the global estimates, in the United States the second greatest source of illicit substance use was reported for psychotherapeutics (2.7%), followed by cocaine/crack (0.6%), hallucinogens[b] (0.5%), inhalants[c] (0.3%) and heroin (0.1%). Looking at psychotherapeutics specifically, the use of methamphetamines was reported by only <0.1% and has been dropping since 2005 (SAMHSA, 2011; CDC, 2011). The majority of abuse in this category is from the unregulated use of non-prescription painkillers such as

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[a] These categories cover numerous prescription type medications that survey respondents identified using for non-medical purposes. Stimulants also include amphetamine and methamphetamines. Combined category known as psychotherapeutics.
[b] Includes: LSD, PCP, peyote, mescaline, psilocybin mushrooms, and "Ecstasy" (MDMA)
[c] Includes: nitrous oxide, amyl nitrite, cleaning fluids, gasoline, spray paint, other aerosol sprays, and glue

vicodin (2.0%). This fact highlights the increased use of prescription drugs for non-medical purposes as a growing problem in the United States (Compton, Volkow, 2006). In LAC specifically, 15.4% of adult residents report binge drinking behavior, and 5.2% report misusing prescription drugs in the past year (LACDPH-KIH, 2013; LACDPH-SAPSE, 2013).

<u>HIV-infected Substance Users and Health Outcomes</u>

Multiple studies have observed high rates of substance use among HIV-infected populations (Mimiaga, Reisner, Grasso, Crane, Safren, Kitahata, 2013; Golin, Marks, Wright, Gerkovich, Tien, Patel et al., 2009; Chander, Himelhoch, Moore, 2006). Additionally, increased morbidity and mortality has been linked to substance use disorders among HIV-infected persons (Green & Feinstein, 2012; Krishnan, Wickersham, Chitsaz, Springer, Jordon, Zaller, Altice, 2013; Korthuis, Fiellin, McGinnis, Skanderson, Justice, Gordon, 2012; Shoptaw, Stall, Bordon, Kao, Cox, Li, 2012; Altice, Bruce, Hobbs, Lum, Korthuis, Flanigan, 2011; Kipp, Desruisseau, Qian, 2011). Substance use has been shown to affect both ART adherence and clinical care, which in turn have profound effects on viral replication, immune function, infectivity, disease progression, community viral load and mortality (Gonzalez, Barines, O'Cleirigh, 2011; Consortium, W.T.S, 2009; Hinkins, Barclay, Castellon, Levine, Durvasula, Marion, 2006). Early and consistent adherence to an ART regiment lead to significant decreases in negative biological effects from HIV disease, as well as a 96% reduction of partner seroconversion risk (Cohen, McCauley, Gamble, 2012; HTPN-052 Fact Sheet, 2012).

A review of barriers to ART adherence cite substance abuse as a significant factor (Sankelowski, Voils, Chang, Lee, 2009; Hinkins et al. 2006). Additionally, a study of HIV-infected injection drug use (IDU) found that factors such as housing, medical insurance and interactions with health-care workers affected ART adherence (Malta, Magnanini, Strathdee, Bastos, 2010). Methamphetamine use, specifically, has also been

associated with decreased medication adherence among men who have sex with men (MSM) seeking emergency post-exposure prophylaxis (PEP) treatment (Landovitz et al., 2012). A qualitative analysis of HIV-infected methamphetamine abusing gay men in Los Angeles found that reasons for unplanned, non-adherence were irregular schedules and sleep patterns, being high, eating difficulties due to dehydration and reduced appetite (Reback, Larkins, Shoptaw, 2003). This demonstrates that substance use is a significant roadblock to ART medication adherence, affecting the health of HIV-infected individuals.

With respect to medical care, substance use affects the number and frequency of HIV medical care visits (Giordano, Gifford, White, 2007). According to Health Resources and Services Administration (HRSA) guidelines, HIV-infected patients who receive two medical visits a year (at least three months apart) where routine tests such as CD4 and viral load are performed are considered to be in regular HIV medical care (HRSA, 2011). In a recent analysis, Gardner, McLees, Steiner, Del Rio & Burman, (2011) described a cascade model with the actual proportions of HIV care and treatment in the United States (Gardner et al. 2011). This analysis revealed that among HIV-infected persons, approximately 60% are in care according to the HRSA definition above, but of those in care, only 24-36% are on ART, and of these only 19-28% have achieved viral suppression (CDC 2011; Gardner et al. 2011). This highlights the fact that among HIV-infected populations, many important health benchmarks are still elusive. Though a cascade such as this has not been developed for HIV-infected substance users, one can only speculate that access and utilization may be much lower for this population.

In addition to the above-mentioned ART and care adherence concerns, substance use has generally been linked to other problematic health related behaviors and outcomes (Kipp, Desruisseau, Qian, 2011). Substances such as marijuana and alcohol have been associated with non-adherence to medications related to co-occurring infections such as *Pneumocystis carinii* pneumonia (PCP) and tuberculosis (Amuha,

Kutyabami, Kitutu, Odoi-Adome, Kalyango, 2009; Heffelfinger, Patel, Brooks, Calvet, Daley, et al., 2009). Use of stimulants has been independently linked to disruptions in normal immune function and increased HIV replication in vitro (Roth, Rashkin, Choi, Jamieson, Zack, Baldwin, 2002; House, Thomas, 1994; Chiapelli, Frost, Manfrini, Lee, Pham, Garcia, 1994). Equally troubling are the potentially harmful drug-drug interactions that exist between some HIV medications, illicit drugs and opiate replacement therapies such as methadone and buprenorphine (McCance, 2011). Additionally, there is evidence that drug withdrawal itself has immune compromising effects, leading to further complications for immuno-compromised individuals seeking drug treatment (Roy, Ninkovic, Banerjee, Charboneau, Das, Dutta, Kirchner, Koodie, Ma, Meng, Barke, 2011).

Studies have also shown that stimulant use negatively affects HIV disease progression and immune system viral biomarkers related to disease progression, even in the presence of ART (Baum, Rafie, Lai, Sales, Page, Campa, 2009; Carrico, Johnson, Morin, 2008). More recent work, however, has shown that substance use related disruptions in normal immune function, though statistically significant, may have little clinical effect within the context of long term and consistent ART adherence (Shoptaw, et al. 2012). Still, these findings add to an increasing body of evidence showing that illicit substance use has damaging biological effects for immuno-compromised individuals.

Identifying and Defining Substances of Abuse

Several classification systems have been developed for drugs of abuse; of these the most commonly used are from the American Psychiatric Association (Diagnostic and Statistical Manual for Mental Health Disorders-5th Edition, 2013), the World Health Organization (International Classification of Disease and Related Heath Problems, 10th Edition, 1992), and the United States Drug Enforcement Administration (DOJ, 2014; Sussman et al., 2001). Other classification systems have been developed but their use has been limited from a clinical and policy perspective (Sussman et al., 2001). The DSM

has twelve distinct categories of drugs of abuse/dependence, the ICD-9 has nine and the DEA identies six (Sussman et al., 2001; Julien, 2001). Both the ICD and DSM-IV share very similar categories (i.e., alcohol, cocaine, amphetamines, nicotine/tobacco, opioids) as these schemes are primarily interested in classifications based on a substance's abuse profile (ability to classify behaviors as use, abuse, and dependence), as well as, medical/psychological consequences (i.e., psychosis or paranoia). The DEA classification system, on the other hand, is more concerned with a substance's *abuse liability* (WHO, 1994).

What constitutes acceptable and unacceptable types and amounts of use of substances has primarily been based on social norms and history (Segal, 2005; Weil, 1972; Austin, 1978). While our modern understanding of terms such as *use*, *abuse* and *dependence* are rooted in both medical and psychological sciences, attitudes toward substance use continue to be culturally based (Sussman et al., 2001; Edwards, Arif, Hadgson, 1981). This topic can be further confused by the many different terms used by both professionals and laypersons to describe and define these concepts. Many persons use terminology such as *use*, *abuse*, and dependence interchangeably, often times without an appropriate context (Galea, Nandi, Vlahov, 2004). Modern uses of these terms are intended to signify intensifying degrees of substance use behavior, from recreational or even use beneficial to increasingly problematic and self-destructive use (Sussman & Sussman, 2011).

The term *use* is fairly ubiquitous, intended to describe any type of use of a number of substances (some illegal). Terms such as *abuse* and *dependence* are medical terms, which have accompanying diagnostic criteria (DSM-V, 2013). Much of the confusion is encountered when these terms are used without accompanying diagnosis, leading to confusion among researchers and lay-persons as to the true level of problematic behavior being described. Additionally, the term *addiction* is also

frequently used to describe persons with problematic levels of use, but this term is freely used to describe behavior not necessarily bound to a medical diagnosis as there is still debate in the scientific and social sciences on what actually constitutes addiction (Sussman, Sussman A.N., 2011). The evolution of these terms, and their definitional distinctions, are important to understanding how cultural attitudes towards substance use have changed. As the current study collected limited data on diagnostic measures used to define abuse or dependence, the term *substance users* was used when describing sample participants who report illicit use.

Illicit substances use and HIV

There is a robust body of research documenting the role that use of illicit substances (i.e., stimulants, depressants, inhalants and hallucinogens) play in HIV risk (CDC, 2013). It has been estimated that substance use plays either a direct or indirect role in almost half of HIV incidence cases annually (CDC, 2012). Early in the epidemic, it was believed that the primary causal role drug use played in the spread of HIV infection was due to IDU behaviors, but more recent research has shown that the role non-injection drugs play in creating risk environments where HIV is easily spread may play an equally substantial role in transmission (Shoptaw, et al. 2013; Strathdee, Hallett, Brobova, Rhodes, Booth, Abdool, Hankins, 2010; Celentano, Latimore, Mehta, 2008; Royce, Sena, Cates, Cohen, 1997). The National Institute of Drug Abuse (NIDA) reports that behaviors related to substance use are the single largest factor associated with HIV infections, with as many as 64% of all HIV-infected persons having reported illicit use, 19% of which are IDU (NIDA, 2006). A variety of substances such as stimulants (i.e., cocaine and amphetamine-based substances), volatile nitrates (i.e., poppers) and alcohol have been linked to increased HIV transmission among high risk groups (Rajasingham, Mimiaga, White, 2012; Plankey, Ostrow, Stall, 2007; Volkow, Wang,

Fowler, 2007; Hoffman, Klein, Eber, 2000). It should be noted that marijuana use alone

has never been linked to increased HIV infection rates (Smith, Ferris, Simpson, 2010).

Among HIV-infected persons, use of illicit substances tends to affect more

vulnerable populations such as men who have sex with men (MSM), the mentally ill and

those of lower socioeconomic status (SES; Plankey, Ostrow, Stall, 2007). Among MSM,

use of methamphetamines has been well documented as a driver of continued HIV risk

and disease progression (Landovitz et al., 2012). A recent meta-analysis revealed that

non-injection drug use increases disease progression indirectly by affecting ART

adherence, immune function and a deterioration in general health, but direct effects on

increased mortality are unsubstantiated (Kipp, Desruisseau, Qian, 2011).

Costs of treatment

Health care in the United States is among the most expensive in the

industrialized world (Kane, 2012). Studies investigating the cost benefits of public health

interventions have important policy implications. These types of analyses have been

broadly applied to diverse types of interventions such as vaccination and drug treatment

programs to prove their long-term financial benefit (Godfrey, Stewart, Gossop, 2004;

Nichol, 2001). Although there are multiple ways to measure the cost savings of such

programs, the majority of the literature focuses on two types, direct medical costs (direct

comparison of different treatments) and societal costs (defined as, "…reduction in the

negative costs to society engendered by the adverse consequences..."; Cartwright,

2000). These costs are generally operationalized as costs-of-illness measures looking at

three broad categories of non-direct costs of substance abuse and include: physical

health, mental health and social problems. Cartwright (2000) admits that the

operationalization of these measures can be complicated to evaluate, as they include

multiple sub-categories of services. In the field of substance abuse, direct medical cost

savings comparing outpatient drug treatment to hospitalization have been well

established (Basu, Paltiel, Pollack, 2008; Ettner, Huang, Evans, 2006; Cartwright, 2000).

These savings have been shown to be beneficial for both outpatient and short-term

residential treatment when compared to hospitalization (Tabbush, 1986; Harwood,

Hubbard, Collins, Rachal, 1995). In one example, the California Department of Drug and

Alcohol Programs showed savings were over four times greater per patient for

methadone maintenance, and over two-times greater for 60-day residential treatment,

when compared to hospitalization; although it did not take recidivism rates into account

(Gerstein, Johnson, Harwood, Fountain, Suter, Malloy, 1994). Also notable, costs

savings analysis of ART medication adherence programs among substance users have

been shown to reduce complications related to HIV infection, resistance and adherence

(Altice, Kamarulzaman, Soriano, Schechter, Friedland, 2010; Wolf, 2010).

It is estimated that lifetime costs of care and treatment of HIV-infected persons

can range from ~$300,000-$500,000 depending on the timing of antiretroviral therapy

(ART) initiation and patterns of adherence (Levy, James, Johnson, Hogg, Harrigan,

Harrigan, 2006; Schackman, Gebo, Walensky, Losina, Muccio, Sax, 2006). This type of

research, however, has limitations. First, the previous examples cited were all based on

cost-comparison research, and did not include estimates of societal benefits. Another

limitation of this cost-benefit analysis of HIV-infected persons is that accounting for

additionally costs related to acquiring other co-morbid conditions is difficult to do

(Cartwright, 2000). Research has shown that cost savings of ART treatment for HIV-

infected persons with co-morbid conditions tend to decrease due to increased costs of

medication and decreased income due to extended illnesses (Cartwright, 2000). HIV-

infected substance users tend to be at greater risk for acquiring co-morbid infections

such as viral hepatitis, tuberculosis and bacterial infections (as well as being further

along in disease progression) than non-substance users (Altice, et al. 2010).

Additionally, HIV-infected substance users tend to have poor ART treatment adherence

and medical follow up, complicating treatment outcomes and increasing drug resistance (Wood, Montaner, Yip, 2003; Deeks, 2000; Tam, Chui, Brumme, Bangsberg, Montaner, Hogg, Harrigan, 2008). One analysis put cost for treatment of HIV-infected substance uses who were co-infected with a mental health disorder at $3,880 per day, which is twice that of HIV-infected persons not suffering from those conditions (Conover, Weaver, Ang, Arno, Flynn, Ettner, The HIV/AIDS Treatment Adherence Health Outcomes and Cost Study, 2009). For these reasons, costs of treatment for HIV-infected substance users tend to be higher than for substance abusers that are not infected (Altice, et al. 2010; Wolf, 2010; Conover et al., 2009).

<u>Barriers to Care</u>

HIV-infected substance users face a variety of interpersonal and structural barriers with respect to management of HIV disease (Kempf, McLeod, Boehme, Walcott, Wright, Seal, 2010; Tobias, Cunningham, Cabral, Cunningham, Eldred, Naar-King, 2007; Berg, Michelson, Safren, 2007). HIV-positive persons generally do not access and engage in HIV care in a timely manner for a variety of reasons: housing insecurity, language difficulties (limited or non-English speaking), unmet support services, health beliefs (e.g., "I don't trust the medical system to do the right thing for me", "I don't think I am sick enough to see the doctor every 6 months"), substance use and stigma (Wohl, Galvan, Myers, 2011a; Wohl, Tejero, Frye, 2009; Tobias, et al. 2007; Aidala, Cross, Stall, Harre, Sumartojo, 2005; Timmins, 2002). Substance abusing HIV-infected patients, specifically, are more likely to report irregular care, miss appointments, not receive ART and rely on hospital emergency departments to receive care more often than non-substance abusing HIV patients (Josephs, Fleishman, Korthuis, 2010; Meade, Hansen, Kochman, Sikkema, 2009; Ulett, Willig, Routman, 2009). Bell, Metsch, Vogenthaler, (2010) found that among a sample of HIV-infected crack cocaine users, factors associated with reduced care were low income, no history of drug treatment, and not

receiving appropriate support services. Additionally, factors such as housing insecurity, socioeconomics and mental health status have all been independently linked to poor disease outcomes for HIV-infected individuals (White House, 2010a,b).

<u>Housing Insecurity</u>

Housing insecurity has been independently linked to poor health care access and outcomes for HIV-infected persons generally (Kidder, Wolitski, Campsmith, Nakamura, 2007; Aidala, Lee, Abramson, Messeri, Siegler, 2007). Improving housing is a key component in decreasing HIV health care access disparities according to the National HIV/AIDS Strategy and Implementation Plan (White House, 2010b). According to the Los Angeles County Homeless Services Authority, there are an estimated 57,737 homeless person living in LAC, 31% of which report substance abuse (LAHSA, 2013). Many substance users suffer from chronic homelessness, and in Los Angeles in particular, homelessness due to substance abuse ranks higher than in most other urban jurisdictions (Homeless Research Institute at the National Alliance to End Homelessness, 2009; Lowe, 2001). Among homeless populations, HIV infection rates range from 10-20% (Milloy, Marshall, Montaner, Wood, 2012; Robertson, Clark, Charlebois, Tulsky, Long, Bangsberg, 2004). In LAC, it is estimated that 3.5% of homeless individuals are HIV-infected, representing 10% of all HIV-infected individuals in (LACDPH, 2009). It should also be noted that among homeless populations high correlations between HIV, hepatitis C and tuberculosis also exist (Beijer, , Wolf, Fazel, 2012).

Among homeless MSM specifically, high rates of substance dependence, psychiatric disorders, HIV infection and *exchange sex* (e.g., sex for money, drugs, housing or transportation) are reported (Reback & Larkins, 2008; Shoptaw, Reback, 2006). In general the relationship between insecure housing and substance use among HIV-infected populations is complex and is associated with co-occurring factors such as

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lack of health insurance and mental health issues (Altice, et al. 2010).

<u>Socioeconomic Status</u>

Socioeconomic status (SES) is a complex construct that attempts to incorporate a person's income, wealth, education and occupation as a gauge of social position (Herd, Goesling, House, 2007). Though sometimes loosely defined, SES has long been used as a measure of social status and is predictive of a variety of health outcomes such as heart disease and overall mortality (Minkler, Fuller-Thompson, Guralnik, 2006; Liberatos, Link, Kelsey, 1988). The direct relationship between SES and health has long been observed by social scientists, leading many to classify it as a "fundamental cause" of disease (Marmot, 2003; Wallman, Evonger, Schechter, 2000; Link, Phelan, 1995). Link, Phelan, (1995), described a social condition as being a fundamental cause of disease when, "…the health effects of causes of this sort cannot be eliminated by addressing the mechanisms that appear to link them to disease."

Different studies, using different interpretations of SES, have generally consistently found it to be an important indicator of health. Additionally, low SES has long been recognized as a contributing factor to both substance use/abuse and HIV infection, since both are embedded in social and economic inequality (Marzuk, Tardiff, Leon, Hirsch, Stajic, 1997). The effect of SES on both the susceptibility to, and progression of, HIV is highly complex, as distinguishing between SES and other potential confounding factors is difficult to do (Johnson & Bundlender, 2002).

For example, Cunningham, Hays, Duan, Andersen, Nakazono, Bozzette, Shapiro, (2005) used multiple measure of SES (as measured by income, wealth, employment and education) to demonstrate that HIV-infected persons with low SES had greater risk of death. In this study substance use specifically was also associated with increased mortality among persons of low SES (Cunningham, et al. 2005). SES has been independently linked to poor health outcomes among those with chronic conditions

such as cardiovascular disease and cancers (Lazzarino, Hamer, Stamatakis, Steptoe, 2013; Klassen, Smith, 2011). Lazzarino, Hamer, Stamatakis, Steptoe, (2013) used a measure of social class and employment status exclusively used throughout Britain to measure SES. Among substance users, low SES is strongly linked to HIV risk behaviors such as needle sharing and unsafe sexual behaviors while intoxicated (Galea & Vlahov, 2002 not in bib; Schoenbaum, Hartel, Selwyn, Klein, Davenny et al.,1989). Yet, few studies examine the link between SES and HIV disease mortality, and those reported suffer from methodological challenges related to the measurement of SES (McMahon, Wanke, Terrin, Skinner, Knox, 2010; Shavers 2007).

Despite methodological challenges, research has shown that persons of low SES (compared to high SES) exhibit faster disease progression and increased mortality rates (Joy, Druyts, Brandson, Lima, Rustad, Zhang, Hogg, 2008; Cunningham, et al. 2005). For example, a recent analysis by McMahon et al. (2010) demonstrated that HIV-infected persons of low SES had increased rates of overall mortality compared to those of high SES. The authors equated this disparity to both direct and indirect effects of HIV infection. Direct effects were caused by the fact that low SES HIV-infected persons had overall lower CD4 counts and higher viral loads, while indirect effects were from the fact that low SES persons also reported overall lower education, higher rates of homelessness and poverty.

SES factors associated with HIV-infected substance users have been implicated as affecting a variety of health related behaviors including medication adherence, access to medical care and HIV care consistency (Horstmann, Brown, Islam, Buck, Agins, 2010; García, Cote, 2003). HIV-infected substance users also tend to have more emergency room visits compared to non-substance abusing MSM, indicating a lack of medical resources (Barash, Hanson, Buskin, Teshale, 2007). Factors associated with SES that affect HIV incidence and mortality continue to be associated with both the spread and

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progression of HIV disease among this population, and affect the care they receive or have access to.

<u>Mental Health</u>

Mental health disorders (such as depression, anxiety, schizophrenia /schizoaffective or bipolar disorders) affect up to 50% of HIV-infected individuals at some time during their illness (Bing, Burnman, Longshore, 2001). Research on depression alone among HIV-infected populations has consistently shown it negatively effects ART adherence and compliance with other medical treatments; it has also been correlated with increases in sexual risk behaviors, and mortality (Walkup, Blank, Gonzalez, Safren, Schwartz, Brown, 2008; Chandler, Himelhoch, Moore, 2006; Cook, Grey, Burke, 2004; DiMatteo, Lepper, Croghan, 2000). Similarly, anxiety has been linked to poor ART adherence (Ammassari, Murri, Pezzotti, 2001), but findings are not as robust since this condition is less often assessed clinically (Walkup, et al. 2008).

Also of concern are individuals with severe mental illnesses (schizophrenia, schizoaffective disorder, non-substance abuse related psychosis, bipolar and other Axis 1 disorders), defined in the literature as more persistent forms of mental illness usually requiring multiple hospitalizations (Chandler, Himelhoch, Moore, 2006; DSM-IV-TR, 2000; Schinnar, Rothbard, Kanter, 1990). It is estimated that 3-7% of persons suffering from these conditions are HIV-infected (Chandler, Himelhoch, Moore, 2006; Blank, Mandell, Aiken, 2002; McKinnon, Cournos, Herman, 2002; Rosenberg, Goodman, Osher, 2001).

Persons who are co-morbid with HIV infection, substance abuse and mental health disorders has been described by researchers as 'triply' diagnosed individuals (Douaihy, Jou, Gorske, Salloum, 2003; Walkup, et al. 2008). It is estimated that as many as 13% of HIV-infected persons fall into this category (HIV infection, mental health disorder, substance use disorder), but these numbers have fluctuated across studies

(Chandler, Himelhoch, Moore, 2006). The causal pathways of the co-occurrence of HIV infection, substance abuse and mental health disorders are unclear (Chandler, Himelhoch, Moore, 2006). One study found that among HIV persons, those with a history of substance use had a four and a half times greater odds of reporting a mental health disorder (Regier, Farmer, Rae, 1990), while others have reported that those with histories of a mental health disorder are more likely to report a recent substance use (Merikangas, Mehta, Molnar, 1998). Still others have found that both factors are independently associated with lack of access to primary HIV medical care (Tobias, et al. 2007). Much of this confusion lies in the fact that both conditions are inherently linked with respect to their individual disease etiologies (Grant, Stinson, Dawson, Chou, Dufour, Compton, 2004). Despite this confusion, those with this triple diagnosis are considered especially vulnerable with respect to complications related to HIV disease progression, as both conditions are associated with decreased use of HIV related services (Conover et al., 2009).

<u>Insurance Status</u>

Among RW recipients, results relating to insurance status as a barrier to obtaining either primary care or ancillary services have been mixed (Schneider, Juday, Wentworth, Lanes, Hebden, Seekins, 2013; Morales, Cunningham, Galvan, Andersen, Nakazono, Shapiro, 2004; Ashman et al., 2002; Conviser & Pounds, 2002a; Parham & Conviser, 2002; Shapiro et al, 1999a). Although RW coverage is intended to fund medical and social service needs of low income HIV-infected persons in the United States, insurance status continues to matter with respect to obtaining some of these services (Schneider et al. 2013; Parham & Conviser, 2002; Morales et al. 2004; Shapiro et al., 1999a). Results from the HIV Cost & Services Utilization Study (HCSUS) showed that those with either public insurance or no insurance reported increased emergency room visits, and later access to ART, compared to those with private insurance Shapiro

et al., 1999a). A recent analysis also showed that payer type (e.g., Medicare, private, etc.) continues to impact the timing of ART initiation (Schneider, et al. 2013) for these patients. Also, a study of Hispanic HCSUS participants showed that insurance status was correlated with poor access to care for this population (Morales, et al. 2004).

It should also be noted that even though Morales et al. (2004) reported that Hispanic's with no insurance received poorer access to care overall, certain medical services (i.e., emergency room visits, dental care) were not significant. Biological indicators of disease progression (CD4 and viral load results) were also not significantly related to insurance status. Other studies, however, have shown that insurance status has no effect on need or use of ancillary services (Wohl, Carlos, Tejero, Dierst-Davies, Daar, Kahnlou, 2011b; Chan, 2002). So the role of insurances status affecting access to ancillary services is still not clear.

<u>Socio-demographic Variables</u>

In addition to the aforementioned factors, much of the social science literature also includes socio-demographic variables (e.g., age, gender, sexual orientation and race/ethnicity) as predictors of health utilization among HIV-infected persons (Suchman, 1964; Dressler, Oths, Gravelee, 2005; Chaisson, Keruly, Moore, 1995; Shapiro et al, 1999a). More recently, a robust debate has emerged as to the relevance of using such variables as predictors of complex health and social outcomes (Oppenheimer, 2001; Williams, 1997). Too often these variables have been used as poor proxy measures for factors that are contextually difficult to directly observe/measure such as socioeconomic status, class, institutionalized racism, sexism or competing needs (Dressler et al., 2005). This is no more evident when applied to the construct of race/ethnicity (Harawa & Ford, 2009; Bhopal, 2006), but the same can be said of constructs such as sexual orientation, and gender as well. Some suggest we move away from these measures as indicators of true social disparities among marginalized groups (Oppenheimer, 2001), while others

suggest that an application of these variables be accompanied by more vigorous theoretical discussion of their true utility (Ford & Harawa, 2010; Bhopal, 2006; Dressler, 2005; Davidoff, 2000). As variables such as race/ethnicity, gender and sexual identity are all socially constructed; a broader discussion on their social context while interpreting results in health research is a prudent approach. As applied to this proposed investigation, great care was taken to carefully frame important findings based on the aforementioned variables. Barriers to care identified by participants may be more helpful in understanding the reasons behind service gaps than simple demographic indicators. Additionally, factors such as SES, incarceration histories and specific substance use characteristics (type of and number of substances used) may prove helpful in contextualizing results.

Health Related Services for HIV-Infected Individuals

Early on in the HIV epidemic, the federal government was slow to respond to the health and social service needs of HIV-infected individuals, and few medical interventions were available (Parham et al., 2002). With the development of ART in the 1990's, patients were experiencing longer lag time in seroconversion from HIV to full-blown AIDS and decreased rates of mortality (Kallings, 2008). This meant that treatments for HIV-infected patients shifted from hospital/hospice inpatient primary care to outpatient treatment with an increased emphasis on adherence to drug regimens. Additionally, the increased need for non-medical support services meant that there was an increased need for effective management of the myriad of social and medical needs for this growing population (Aday, 2002).

In response to this, the RW Comprehensive AIDS Resources Emergency (CARE) Act was first enacted in 1990 to fund medical and social services for low-income persons living with HIV/AIDS (PLWHA) in the United States (USDHHS, 2010). Early on, this program was focused on primary medical care, but as the program matured, there

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was an increased emphasis on non-medical social support services and dental care (Parham et al., 2002; HRSA, 2010). The RW HIV/AIDS program, managed by the Health Resources and Services Administration (HRSA), is the largest funder of HIV/AIDS services nationally, and it is estimated that half a million people each year access RW services in the United States (HRSA, 2010). The 2010 reauthorization of the CARE Act provided $2.3 billion to fund medical and social service needs of PLWHA nationally, including an allocation of $34 million to LAC to fund direct patient services (HRSA, 2010; DHSP, 2014).

<u>Service utilization among HIV-infected substance users</u>

Limited research has looked specifically at utilization of health and ancillary support services among HIV-infected populations. What has been performed primarily has come from the HIV Cost & Services Utilization Study (HCSUS), a multistage probability sample of HIV-infected adults drawn from medical providers in the contiguous United States (Bonuck, Arno, Green, Fleishman, Bennett, Fahs, Maffeo, 1996; Morales et al, 2004; Katz, Cunningham, Mor, Andersen, Kellogg, Zierler, 2000; Burnam et al., 2001; Gifford, Collins, Timberlake, Schuster, Shapiro, Bozzette, Kanouse, 2000; Mathews, McCutchan, Asch, Turner, Gifford, Kuromiya, 2000; Frankel, Shapiro, Duan, Morton, Berry, Brown, 1999; Shapiro et al., 1999a; Shapiro, Berk, Berry, Emmons, Athey, Hsia, 1999b; Bozzette, Berry, Duan, Frankel, Leibowitz, Lefkowitz, 1998; Duan, McCaffrey, Frankel, St.Clair, Beckman, Keesey, 1998). Although the primary outcomes of this project were to study the use of HIV primary care services (Bozzette et al, 1998; Shapiro, et al., 1999a), secondary analysis has yielded important findings related to the use of mental health and substance abuse services (Burnam et al., 2001), health care access (Morales et al., 2004) and predictors of unmet ancillary service needs (Bonuck et al., 1996; Katz et al., 2000). Since HCSUS, other studies have examined the role that ancillary services play with respect to access to primary medical care (Wohl et al.,

2011b; Rockett, Putnam, Jia, Chang, Smith, 2005; Reif, Whetten, Lowe, Ostermann, 2006).

<u>Defining Ancillary Services</u>

According to HRSA, ancillary services are defined as any non-direct medical services such as housing, case management, nutritional support and other social services such as legal or transportation (HRSA, 2010). Research into service utilization among HIV-infected populations has yielded several different classifications with respect to what constitutes ancillary services. Bonuck et al. (1996) identified three distinct categories, including home care (in home nursing services, homemaker services and in home meals delivery), mental health (support group or psychological counseling services), and housing (housing assistance programs, short term housing grant/loans). Reifk et al. (2006) identified seven need/unmet need categories used by HIV-infected persons: housing, support services, emergency provisions, counseling, legal assistance, supplemental nutrition and financial benefits. HCSUS defined 10 distinct ancillary service categories used by HIV-infected persons: mental health counseling/treatment, substance use counseling/treatment, case management, housing assistance, food bank, emergency financial assistance, transportation, buddy/companion services, advocacy and day or respite care (Asham et al., 2002). Currently, the Medical Monitoring Project-MMP(a CDC funded national survey of HIV-infected person in care) has defined 12 distinct ancillary service categories used by HIV-infected persons: HIV care management, mental health counseling, social services, assistance in finding a doctor, assistance in finding dental services, home health services, homemaker services, shelter/housing, meals/food, transportation, HIV education, other services (Wohl et al., 2011b).

In total, each of the aforementioned investigations utilized several different classification systems for categorizing and analyzing data related to ancillary services. In

the 2011 LACHNA dataset (the source for this analysis) persons were asked about 47 separate types of HIV services available to Ryan White recipients in LAC (DHSP, 2011). Analysis conducted for a final report (DHSP, 2011) organized services into five categories similar to what had been done by many of the aforementioned studies: HIV clinical care, residential care and housing services, support services, substance abuse services and oral health care. It should be noted that these were also the categories used to stratify the dataset to conduct the facility level sampling frame (see Section 5 below for a detailed description of the sampling methodology). As types of RW ancillary services may change by jurisdiction based on local needs, no uniform list of what constitutes ancillary services exists. Despite this, certain types of services (such as case management, mental health and housing) are commonly needed by HIV-infected persons. For the purposes of this investigation ancillary services are defined as any non-direct medical care type of services. This includes 46 of the 47 services included in the LACHNA-Care survey.

<u>Gaps in Research</u>

While a great deal of research has shown how many of the above mentioned factors such as housing (Kidder et al., 2007; Aidala et al., 2007), socioeconomics (Joy et al., 2008; Cunningham et al., 2005), mental health (Walkup et al., 2008; Chandler et al., 2006; Cook et al., 2004; DiMatteo et al., 2000) and insurance status (Shapiro et al., 1999a) affect HIV care and medication adherence, less has been devoted to how these factors affect ancillary services utilization. Among RW recipients, ancillary services are supposed to provide a social support framework allowing patients to overcome both structural and interpersonal barriers to obtaining consistent medical care for their HIV infection (Aday, 2002; Pharham et al., 2002). Studies have shown that persons who effectively use ancillary services have better HIV care and medication adherence

outcomes (Conover & Pounds, 2002a, b), but little research has quantified this across a system of care (Uphold & Mkanta, 2005).

This study appears to be the first to attempt to identify the central role that substance use plays in predicting ancillary service gaps among a sample of HIV-infected RW recipients. Also, this is the first analysis that attempts to identify groups (or sub-classes) of service gaps in a systematic way. This analysis will also highlight an important gap in the literature, by identifying the role that substance use specifically plays as an independent predictor of service gaps for an entire system of care, serving approximately 45% of all HIV infected LAC residents. These results have important policy implications, as they will highlight services that are underutilized, and identify important roadblocks these patients experience while attempting to receive important services necessary for maintaining health.

CHAPTER 4: CONCEPTUAL MODELS AND FRAMEWORKS

Section 4.1: Theoretical Approaches

This research attempts to better understand the central role that substance use plays in affecting the utilization of ancillary social services among HIV-infected populations. Four different theoretical models and frameworks are used to support this project. The two main theories providing explanatory insights into the population and analytical results are Social Learning Theory (Bandura, 1963; 1971) and the Information-Motivation-Behavior Change model (Fisher et al., 1992). Theoretical frameworks informing the analytical approach are supported by Ronald Andersen's *Behavioral Model of Health Service Use* model (herein known as the *Andersen Model*) and the *Behavioral Model for Vulnerable Populations* developed by and Lilian Gelberg, both of which examine factors associated with health care utilization among marginalized populations (Andersen, 1968; Anderson 1995; Gelberg et al., 2000).

Social Learning Theory

Social Learning Theory posits that learning is a social process (opposed to being exclusively reinforcement based) that explains both the development of, and modifications to, human behaviors (Bandura, 1963; Bandura, 1971).

Figure 4.1: Social Learning Theory
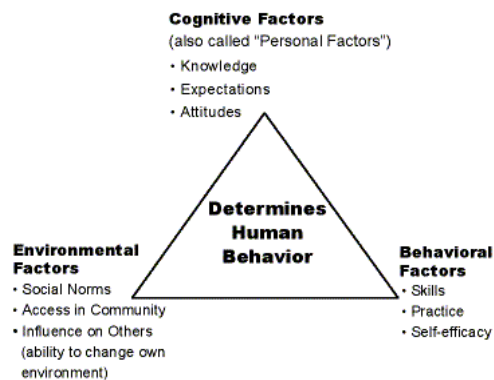
Bandura (1963) stated that, "…social behavior patterns are most rapidly acquired through the combined influence of *[role]* models, and differential reinforcement." As

shown in Figure 1 above, a combination of cognitive, environmental and learned

behavior skills work to influence the formation of new behaviors or support existing ones.

These factors interact in a process where humans constantly alter how they view the

world based on their changing perceptions of it (*reciprocal determinism*; Bandura, 1963;

1977; 1997).

Bandura (1977) also emphasized that self-efficacy (the sense that one can

control his or her motivation and environment, and especially his or her own behavior;

Fisher, 2000, pg. 24) was an important factor that supported behavior change. He wrote

that, "Efficacy expectations form the cornerstone of human agency," meaning that our

ability to perform a behavior is guided heavily by our confidence (or self-efficacy) that we

can perform it, a concept described as "efficacy expectation." This overarching theory of

human behavior is seen as one of the primary influences in the development of many

behavioral models in the fields of public health, psychology and sociology (Gebhardt &

Maes, 2001).

In the field of substance abuse, Social Learning Theory has been used to explain

multiple aspects of abuse behavior, including initiation/experimentation (Moos, 2007a;

Akers et al., 1996; Akers et al., 1979), reinforcement (Niaura, 2000; Akers et al., 1979),

and treatment outcomes (Moos, 2007a; Moos, 2007b, Akers et al., 1979; Bandura, 1997;

Des Jarlais, et al., 1988). Social Learning Theory has also been applied to the field of

HIV prevention, or as stated by Fisher & Fisher (2000) when discussing HIV behavior

change specifically,

> "According to Bandura, the biggest problems with respect to *[HIV]* behavior
> change is not instructing people in what they need to do (e.g., use condoms
> or to clean needles), it is imparting them the social and self-regulatory skills
> and the self beliefs necessary to practice safer behaviors." (pg. 24)

Though these studies provide results consistent with theoretical aspects of Social

Learning Theory, Fisher et al. (2000) expressed concern that, "Since the interrelations

between the elements of SCT have not been specified, it cannot be considered to be an integrated multivariate model and cannot be tested as such" (pg. 26). For this reason, other theoretical models are generally used to empirically test Social Learning Theory indirectly.

<u>Information Motivation Behavior Skills Model (IMBS)</u>

Many of the key aspects of Social Learning theory are incorporated within the IMBS model (Figure 4.2). IMBS posits that well-informed and motivated individuals with appropriate skills are more likely to engage in new behaviors (Fisher et al., 1996). It is a well-established and comprehensive model of behavior change, which was originally designed to describe necessary aspects of successful HIV prevention interventions (Fisher et al., 2000; Fisher et al., 1996), but its principles have been used to explain behaviors such as substance use (Kalichman et al., 2005), condom use (Song et al., 2009), sexual risk behaviors (Cornman et al., 2007), as well as HIV medication (Fisher et al., 2006; Amico et al., 2007) and HIV primary care adherence (Konkle-Parker et al., 2011).

Figure 4.2: Information Motivation Behavior Skills Models (IMBS)
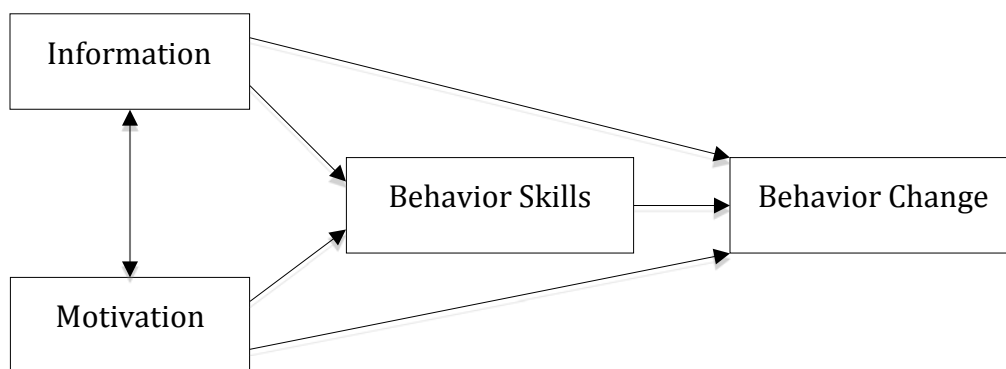
The basic assumptions of IMBS are that individuals who are well informed, motivated, and possess appropriate skill sets are likely to engage in, or maintain, intended future behaviors. Behaviors are mediated through two main processes: 1)

information and 2) motivation. These two constructs work jointly through behavior skills

to either indirectly affect behavior change, or work to directly to support new behaviors.

Many of these constructs described here are aligned closely with aspects of Social

Learning Theory. The *information* aspect of IMBS is aligned with cognitive factors of

Social Learning. The *motivation* aspect can be seen as aligned with environmental

factors. Finally, *behavior skills* can be found in both IMBS and Social Learning theory,

and are noted by both models as being integral parts of learning as they affect self-

efficacy.

Fisher et al. (1992), described information as being an important cornerstone of

risk reduction behavior. This concept is closely aligned with the construct of modeling

from Social Cognitive Theory, which states that, "…influences produce learning

principally through their informative functions and that observers acquire mainly symbolic

representation of modeled activities…" (Bandura 1971, pg 6).

Motivation to engage in a behavior is closely aligned with the concepts of

perceived subjective norms and behavioral attitudes. Motivation can also be found within

the constructs of environmental and personal/cognitive aspects of Social Learning

Theory, an important aspect of behavior change (Bandura, 1971). Bandura (1963)

stated,

> "Since the eliciting and maintaining of imitative behavior are highly
> dependent on the response consequences to the model, an adequate
> social-learning theory must also take into account the role of vicarious
> reinforcement, through which the behavior of an observer is modified on
> account of the reinforcement administered to a model." (pg. 4)

So motivation to engage in a new behavior, as influenced by a particular reinforcement

pattern, plays a central role in behavior modification. In this sense motivation has both

interpersonal as well as social/environmental components. In a paper on IMBS and ART

adherence by Amico et al. (2007), the author stated,

"Adherence motivation is comprised of components of personal and social motivation. Personal motivation rests upon an individual's attitudes and beliefs about adherence and non-adherence, whereas social motivation reflects the extent to which one feels that his or her adherence is supported by significant others."

As stated above, personal motivation relates to personal/cognitive factors of Social Learning theory, as persons must have some internal motivation to want to engage in a new behavior. Social motivation deals specifically with social consequences of engaging in new behaviors, framed in Social Learning theory as environmental factors. Motivation can work in-sync with other aspects of the IMBS model to influence behavior skills that will in turn directly effect behavior change. It can also work independently to directly influence behavior change, because well-informed individuals who lack motivation can still engage in new behaviors.

The final aspect of IMBS is the behavior skills component. Behavior skills are necessary to ensuring that persons are capable of practicing newly acquired behaviors (Fisher et al., 2000). This concept is closely aligned with the reinforcement aspects of the Social Learning Theory model, which states that learning skills related to a new behavior is an important factor related to a person's self-efficacy (Bandura, 1971; Bandura, 1977). Having appropriate skills is seen as an integral part of whether well-intentioned and motivated individuals will engage in this behavior (Fisher et al., 1992; Fisher et al., 2000). IMBDS model specifies that both motivation and information can strengthen behavior skills to help change or sustain behaviors.

Interventions based on IMBS principles have been shown to affect behaviors such as substance use (Kalichman et al., 2005), condom use (Song et al., 2009), sexual risk behaviors (Cornman et al., 2007), as well as medication (Fisher et al., 2006; Amico et al., 2009) and primary care adherence (Konkle-Parker et al., 2011) among HIV-infected populations.

Behavioral Models of Health Service Use (Andersen Model)

Conceptual models examining health care utilization among marginalized populations are based on works by Ronald Andersen (Andersen, 1968, 1995) and Lilian Gelberg (Gelberg et al., 2000). Combined, these two researchers have created models that attempt to explain how individual and structural elements (known as predisposing and enabling factors) affect health care utilization (mostly primary medical care). These have long been used to better understand barriers to care among diverse populations (Phillips et al., 1998; Burnam et al., 2001; Evashwich et al., 1984).

Andersen (1968) developed the first widely accepted conceptual model of health care utilization (known as the *Behavioral Model of Health Service Use*) as part of his dissertation work. It has since been revised several time in response to both critiques and scientific advances in behavioral sciences (Andersen, 1995). Phase 2 of the model was developed collaboratively during the 1970's and included expansions that recognized the individual as the main unit of analysis (as opposed to the family; Andersen 1968), direct influences from the health care system on utilization factors, specific variables defining access and use (i.e., type, location and purpose), and consumer satisfaction elements (Andersen et al., 1970; Andersen et al., 1973; Aday & Andersen, 1974). A third iteration of this model (Phase 3) was developed to account for external influences on health care access (Andersen, 1995). The latest iteration (Figure 4.3) was developed in 1995 and is simply known these days as the Andersen Model. This model incorporates all previous changes as well as including health status outcomes. It emphasizes what Andersen himself called "…the dynamic and recursive nature of health services' use…"(Andersen, 1995). Figure 1 below describes the model as presented.

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Figure 4.3: Andersen Model of Health Care Utilization

ENVIRONMENT   POPULATION CHARACTERISTICS   HEALTH BEHAVIOR   OUTCOMES

Health Care System	Predisposing Characteristics → Enabling Resources → Need	Personal Health Practices	Perceived Health Status
			Evaluated Health Status
External Environment		Use of Health Services	Consumer Satisfaction
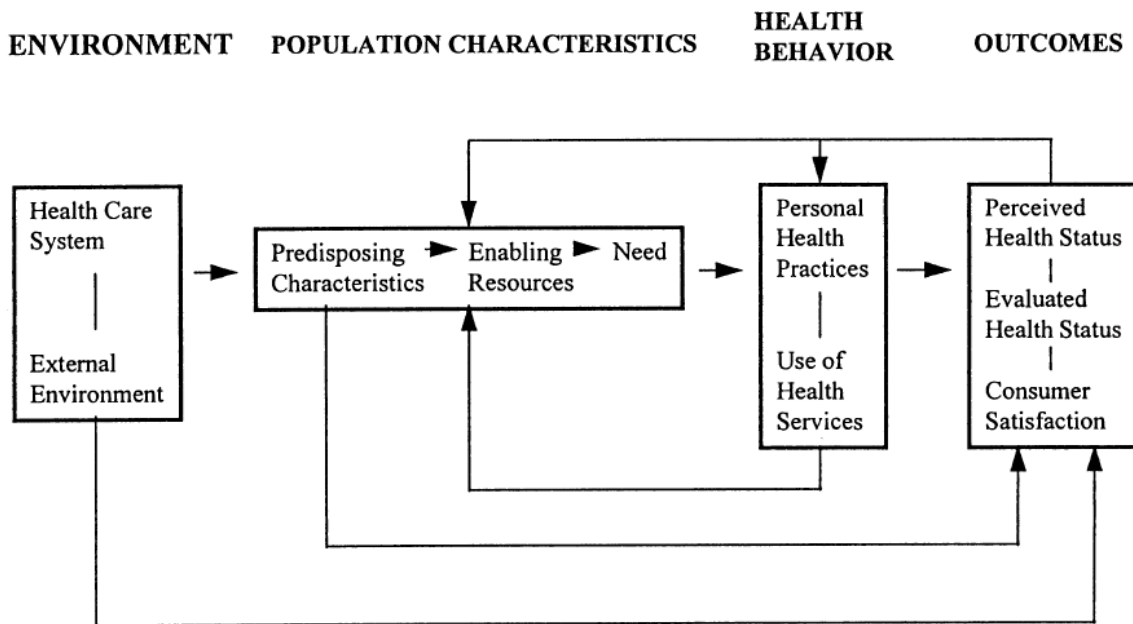
Using Figure 3 above as a guide, this analysis is specifically focused on understanding how substance use affects health behavior (use of health services) within the context of other identified population characteristics (predisposing characteristics and enabling resources) among HIV-infected persons accessing RW funded services in LAC. Factors associated with the aforementioned model include characteristics that would be considered both structural and agency/interpersonal in nature from a social scientific perspective (Cockerham, 2005).

Throughout the development of his model, Andersen has described predisposing characteristics as, "…peoples use of health services is a function of their predisposition to use services, factors which enable or impede use, and their need for care." (Andersen 1995). Others have described predisposing characteristics as demographic and social structural factors that, "…are fixed and hypothesized to influence service use both directly and indirectly through the enabling and need variables." (Uphold et al., 2005). In original works by Andersen, predisposing characteristics have consistently been

described as gender, age, race/ethnicity, education, occupation, and income, as well as, health beliefs and values that influence attitudes about use of health services. As noted previously, socio-demographic factors (such as race, ethnicity, age and income) have been shown to affect utilization of health services among substance users (Weaver, Conover, Proescholdbell, Arno, Ang, Ettner, 2008), but few have looked at the influences of health beliefs or attitudes on utilization of these services among substance users (Shoptaw et al., 2009). Early iterations of this model did not include psychological conditions (mental health status) as predisposing characteristics, but were later added as the effects of conditions such as depression, anxiety and other Axis 1 disorders on health utilization can't be denied (Aday et al., 1974).

Enabling resources have been described as structural factors associated with health care access. Originally, these were defined as both physical location and institutional structures/policies of a health facility that may affect access to care (i.e., wait times, travel distances and insurance status); factors that are all still relevant today with respect to access to services for HIV-infected populations (Higa, Marks, Crepaz, Liau, Lyles, 2012; Uphold et al., 2005). Later iterations of this model greatly expanded these construct to include social interactions, interpersonal relationships and consumer satisfaction (Alli, Maharaj, Vawda, 2013; Beattie, Bhattacharjee, Suresh, Isac, Ramesh, Moses, 2012). It should be noted that in his original works Andersen did not identify substance abuse specifically within the context of these models, though other investigators have identified it as a predisposing characteristic (Gelberg, Gallagher, Andersen, Koegel, 1997; Gelberg et al., 2000).

Behavioral Models For Vulnerable Populations

Gelberg et al. (2000) supplemented the Andersen Model by adding factors consistent with health disparities found among vulnerable populations (i.e., homeless). Defining what constitutes a vulnerable population in the health sciences has varied

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(Aday, 1994). Research has long identified populations that consistently suffer relatively higher rates of disease burden as vulnerable populations. These include the homeless (Milloy et al., 2012; Gelberg et al., 2000), racial minorities (Snowden, 2012; Milletta, Floresa, Peterson, Bakemanb, 2006), persons of low socioeconomic status (Tricco, Lillie, Soobiah, Perrier, Straus, 2012), HIV-infected persons (Padian, Isbell, Russell, Essex, 2012) and substance users (Charlson, Baxter, Dua, Degenhardt, Whiteford, Vos, 2014). These populations are generally considered to be vulnerable to increased morbidity and mortality from a myriad of health conditions (Aday, 1994). The *Behavioral Model for Vulnerable Populations* (Gelberg et al., 2000) added what was described as "vulnerable domains" to the list of existing variables previously contained in the Andersen Model. Figure 4.4 displays the Gelberg model, which identified specific vulnerable domains as well as identifying the constructs from the original Andersen model with which they were associated (see *Vulnerable Domains* list).

Figure 4.4: Behavioral Model for Vulnerable Populations
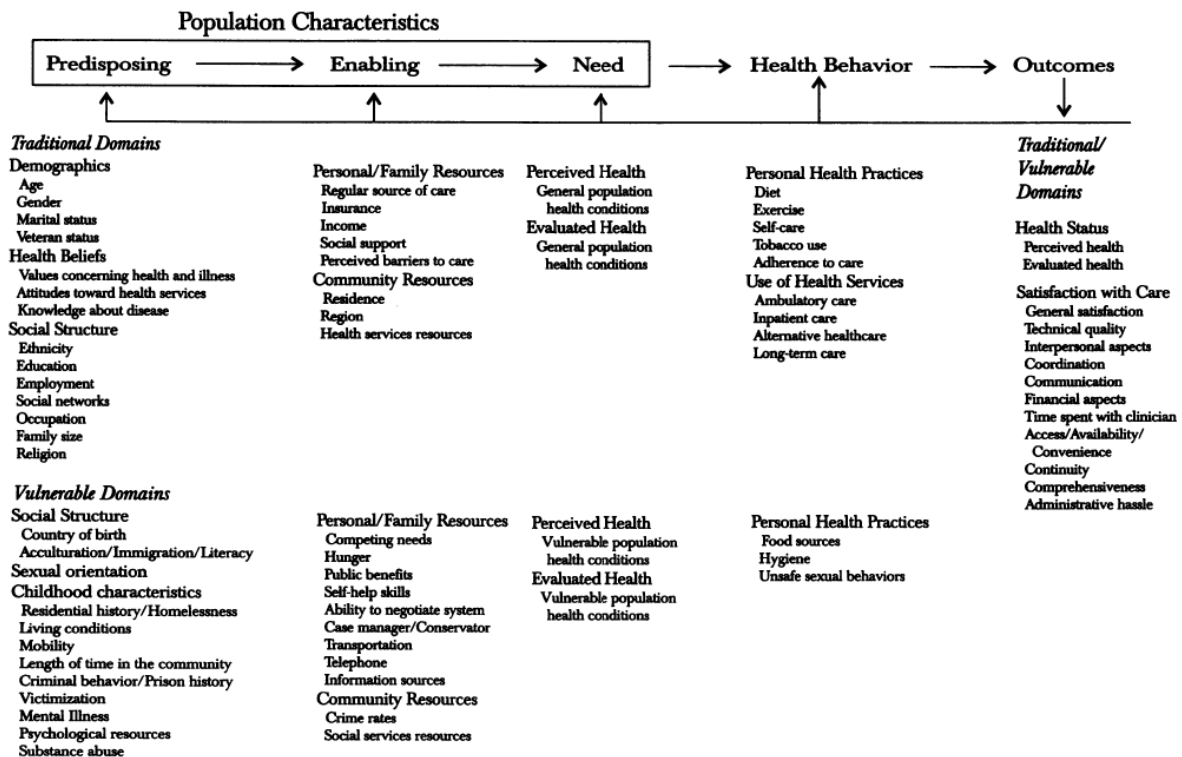
With respect to predisposing characteristics, in addition to the traditional demographic and health belief domains, socio-structural (i.e., country of birth), sexual orientation and childhood characteristics (i.e., living conditions, criminal history/prison history) and substance abuse factors were included. Though developed to better understand health care utilization among homeless populations, factors such as transportation (Sagrestano, Clay, Finerman, Gooch, Rapino, 2013), stigma (Madiba, Canti-Sigaqa, 2012; Wohl et al., 2011), acculturation and language (Rajabiun et al., 2008), and mental illness (Chandler et al., 2006; Bing et al., 2001) have all been shown to impede access to both direct medical and ancillary support services for HIV-infected populations, as well as those for HIV-infected substance users specifically (Gonzalez, Mimiaga, Israel, Andres-Bedoya, Safren, 2012; Blair et al., 2011).

Additional vulnerable elements added to enabling resources include factors related to personal/family resources, competing needs, use of support services (i.e., case management), self-care, and availability of health information (health literacy). These factors have also been shown to be associated with HIV care and treatment (Smith et al., 2012; Craw, Gardner, Marks, Rapp, Bosshart, Duffus, 2008; Cunningham et al., 2005). For HIV-infected persons, the concept of self-care has been inherently linked to utilization of health services, frequency of care and medication adherence (Gielen, McDonnell, Wu, O'Campo, Faden, 2001). Many measures of adherence exist, but to date no gold standard has been established (Marcellin, Spire, Carrieri, Roux, 2013). Recently research has relied on biological markers (CD4 and viral load) as being reliable proxies for medication adherence when assessing community wide viral loads (Miller, Powers, Smith, Cohen, 2013).

The concept of *need* is present in both theoretical approaches as being associated with population characteristics generally (Andersen, 1995; 2000; Gelberg et al., 2000; Aday, 2002). Andersen described need as containing two distinct components:

perceived (self-perception) and evaluated (health professional) need (Anderson, 1968; 1995). Gelberg maintained these distinctions in the expanded model (Gelberg et al., 2000). Though a straightforward concept, research attempting to measure or characterize need for health-related services has generally focused on only one aspect of the construct, perceived need (Evashwick et al., 1984; Burnes, Giger, Georges, 2004), with a few exceptions (Katz, Downs, Cash, Grotz, 1970). When evaluated need has been investigated independently, these analyses rely heavily on scales or diagnostic assessments (Evashwick et al., 1984; Burns et al., 2004; Katz et al., 1970). Such examples include using DSM criteria to assess need for mental health services or HHS criteria for assessing the need for ART therapy (Andersen, 2000; Katz et al., 1970). Andersen (2000) did evaluate both aspects of the need construct with respect to ART exposure, but only evaluated need (i.e., low CD4 counts) was predictive of ART exposure. This finding is not surprising, as low CD4 counts have always been a clinical benchmark for receiving an ART prescription. (DHHS, 2013; Aberg, Kaplan, Libman, Emmanuel, Anderson, Stone, 2009). These examples show that need as an independent construct may be difficult to measure, as it is contextually linked to the outcome of interest in many situations.

In Andersen's early writings, it was hypothesized that different predisposing, enabling and need characteristics may have separate (independent) influences on utilization of services (Andersen, 1968). Although, need was never intended to be seen as a predictive variable for determining utilization but rather as, "…an immediate reason for use to take place…" (Andersen, 1995), which is an important distinction either not addressed or understood in the literature (Uphold et al., 2005). In this sense, need may be less of a variable for analysis and more of a constant along the causal path between population characteristics and health behaviors (Aneshensel, 2013). While writing about use of ancillary services among HIV-infected populations Aday (2002) stated that,

"Need is a central mediating variable in many of the papers [in this journal], with the etiological assumption being that the provision of ancillary services such as assistance with service coordination, transportation or substance abuse treatment will ameliorate needs that could interfere with the ability to facilitate HIV/AIDS patients' entry and retention in the complex ART treatment protocols." pg. S134

As described by Aday (2002) above, in this context need is also viewed as a mediator along the causal path between a patient's substance use behavior and reported ancillary service gaps. This makes need a constant and not a variable.

Limitations of the model

Several limitations exist for all models and frameworks described. Some general criticisms that apply to both SLC and IBMS are that they rely heavily on cognitive theory. Several criticisms have been raised with respect to cognitively based models when applied to health behaviors, these include the fact that they assume cognitive processes alone are primarily capable of assisting individuals in making rational health choices; they don't always take into account effects of antecedents (such as demographics, religious, cultural beliefs, socioeconomics or stigma); assume individuals possess the appropriate necessary skills to obtain their health goals; and assume that given correct circumstances individuals will make rational health decisions (Janz & Becker, 1984; Mullen, Hersey, Iverson, 1987; Weinstein, 1993; Harrison, Mullen, Green, 1992; Stroebe & deWitt, 1996; Armitage & Conner, 2000; Yarbrough & Braden, 2001; Munro, Lewin, Swart, Volmink, 2007). Recently, new work has highlighted that much of the research on such models of behavior change have been poorly tested in minority communities, suggesting that many of these assumptions may not apply universally (Pasick, Burke, Barker, Joseph, Bird, Otero-Sabogal, Tuason, Stewart, Rakowski, Clark, Washington, Guerra, 2009). Finally, once developed, these theoretical approaches become a panacea for a broad variety of health related behaviors they were not originally developed to predict (Mullen et al., 1987).

Within the fields of both HIV/AIDS prevention and substance use specifically, cognitive based models have faced specific criticisms about their utility for understanding these health behaviors (Webb, Sniehotta, Michie, 2010). In HIV/AIDS research, these models have been criticized for their inability to explain behaviors related to sexual practices, condom use and antiretroviral medication adherence (Barnett & Whiteside, 2006). Within the field of substance abuse the discussion has been much more robust, as addiction incorporates many different behavioral facets (i.e., experimentation, repetitive use, craving, and relapse) that cognitive approaches have had only limited success in predicting (Niaura, 2000). Some have expressed the idea that although many mechanisms related to the development of addictive behaviors may be cognitively mediated, the manifestations of addiction are primarily behavioral (Webb et al., 2010). Also, the field of addiction research has many competing theories based in sociology and medicine that are seen as more effective at predicting certain aspects of addictive behaviors such as withdrawal (Wagner, Unger, Bluthenthal, Andreeva, Pentz, 2010). Where cognitive approaches have been used they have been most heavily applied to our understanding of initiation of drug use and relapse behaviors but have offered limited predictive success (Wagner et al., 2010).

Many are equally critical of the health utilization models of Andersen and Gelbert. First, the way the Andersen Model is presented, one could assume the causal order as predisposing characteristics affecting enabling resources and need in a linear way. This criticism is one that Anderson himself has addressed, and admitted that the way these domains are presented in no way should affect the directionality of influence. While arguments have been made that certain variables (such as race/ethnicity and gender) can be thought of as immutable (within a certain context) with respect to their causal influence, this fact only applies to a small proportion of population characteristics identified by these theoretical frameworks. It should be noted that although race was

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historically considered immutable in the social science literature (as well as at the time

this framework was conceived), the concept of race as a biological construct has been

invalidated by modern scientific literature (Guillaumin, 1980; Ford et al., 2010). Despite

this clarification, many researchers have assumed that predisposing characteristics are

both necessary and sufficient to affect enabling resources (Uphold et al., 2005; Rockette

et al., 2005); or as put by one author,

> "The Andersen Model assumes that there is a sequential relationship
> between the following three sets of determinants and service use: (1)
> predisposition to use services (predisposing factors); (2) ability to obtain
> services (enabling factors); and, (3) medical need (need factors)."
> (Uphold et al., 2005).

Such assumptions (besides being a mischaracterization of the original work) may bias

research attempting to identify the true nature of the relationships between these factors

and their effect on access to services.

Another major limitation relates to the need construct as described above. Need,

as it is defined currently within these frameworks (evaluated and/or perceived), has

traditionally been portrayed as a variable as opposed to a constant. This distinction has

created confusion among those attempting to evaluate the role need plays as an

independent predictor of health care access (Uphold et al., 2005; Andersen, 2000).

Viewing need as a constant along the causal pathway may make its role easier to

articulate, especially where it may be contextually difficult to distinguish from outcomes

of interest.

A final criticism is the basis for this research. The majority of research looking at

the heath of HIV-infected person's focuses on access primarily to medical care (i.e.,

number of primary care visits within a certain timeframe; Ashman et al., 2002; Shapiro,

1999a). Though access to medical care is important, of interest, and straightforward, this

overreliance on this single measure has created a gap in the literature. Less has been

devoted to the role that ancillary support services (also referred to as rap-around

services or enabling services) play in the health of HIV-infected persons. Some research has looked at the role individual services (e.g., Case Management or nutritional support) may play on health care access (Ashman et al., 2002), but this research is both limited and is becoming increasingly outdated (Aday, 2002), especially in light of changes to our health care system (Rosenbaum, 2010).

<u>Theoretical Approach</u>

Given the above-mentioned limitations, this analysis will attempt to integrate essential elements from these four theoretical models and frameworks to gain a deeper understanding of how substance use affects the existence of service gaps for HIV-infected RW recipients. Figure 5 below demonstrates the proposed overall theoretical approach.

As previously mentioned, both Andersen and Gelberg's theoretical frameworks were used to inform variable selection for the theoretical approach. The SLC and IMB models were used to assist in an inductive process, by helping inform how future iterations of the chosen dataset (Ryan White Needs Assessment) can incorporate theoretically elements. This process will assist the development of future needs assessments of this type by creating a more robust framework for explaining observed health behavior patterns and disparities that they are attempting to characterize (Aneshensel, 2014). Within the context of these research questions, such an analysis can aid in better determining why such service gaps exist, or disparities are found, for certain groups. This is a much more useful context for explaining these patterns of behavior, as opposed to merely reporting their existence.

Figure 4.5: Proposed Theoretical Approach-Generalized Model
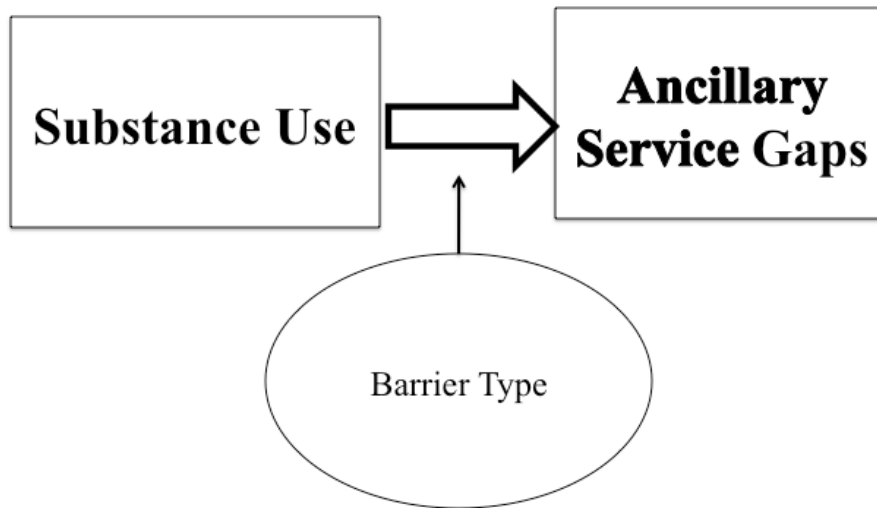
This model illustrates the hypothesized focal relationships between reported substance use and ancillary social service gaps. While other research has shown that many factors identified by both the Andersen and Gelberg frameworks affected access to primary medical care (Ashman et al., 2002; Chan et al., 2002), this is the first such investigation to explore the direct effect of substance use on reporting ancillary service gaps among a population of HIV-infected RW recipients.

In addition to investigating this primary focal relationship, the strength of this relationship was tested in the context of potential confounding factors, as well as the potential moderating effect of the specific types of barriers to receiving services reported by respondents, was explored. This will allow for a deeper understanding of the role of substance use as an independent predictor of service gaps.

A secondary analysis among substance users specifically will explore the effects of substance use characteristics (e.g., stimulant use and number of substances used) have on the number of service gaps reported. This will allow for a deeper understanding of the role that factors associated with use (i.e., type and number) play on the strength of the aforementioned focal relationship among substance users specifically.

Figures 4.6 and 4.7 below describe the analytic approach in more detail. A detailed description of each variable and the role it plays within this analytical model is described below. The majority of these variables are considered to be either predisposing characteristics (age, gender, race/ethnicity, sexual orientation, education, language if interview, past lapse in care) or enabling resources (employment, mental health, insurance status, federal poverty guideline (FPG), residency status, transportation, travel time and residency status) as described in frameworks by Andersen and Gelberg. The next classes of variables to consider were potential rival independent variables (incarceration history and housing status). Finally, potential moderating effects of reported barrier to receiving services were explored on the full analytic models.

Figure 4.6 specifically applies to the primary focal relationship and is intended to answer specific aim two. Figure 4.7 applies to the contingent relationship that only includes analysis of the substance users in the sample and is used to analyze specific aim three.

Figure 4.6: Analytic Model-Full Sample (Aim 2)
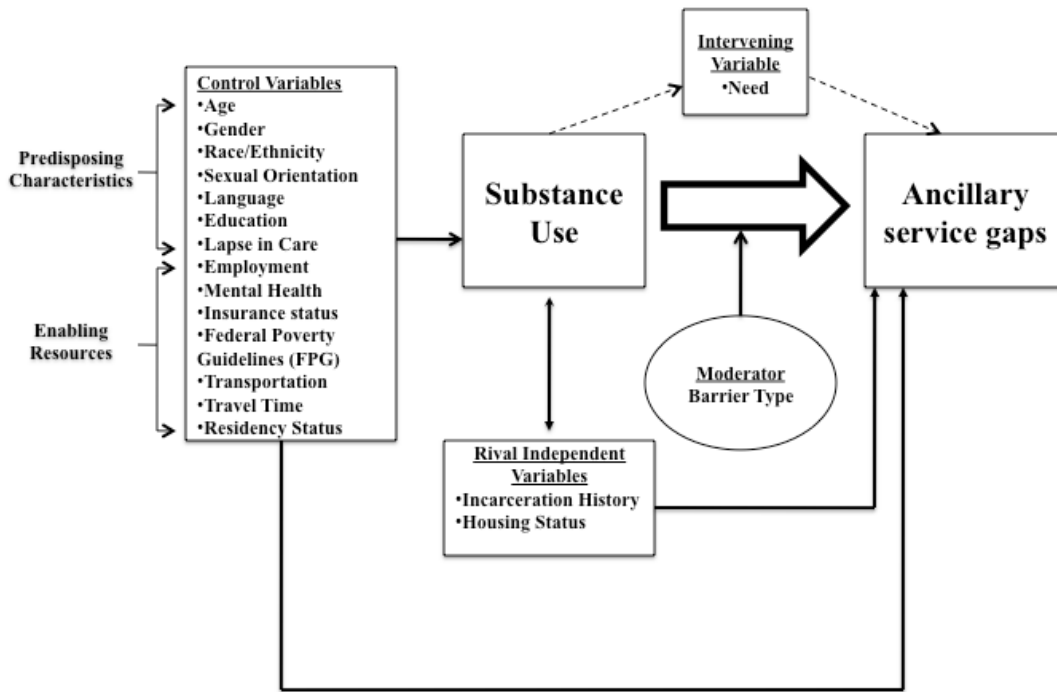
Figure 4.7: Analytic Model-Substance Users Only (Aim 3)
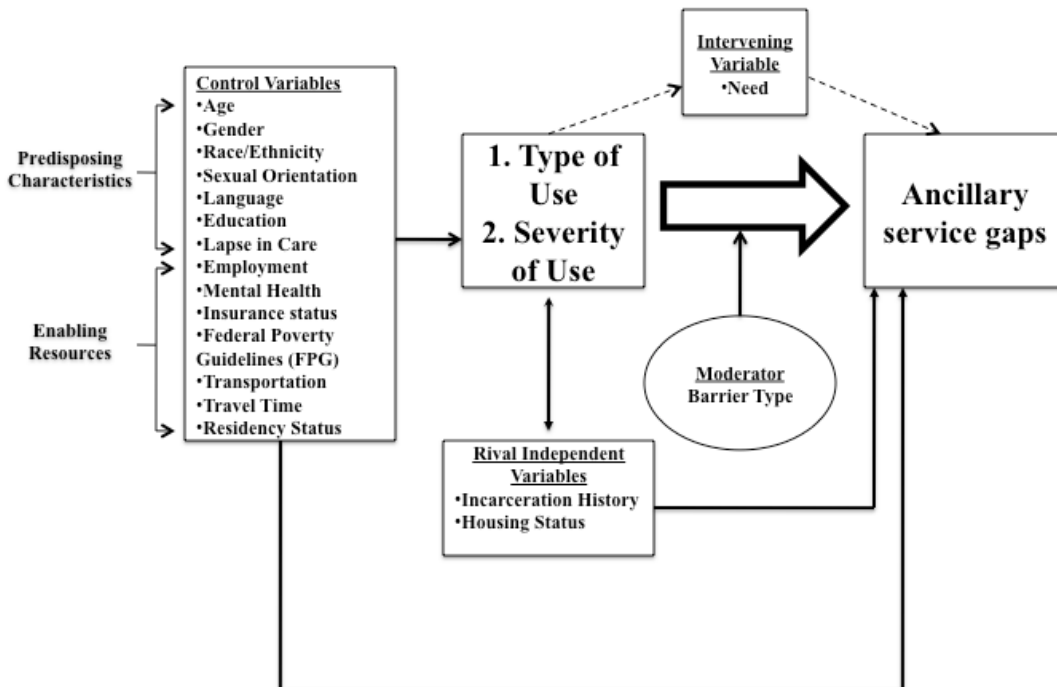
Section 4.2: Key Constructs and Hypothesized Mechanisms

Below is a detailed description of variables listed in Figures 4.6 and 4.7, as well as their role in this analysis. This investigation is based on the elaboration model for theory-based data analysis (Aneshensel, 2013). In short, the major components of interest are the primary focal relationship, which is made up of a focal independent variable (substance use) and focal dependent or outcome variable (reported ancillary service gaps).

Associated with the focal relationship are control variables (also know as confounders; Rothman & Greenland, 2005) intended to account for what has been described as spuriousness, or ruling out alternative explanation of the focal relationship (Aneshensel, 2013). The model also contains several rival independent variables (intended to control for what has been described as redundancy) that account for important factors that previous research or theoretical models have used to explain the observed effect on the dependent variable (Aneshensel, 2013). Represented in the model is need as an intervening variable, need. Finally, potential moderation based on the barrier related to service gaps (dichotomized as either an information based barrier or other type of barrier) was explored.

Focal Relationship

The focal relationship for this analysis is the association between substance use and reported ancillary service gap(s). As stated previously, limited research has focused specifically on ancillary services as the outcome variable. This analysis is unique for two reasons. First, it attempts to describe how substance use directly affects social service gaps. And, second, since the majority of participants (n=374) in this sample report receiving primary HIV medical care, it identifies the effects of substance use on service gaps independent of access to primary medical care.

<u>Focal Dependent Variable-Ancillary Service Gaps</u>

The primary outcome of interest is the presence of an ancillary service gap. Ancillary services have been described as gatekeepers to obtaining primary medical care by alleviating patients' social service needs (Chin, Botsko, Behar, Finkelstein, 2009; Conviser, 2002a; Ashman et al., 2002). To date, few studies have attempted to understand what factors may directly influence gaps in ancillary services, and none have looked specifically at the independent role of substance abuse in this relationship.

Chin et al. (2009) did show that the use of ancillary services was helpful in alleviating intermediate outcomes related to medical care (i.e., housing, sobriety, medication adherence), but this study did not look specifically at gaps in care. Other research has looked at the effects of certain types of ancillary services (such as case management) on primary care utilization (Willis, Castel, Ahmed, Olejemeh, Frison, Kharfen, 2013; Ashman et al., 2002), but not on how substance use affected patients' access to other services.

<u>Focal Independent Variable-Substance Use</u>

The primary independent, or predictor, variable is reported substance use. Substance use has been independently linked to poor health care utilization and medical care retention (as well as poor medication adherence) among samples of HIV-infected persons (Gonzalez, Mimiaga, Israel, Andres-Bedoya, Safren, 2012; Gonzalez et al., 2011; Wolf et al., 2010). Despite this evidence, a complex relationship between substance use and factors such as race/ethnicity, socioeconomics and housing status makes its function as an independent predictor of ancillary service gaps difficult to quantify.

This research attempted to understand this relationship while accounting for factors that may mask the true effects that substance use has on accessing supportive services. Wohl el al. (2011) reported that HIV-infected persons with a history of injection

drug use were more than twice as likely to report an unmet social service need, but this relationship did not take into account non-injection drugs or levels of use. For this reason, this analysis will explore this relationship within the context of other factors that may also affect ancillary services gaps to better understand the central role of substance use.

<u>Control Variables: Predisposing Characteristics and Enabling Resources</u>

Below is a detailed description of all control variables listed in Tables 4.6 and 4.7, as well as their associations with respect to the focal relationship. Control variables are intended to test the strength of the focal relationship by introducing potential confounders. This has the effect of ruling out alternative explanations associated with the outcome under study (Aneshensel, 2013). By definition, a confounder must be independently associated with both the independent and dependent variable (Rothman & Greenland, 1998). While evidence of confounding may not be clear for all control variables listed, controlling for them may still be important as it reduces potential "noise" from certain variables (Aneshensel, 2013).

<u>Predisposing Characteristics</u>

<u>Age</u>

Previous research has shown that age influences use of primary medical care among HIV-infected persons (Ashamn et al., 2002). Among a sample of HIV-infected women, those over 45 years reported more primary medical care visits (Palacio, Shiboski, Yelin, Hessol, Greenblatt, 1999). Additionally, increased age has shown to have a positive influence on ART adherence (Agwu, Fleishman, Korthuis, Siberry, Ellen, Gaur, 2011), as well as overall engagement with HIV treatment (Shapiro et al, 1999a). Very little data exists with respect to ancillary services utilization. The major exception is Ashman et al. (2002), who found that older HIV-infected RW recipients were more likely to both receive, and be retained in, HIV primary care. Also, Chan et al. (2002) revealed

that for individuals over 35 years of age, the number of ancillary services received had a positive effect on use of primary HIV care. With respect to substance use, while it is know that substance users tend to be younger, the relationship between age, substance use and ancillary service gaps is untested.

Gender

Gender differences can be found in both substance use and use of health care services. With respect to substance use, women report lower rates of both use of, and dependence on, all substances of abuse (including alcohol and tobacco) compared to men (Brady & Randell, 1999; Tuchman, 2010). The major exception to this is that women abuse prescription drugs more than their male counterparts (Choo, Douriez, Green, 2014). Despite this fact, women face unique challenges in their attempts to obtain treatment compared to men, such as child custody issues, sexual harassment and intimate partner violence (Tuchman, 2010; Grella, Polinsky, Hser, Perry, 1999). These challenges make drug treatment for women especially difficult as the majority of programs are geared towards men. Also, drug use by women is more often associated with sexually related risk behaviors (prostitution or intimate partner of a substance user), putting them at greater risk for sexually transmitted diseases than their male counterparts (Tuchman, 2010).

With respect to HIV treatment and care, women get tested for HIV less often, and test positive much later in the disease progression, than men. In part, this is due to increased HIV stigma and lower perceptions of HIV risk (Duffus, Davis, Byrd, Heidari, Stephens, Gibson, 2012) than gay identified men. Although women generally utilize health care services more than men (Bertakis, Azari, Helms, Callahan, Robbins, 2000), the opposite pattern is true among women with respect to primary HIV health care (Sohler, 2009; Shapiro, 1999). It has been reported that use of ancillary services by HIV-infected women increases both use of primary HIV care and medication adherence

(Magnus, Schmidt, Kirkhart, Schieffelin, Fuchs, Brown, Kissinger, 2001). A study of HIV-infected women with co-occurring substance use and mental health disorders found that without extra support, these women have poor medical appointment and ART adherence, as well as increased emergency room visits (Anderson, 2005). Given these associations between substance use and service use gaps, the potential confounding effects of gender on the focal relationship were explored.

Race/Ethnicity

A recent meta-analysis revealed that HIV prevalence among racial minorities who inject drugs was twice that of whites (Des Jarlais, Bramson, Wong, Gostnell, Cepeda, Arasteh, Hagan, 2012). Also, data looking at disparities in access to medical care have consistently shown that racial and ethnic minorities in the United States have harder times accessing needed services and medications compared to whites (Smedley, Stith, Nelson, 2004). This trend also holds true for HIV care and treatment (Maulsby, Millett, Lindsey, Kelley, Johnson, Montoya, Holtgrave, 2014; Oramasionwu, Brown, Ryan, Lawson, Hunter, Frei, 2009; Shapiro et al., 1999a). Interestingly, these differences may not affect utilization of support services as one would expect (Scott, Fuqua, Raymond, 2013; Wohl et al., 2011b). Although Chan et al. (2002) did show a positive relationship between the number of ancillary services used and utilization of primary HIV medical care for both Caucasians and Latinos, this trend was not evident for African Americans. Given this evidence, the role that race/ethnicity plays in affecting service gaps within the context of substance use needs further exploration.

Sexual Identity/Orientation

Men who have sex with men continue to be disproportionately affected by HIV (CDC, 2013; Wolitski & Fenton, 2011). Assessment of sexual orientation in research has improved considerably over the years, and sexual orientation is now recognized as a multi-dimensional construct comprised of at least three components: attraction, behavior

and identity (Green, McGowan, Yokell, Pouget, Rich, 2012). On survey instruments, sexual minorities have been categorized both by identity (self-identified gay, lesbian or bisexual persons) and behavior (same sex behavior patterns). Much research has been devoted to sexual behavior patterns of gay and non-gay identified persons in the United States (Sanchez, Finlayson, Drake, Behel, Cribbin, Dinenno, 2006; Pathela, Hajat, Schillinger, Blank, Sell, Mostashari, 2006; CDC, 2003). Research looking at access to health care services has been mixed (Heckm, Sell, Gorin, 2006; Conron, Mimiaga, Landers, 2010), primarily due to the lack of population-based data with respect to sexual minority status and health care access (Conron et al., 2010). Recently, Wohl et al. (2011b) reported that those identifying as gay/bisexual have a 2.8 greater odds of reporting a service gap compared to self-identified heterosexuals, but this sample was not limited to substance users.

Among substance users, the relationship between sexual behavior and identity is complex, particularly among racial and ethnic minorities (Green et al., 2012; Rohde-Bowers, Branson, Fletcher, Reback, 2011; Cáceres, 2002; Millett et al., 2005). Some research has shown that acquisition of drugs and survival may be a motivator of same sex behaviors (Rohde-Bowers et al., 2011; Reback, Shoptaw, Grella, 2008), while others have described such behaviors around substance use as manifestations of psychological burdens related to the sexual identity developmental process (Green et al., 2012; Harawa, Williams, Ramamurthi, Manago, Avina, Jones, 2008; Hughes, Eliason, 2002).

Additionally, as sampling methodologies improve, there has been discussion of the true prevalence of substance use behavior among sexual minorities (Green et al., 2012; Stall & Purcell, 2000). Although sexual identity does affect patterns and severity of substance abuse among HIV-infected persons (Pantalone, Bimbi, Holder, Golub, Parsons, 2010), its impact on access to ancillary services is largely unknown. One study

did find that use of ancillary services among MSM was positively associated with receipt of primary medical care, but this finding was also true for the non-MSM in the sample. Based on this limited evidence, it is unknown how sexual identity affects receipt of ancillary services.

Education Level/Attainment

Many studies linking education level and preventable mortality suggested that disparities are due to differential accessibility, utilization and quality of care (Huisman, Kunst, Bopp, Borgan, Borrell, Costa, 2005; Stirbu, Kunst, Bopp, Leinsalu, Regidor, Esnaola, 2010). With respect to education level as a cause of health disparities among HIV-infected populations, evidence is mixed and limited. Studies linking education and ART adherence are inconclusive (Peltzer, Pengpid, 2013; Gari, Smail, Malungo, Martin-Hilber, Merten, 2013). While studies have identified education as a barrier to HIV testing (Gari et al., 2013), little evidence exists identifying education alone as a factor affecting access to health care or other ancillary services for HIV-infected persons. Cunningham et al. (2005) did show that among HIV-infected populations, low education was a predictor of mortality, independent of income. Despite this evidence, no studies have identified education independently as a factor affecting gaps in social service needs. Hence, its role as a potential confounder to the stated focal relationship should be explored further.

Residency Status and Language

Residency status and language affect health care access, utilization and treatment outcomes for HIV-infected non-native English speakers and illegal immigrants in the United States (Giordano, Druyts, Garber, Cooper, 2009; Wolff & Ellis, 2009; Drainoni, Rajabiun, Rumptz, Welles, Relf, Rebholz, 2008; Rajabiun, Rumptz, Felizzola, Frye, Relf, Yu, Cunningham, 2008). Factors such as lack of appropriate language

services, insurance difficulties and immigration concerns have been cited as barriers to obtaining needed services (Wolff et al., 2009; Rajabiun et al., 2008).

With respect to substance use, research on acculturation among Latino(a) populations in the United States have shown that factors such as being foreign born and non-English speakers are protective with respect to reported alcohol and substance use and abuse (Alvarez, Jason, Olson, Ferrari, Davis, 2007; Welte & Barnes, 1995). However, no research to date has looked specifically at these variables with respect to service gaps within the context of substance use, so their potential roles as independent predictors have not been fully explored.

Lapses in Care

An important goal of the 2010 US National HIV/AIDS Strategy is to increase the number of infected persons receiving adequate HIV clinical care to 80% by 2015 (White House, 2010a, b). However, even amongst those initially linked into care after diagnosis, retention in consistent HIV medical care is a challenge for some (Mugavero, Norton, Saag, 2010; Mugavero, Amico, Horn, Thompson, 2013). Proportions of HIV-infected persons receiving inadequate clinical care range nationally from 41% to 63% depending on definition and study timeframe (Marks, Gardner, Craw, Crepaz, 2010; Gardner et al., 2011; MMWR, 2011; Hall, Gray, Tang, Li, Shouse, Mermin, 2012). In California, it is estimated that 63% of HIV patients are not adequately retained in care (CDPH, 2013), while in Los Angeles County (LAC) this number is estimated at 44% (Wohl & Dierst-Davies, Commission on HIV Presentation, September 2014). These proportions are not uniform, and can vary widely by socio-demographic factors (Hall, Holtgrave, Tang, Rhodes, 2013; CDPH, 2013; Wohl & Dierst-Davies, 2014; Muthulingam, Chin, Hsu, Scheer, Schwarcz, 2013).

Inadequate retention in HIV care has been associated with suboptimal adherence to antiretroviral treatments, virologic failure, community viral resistance,

increased secondary HIV transmission and poorer survival rates (Crystal, 2001; Giordano et al., 2007; Giordano, Hartman, Gifford, Backus, Morgan, 2009; Ulett et al., 2009; Christopolous, Das, Colfax, 2011; Walensky, 2006). Additionally, recent research has shown that early and consistent antiretroviral therapy (ART) substantially reduces forward HIV transmission risk (Cohen, Smith, Muessig, Hallett, Powers, Kashuba, 2013). While substance use has been identified as a predictor of poor HIV care retention, little research has looked at its role as a predictor of other social service utilization.

Enabling Resources

Transportation and Travel Time

Lack of transportation has been shown to negatively affect health care access for both primary medical care and ancillary services among HIV-infected populations (Sagrestano et al., 2013; Andersen et al., 2007; Ashman et al., 2002). Ashman et al, (2002) found that RW recipients who received transportation assistance were 18% more likely to both receive, and be retained in, medical care. Associated with transportation barriers are geographic barriers (i.e., travel times) to obtaining needed medical care or services (Fortney, Burgess, Bosworth, Booth, Kaboli, 2011; Fortenberry, Martinez, Rudy, Monte, 2012; Fortney, Thill, Zhang, Duan, Rost, 2001; Morales et al., 2004). Fortney et al. (2011), reported that longer distances traveled to acquire medical or psychological services decreased the probability the service was accessed, regardless of the type of transportation used. Fortenberry et al. (2012) also noted that transportation is a common barrier to obtaining care for HIV-infected youth. Studies have shown that co-locating medical and ancillary services in the same facility increased the utilization of both among HIV-infected patients (Steele, Rechberger, 2002). The role these variables play with respect to substance abuse behaviors is largely unstudied, except within the context of its role as a barrier to treatment adherence (Palepu, Horton, Tibbetts, Meli, Samet,

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2004). While both variables have been shown to affect access to primary medical care and support services, their effects within the context of substance abuse is largely unexplored.

Employment

Unemployed HIV-infected persons report higher rates of psychological conditions (i.e., depression, anxiety) and score lower on scales measuring self-efficacy and quality of life when compared to their employed counterparts (Blalock, McDaniel, Farber, 2002; Swindells, Mohr, Justis, Berman, Squier, Wagener, Singh, 1999). Also, employment status is associated with increased mortality among HIV-infected persons (Cunningham et al., 2005). Piette et al. (1993) found that unemployed HIV-infected persons reported a greater need for a variety of social services such as transportation, housing and home care. Unemployment is also high among substance users (Henkel, 2011). Burmane et al. (2001) reported increased odds for outpatient substance abuse treatment for unemployed (4.2), disabled (2.9) and not working (2.8) persons compared to those with full time employment. Additionally, unemployment negatively affects ART adherence (Peltzer et al., 2013). Despite this evidence, the effect that employment status may have on service gaps is largely unexplored.

Mental Health

RW recipients with psychiatric illnesses are less likely to access primary medical care services (Tobias et al., 2007; Ashman et al., 2002). Other research has suggested that receipt of treatment for mental health is positively associated with the use of ambulatory HIV primary care by marginalized HIV-infected individuals (Cunningham, Sohler, Wong, Relf, Cunningham, Drainoni, 2007). Other findings to consider are that as a group, substance users report high rates of mental health conditions (such as depression and schizophrenia) but low rates of consistent treatment (Walkup et al., 2008). These results suggest that mental health status may be an important variable to

consider with respect to the primary focal relationship between substance use and service gaps.

Insurance Status

Medical insurance status (possessing it) and type (e.g., public vs. private) has long been recognized as a structural barrier to obtaining and maintaining access to regular healthcare in the United States (Wolff et al., 2009; Burnes et al., 2004). Among populations such as the HIV-infected, substance users and HIV-infected substance users specifically, insurance status has been independently linked to suboptimal care and treatment (Bozzette et al., 1998; Burnam et al., 2001; Cunningham, Sohler, Berg, Shapiro, Heller, 2006; Uphold et al., 2005; Morales et al., 2004; Knowlton, Hoover, Chung, Celentano, Vlahov, Latkin, 2001). Lack of insurance has also been linked to underutilization of ancillary services for RW recipients (Katz et al., 2000; Piette, Fleishman, Stein, Mor, Mayer, 1993; Knowlton et al. 2001). Chan et al. (2002) did find that persons who used more ancillary services reported higher numbers of primary care visits, but the effects of insurance status (as this was a Ryan White sample and coverage was assumed) on the number of service gaps reported was untested. Wohl et al. (2011) found that HIV-infected persons on public assistance were twice as likely to report a service gap, but they only controlled for lifetime use of injection drugs in the model. For these reasons, the role of insurance status as a potential confounder of the focal relationship were explored.

Federal Poverty Guidelines (FPG)

As mentioned previously, no uniform metric exists for measuring socioeconomic status (SES) in health research (Braveman, Cubbin, Egerter, Chideya, Marchi, Metzler, Posner, 2005; Shavers, 2007). Due to this fact, the federal poverty guidelines (FPG) was substituted as a proxy for SES (HHS, 2011) in this analysis. This was chosen for consistency, as FPG is used by Los Angeles County Department of Public Health as an

SES proxy when reporting on RW recipients (DHSP, 2013). FPG is a federal poverty measure that takes into account a persons income and household size and is standardized across the contiguous United States. The purpose of this measure is to create a measure of determining eligibility for local, state and federal benefits for food, housing and medical assistance.

In general, lower SES (regardless of indicator technique) is associated with inconsistent medical care and poorer treatment outcomes (Cunningham et al., 2005; Burnam et al., 2001; Morales et al., 2004). Lower SES is also associated with substance abuse generally, and is cited as a major barrier to obtaining substance abuse treatment (Padwa, Ni, Barth-Rogers, Arangua, Andersen, Gelberg, 2014; Beijer et al., 2012). Among HIV-infected substance users, lower SES is associated with access to fewer services and poor treatment outcomes (Burnman et al., 2001). Links between SES and medication adherence among HIV-infected persons are inconclusive (Peltzer et al., 2013). The role that SES (as measured by FPG) plays as a barrier to receiving ancillary services should be further explored.

Rival Independent Variables

In the context of the elaboration model, a rival independent variable essentially plays the same role as a confounder or control variable; the major exception is that it is intended to rule out alternative explanations presented by rival theories (Aneshensel, 2013). In this sense they play a different role from a theoretical perspective, as the interpretation of results is held under much more scrutiny. Although, from an analysis perspective the role of rival independent variables is identical to that of control variables. As so few theories have been developed to look at the field of service utilizations, listed variables are ones in which the research into their effects as a predictor of service gaps is fairly well established. Additionally, some of these factors have been identified as key

barriers that HIV-infected persons experience with respect to receiving adequate service delivery, as detailed by the National HIV/AIDS Strategy and Implementation Plan (White House, 2010a).

Incarceration History

HIV-infected persons with incarceration histories suffer poor ART adherence as well as experiencing suboptimal patterns of HIV care (Westergaard, Spaulding, Flanigan, 2013). Incarcerated persons also report high rates of substance abuse, and HIV-infected substance abusers recently released from prison suffer high rates of drug relapse and overdose (Binswanger, Stern, Deyo, Heagerty, Cheadle, Elmore, Koepsell, 2007; Seaman, Brettle, Gore, 1998). In addition, HIV-infected persons recently released from prison have difficulties obtaining consistent medical care and ART prescriptions (Westgaard et al., 2013; Luther, Reichert, Holloway, Roth, Aalsma, 2011).

A major reason is that while incarcerated, many persons lose not only insurance benefits but also ties to important social services (such as case management or housing) they were receiving prior to incarceration (Wakeman, McKinney, Rich, 2009; Harzke, Ross, Scott, 2006). Incarcerated HIV-infected persons have high rates of expressed social service needs, many of which go unmet upon release (Lanier, 2005). As such, therefore, the impact of substance abuse within the context of recent incarceration on service gaps should be further explored.

Housing Status

Among HIV-infected persons, housing insecurity (in the form of homelessness or unstable housing) has long been linked to poor levels of HIV treatment and suboptimal patterns of antiretroviral (ART) medication adherence (Milloy et al., 2012; Kidder et al., 2007; Leaver, Bargh, Dunn, Hwang, 2007). Housing insecurity has been recognized as an important structural barrier to obtaining optimal and consistent HIV care, and is mentioned as a key concern by the National HIV/AIDS Strategy (White House, 2010a,b).

In a study of the medical and social service needs of incarcerated HIV-infected persons, respondents listed housing as their highest priority upon release, over food and medical care (Lanier, 2005). High numbers of HIV-infected homeless persons are substance dependent (Andersen, 2005). Katz et al. (2000) found that RW recipients with a recent (past 12 months) history of substance dependence had over a two-fold increased odds (OR=2.1) of reporting a housing service gap. For this reason, the role that housing plays with respect to the focal relationship between substance use and service gaps was closely scrutinized.

Moderator

Barrier Type

In the context of the elaboration approach a moderator variable, by definition, should change the focal relationship when introduced into the analysis. Moderators are commonplace in research and may have profound effects on the interpretation of results by highlighting the fact that effects are not uniform across a sample. As mentioned in the introduction, a variety of interpersonal and structural barriers have been identified with respect to acquiring needed services among HIV-infected populations, as well as substance users (Kempf et al., 2010; Tobias et al., 2007; Berg et al., 2007). Several classification systems have been identified to account for different types of barriers to obtaining services, but no uniform standard exists. Barriers to care were analyzed for their potential moderating effects on the focal relationship between substance use and ancillary service gaps.

Conditional Relationship

In addition to the primary focal relationship, factors unique to substance users (i.e., type and number of substances used) were explored for their effects on the number

of service gaps reported. This analysis will only include the subset of substance users

(n=119) from the entire LACHNA sample (N=400). Both factors (type and number of

use) will then become the primary independent variables in the focal relationship. This

type of analysis is what Aneshensel (2013) describes as a conditional relationship, as

the outcomes only affect a subset of the sample (e.g., substance users). As Figure 4.7

above shows, all of the previously mentioned control, rival independent and consequent

variables were included in this analysis.

<u>Type of Use</u>

       Much of the early efforts examining HIV risk behaviors among substance users

were focused on opiate use (primarily due to IDU behavior), the role that other

substances play in disease risk and sequelae has gained much more prominence over

the last decade (Shoptaw et al, 2013; CDC 2013; Altice et al., 2010). Among HIV-

infected MSM populations, stimulant use specifically (i.e., amphetamines,

methamphetamines and cocaine/crack) has been identified as an important risk factor

related to poor treatment outcomes and medication adherence (Shoptaw et al., 2013;

Kipp et al., 2011). It has also been identified as a moderating factor between unsafe

sexual practices among infected individuals, as well as a driver of new HIV infections

(Semple, Zians, Grant, Patterson, 2006a; Semple, Zians, Grant, Patterson, 2006b).

       Substance use generally has been shown to affect the number of service gaps

reported (Chan et al., 2002), and drug-seeking behaviors have been linked to problems

with obtaining needed services (Shoptaw et al., 2013; Reback et al., 2003). What has

not been explored is the role stimulant use alone may play in the use of support services

among HIV-infected persons. It can be hypothesized that use of stimulants alone may

increase the likelihood that persons report service gaps, as these substances influence

behaviors related to impulsivity and/or the lack of ability to delay gratification (Reynolds,

2006).

<u>Number of substances used</u>

Another potential moderating effect comes from the number of reported substances used. In the field of addiction research, severity of use refers to, "…the degree of maladaptive compulsive drug-seeking and using behavior displayed by an individual, corresponding to variation in liability above the diagnostic threshold" (Conway, Levy, Vanyukov, Chandler, Rutter, Swan, Neale, 2010). Research has established substance use severity as a barrier to poor treatment outcomes and decreased utilization of medical and support services among HIV-infected populations (Wolfe et al., 2010; Altice et al., 2011). Additionally, severity of use has been shown to affect HIV risk behaviors (Semple et al., 2006a; 2006b). What is unclear is how increasing number of substances used affects the ability to obtain or maintain needed social services. Also, it is unclear if measuring the number of different substances used can act as a proxy for true severity of use as it has been traditionally measured. It can be hypothesized that increased numbers of different substances used, as a proxy for increased drug seeking behaviors and or severity, could potentially affect factors associated with unmet service needs, but this is untested.

CHAPTER 5: RESEARCH DESIGN AND METHODS

Section 5.1: Overall Sampling Methodology

A stratified, cross-sectional, two-stage, proportional-to-size sampling method was used to identify a representative sample of HIV-infected persons in care (Blair et al., 2011; McNaghten, Wolfe, Onorato, 2007). The first stage involved facility selection and the second stage involved participant selection. This methodology used a combination of sampling schemes developed and implemented for the HIV Cost and Services Utilization Study (HCSUS) and two Centers for Disease Control and Prevention (CDC) funded studies, the Medical Monitoring Project (MMP) and the National HIV Behavioral Surveillance System (NHBS) (Blair et al., 2011; CDC 2011; Frankel et al., 1999; McNaghten et al., 2007). These population-based approaches were developed by the CDC to efficiently increase the representativeness of data collected from HIV-infected persons in the United States (McNaghten, et al., 2007, Institute of Medicine, 2004). Appendix B provides a complete list of agency sites, selected facilities, their sampling probability groups and the number of participants interviewed from each site. Figure 5.1 provides a general guide to the sampling methodology used.

Figure 5.1: Sampling Flow Chart

Stage 1: Facility Sampling — Universe of Service Sites (N=93)

Stratification

HIV Clinical Care (n=35)	Social Services (n=25)	Residential Services (n=14)	Substance Abuse (n=14)	Oral Health Care (n=5)

Sampling

Certainty Selection (n=15): n=8 sampled, n=3 sampled, n=1 sampled, n=2 sampled, n=1 sampled

Non-Certainty Selection (n=19): n=10 sampled, n=6 sampled, n=0 sampled, n=0 sampled, n=3 sampled

Linked Facilities (n=13): n=2 sampled, n=3 sampled, n=4 sampled, n=4 sampled, n=0 sampled

Methodology

Samp. Prob=1 — Facility EPL> Strata (EPL/n)

Samp. Prob<1 — b/EPL (b=80 persons)

Samp. Prob<1 — EPL<=b (b=80 persons)

Total Sampled Facilities (n=47)

Stage 2: Patient Sampling — 400 patients sampled

Methodology

Sampling probability p1*p2=1.0

p1=facility
p2=patient

Real Time Sampling
Very Large Facilities=every 4th patient
Large Facilities=Every 3rd patient
Moderately sized facilities=Every 2nd patient
Small facilities=Every patient

Stage 1: Facility Sampling Frame

The goal of the facility sampling stage was to select a representative sample of facilities from RW-funded agencies in LAC. Sampling involved a diverse group of service sites (e.g. HIV outpatient clinics, community-based organizations and social service agencies) with varying numbers of clients (range=2-4000 persons) across the vast geographic region (4,060 square miles) of Los Angeles County. Proportional-to-size sampling was used to select specific service sites for recruitment. Within LAC, 47 agencies provide RW funded services through a complex network of 93 specific agency sites (Appendix B). Many agencies offer the services at multiple locations within the county. To maximize the geographic diversity of the sample individual agency sites were used as the primary sampling units. To ensure that the sample was truly representative, special considerations were made based on both size and type of service provided to avoid under-representation of certain non-clinical services.

First, the 93 agency sites were stratified into an exhaustive list of five mutually exclusive categories: HIV clinical care, HIV social services, residential services, substance abuse services and oral health services. Within each stratum, the sampling probability for each service site was proportional to size, with higher sampling probabilities for the larger service sites. The size of each service site was determined by the number of RW funded clients that each service site reported to the LAC Ryan White Casewatch Surveillance System in FY09 (March 2009-Feburary 2010); this is also referred to as the estimated patient load or EPL. Initially 46 service sites, representing 35 separate agencies, were randomly sampled to participate. An additional three service sites were added and one was removed from the sampling frame to improve geographic representation based on recommendations by the Commission on HIV (study funder). This brought the final total to 47 service sites, representing 36 separate agencies, where patient recruitment took place (Appendix B).

As facility sampling is proportional to size (based on their EPL), sampling probabilities are different for each facility within a stratum. This is due to the fact that some stratums had a higher proportion of persons seeking those types of services (e.g., medical vs. substance abuse services). Statisticians at the CDC assisted Department of Public Health staff in the sampling scheme. Based on EPL, facilities were broken into three general categories: 1) certainty selection facilities (sampling probability=1.0), 2) non-certainty selection facilities (sampling probability<1.0) and 3) linked facilities, very small non-certainty selection facilities (sampling probability<1.0 with EPL's<90th for all non-certainty selection facilities or <80 patients). These facility size determinations ensure that larger facilities don't bias the entire sampling frame.

Certainty Selection

A certainty selection facility is defined as any facility where the EPL exceeds the average EPL for the entire sample ([EPL within strata]/[number of facilities within strata]).

Facilities with an EPL above this value were automatically included in the sampling frame. In total 15 of the sampled 47 agency sites were selected with certainty (32% of the facilities sampled), and 226 of the 400 patients recruited (57% of sample) were interviewed from these facility sites. The remaining facilities that do not have certainty selection status will have a known sampling probability below 1.0.

Non-Certainty Selection

To determine the selection probability for non-certainty facilities (where the probability of selection is <1.0), the equation b/EPL was used. In this equation b=minimum cutoff value for patients seen by an agency. For this survey, a cutoff value of b=80 patients was used. This cutoff was used both out of convention based on advice from the CDC statistician (C. Johnson, personal communication, March 10, 2013) and because 90% of the facilities in the sample frame see more than 80 Ryan White patients. Put another way, 90% of all facilities in the sampling frame saw at least 80 patients during LAC RW Casewatch Surveillance System in FY09. Also, this cutoff value has successfully been used to generate a representative sampling frame from other national studies with similar sampling schemes such as the Medical Monitoring Project and the National HIV Behavioral Surveillance Survey (McNaghten et al., 2007).

Any facility that was not selected with certainty but that has an EPL>80 patients falls into this category. This included 34 of the 93 possible agency sites in the sampling frame. In total, 19 facilities of the 47 sampled were selected using this method (40% of sampling frame), and 136 of the 400 patients recruited (34% of sample) were interviewed from these facility sites.

Linked Facilities Selection

Very small facility sites are defined as those with an EPL either at or below the minimum cutoff value of b (EPL<80 patients). These facilities were then linked with similar types of facilities that also had EPL's below b. The goal of this procedure was to

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ensure that these smaller facilities have a reasonable chance of being selected by creating a lower threshold of facilities with a set EPL (n~80 patients). Facilities were merged based only on their EPL size, creating uniform sampling probabilities for all very small non-certainty selection facilities. Ideally, very small facilities (EPL~2 patients) should be linked with a larger facility within the same stratum (EPL~70 patients) in an effort to generate these uniform sampling probabilities (groups of facilities with combined EPL~80). This linking process created 18 new sampling units that comprised of a total of 43 individual facility sites from the total sampling frame of 93. On average 2.4 facilities were combined to create a new linked sampling unit (range 2-4 facility sites). In total four linked groups were selected using this method. Once unlinked, they represented 13 of the 47 individual facility sites sampled (28% of the sampling frame), and 38 of the 400 patients (9% of sample) interviewed.

<u>Sampling Procedure</u>

A sampling interval (*I*=436) was constructed to determine which non-certainty facilities (including linked facility groups) were selected. To determine *I*, the total EPL from all facilities with non-certainty and linked selection probabilities (n=11,760 patients) was divided by the number of remaining facilities to be selected (n=27). Please note, this calculation is based on the number of sampling units expected to be sampled (n=40), as 13 were already selected (due to certainty selection) this leave 27 facilities left to be sampled. This number increases once facilities become unlinked. Once *I* was determined, a random start number between 1 and 436 was selected. All remaining facilities were then sorted largest to smallest by EPL (regardless of stratum) and the random start number was applied in a cumulative fashion to this list to select the remaining facilities.

Once the remaining sampling units were selected, based on the above sampling procedure, they were organized back into their strata. Recall that four linked facilities

were selected which when unlinked represented a total of 13 individual facilities.

Although it was determined that a total of 40 facilities were to be sampled, due to some

facilities being linked a total of 47 sampling units were selected as recruitment sites.

The overall order of the sampling procedure described above is as follows:

1. Determine the number of "certainty selection" facilities based on EPL;

2. Determine the number of non-certainty and linked selection clinics based on the

   EPL at the remaining facilities where:

   a. Non-certainty selection criteria are used with facilities with EPLs between

      [EPL within strata]/[number of facilities within strata]) and *b*; and

   b. Linked selection criteria are used with facilities with EPL<*b;*

3. Sort remaining non-certainty and linked facilities by EPL;

4. Determine sampling interval (*I*);

5. Obtain random start number (between 0 and *I*);

6. Select facilities to be sampled; and finally

7. Unlink facilities to determine the exact size of sampling frame.

<u>Non-random Sampling Adjustments</u>

Once a sampling frame was constructed and all facilities were selected, it was

determined by the Commission on HIV (study funders) that specific facilities not included

in the sampling frame should be given "certainty selection" status independent of their

size. This was due to either their connection to a special population they serve (e.g.

homeless, transgender, etc…), or a regional representation. Due to recommendations by

the Commission on HIV three additional non-randomly selected facilities were added

and one was removed from the sampling frame bringing the total number of facilities

selected to 49. Since these modifications represented less that 5% of the sample

selected by the aforementioned procedure, it was determined by biostatistician at the

CDC that this would not jeopardize the integrity of the facility sampling methodology (C. Johnson, personal communication, March 10, 2013).

Stage 2 Patient Sampling

The goal of the second sampling stage was to generate a representative random sample of clients from the selected service sites. Standardized calculations indicated that a sample size of 400 was sufficient to represent the approximately 19,000 RW clients (DHSP, 2013). The patient sampling stage took into account both facility and patient sampling probabilities to ensure that patients from larger facilities were not over-represented. This was achieved by multiplying the sampling probabilities from each stage (facility-p_1 and patient-p_2) together to achieve an overall probability of 1.0 ($p_1*p_2=1.0$). The number of participants selected at a given facility (n_i) was based on both the EPL of the facility (p_1), and the client selection probability for that facility (p_2). For non-certainty and linked facilities where their selection probabilities were less than 1.0), the number of individuals selected (n_i) at these facilities over-sampled proportional to their EPL (as compared to certainty selection clinics). This ensures that each individual selected has similar sampling probabilities across both sampling frames, and patients from facilities with larger EPLs don't dominate the sample. To determine the within-facility sampling probability (p_2), the following equation is applied $p_2=k/p_1$ where k=overall sampling probability. For certainty selection facilities k=1.

Once the number of subjects per sample site was established, real-time sampling (a method where eligible participants are sampled as they arrive for services) was used to conduct random participant selection (Frankel et al., 1999). Real-time sampling has been shown to be successful at recruiting statistically representative population-based samples from studies with similar multi-stage sampling frames (CDC 2011; Frankel et al., 1999).

Exact days and times that staff arrived to conduct interviews were chosen weekly at random from a list of day and time slots when sites were open (CDC 2011). Two interview staff were responsible for implementing the sampling scheme, recruiting respondents and conducting the interviews. The number of eligible clients present at an individual site varied depending on hours of operation, day of the week and type of site. To account for varied client flow, recruitment was staggered based on daily facility patient load (e.g., every patient for small facilities, every 4th patient for large facilities). Table 5.1 displays a detailed description of client selection based on facility size. All facilities were listed in ascending order based on daily EPL and broken into quartiles (representing 25% of daily EPLs each) to determine patient selection protocol.

Table 5.1: Sampling Order for Patient Recruitment Using Real-Time Sampling

Quartile	Daily EPL	Patient Recruitment Order
1	1-10	Every Patient
2	11-20	Every Other
3	21-35	Every 3rd
4	>36	Every 4th

Real-time sampling ensured that participant selection was adjusted if sampling took place over several days and the EPL varied. Some facilities had days and time where more potential respondents would arrive for services, based on the timing of programs, staff availability or when services are available. On average, 2.3 site visits were needed to complete all interviews at each site. Sites were instructed not to inform clients about the survey or make any special announcements. Methods used to recruit clients included both recruitment flyers and in-person recruitment by clinic and study staff as clients arrived at the site. The overall response rate was 94%.

Questionnaire

Data were collected using a Computer Assisted Survey Instrument (CASI) method using interview software known as QDS (Questionnaire Design Systems), and conducted in either English or Spanish (no participants were excluded due to language

deficiencies) Variables focused on participant awareness, need and utilization of 47

different HIV service categories available to low-income HIV-positive LAC residents. A

complete list of all service categories can found in Appendix A. Additionally, the specific

questionnaire language used to describe each service to respondents, and how service

gaps were identified, can be found in Appendix C. Information regarding demographics,

insurance status, HIV testing history, sexual behaviors, substance use, mental health

and oral health were also collected. The questionnaire took on average 30-45 minutes to

complete and participants were compensated with $30 in gift cards to local stores

(Ralphs or Target).

Eligible participants were adult (18+), HIV-infected LAC residents who were

receiving Ryan White funded services. All participants spoke either English or Spanish.

The survey instrument was intended to be respondent driven, meaning participants were

offered assistance by staff when necessary, to reduce social desirability bias (Gregson,

Zhuwau, Ndlovu, Nyamukapa, 2002). Research staff were available to assist

participants if needed. Due to disability (blindness), language difficulty or computer

literacy, some participants received more assistance than others. Research assistants

were instructed to identify the level of assistance respondents received at the end of the

interview by quantifying the percent of the survey with which they assisted the participant

(<10%, 10-25%, 26-50%, 51-75% or >75%). This variable was dichotomized (at or below

50% vs. above 50%) and then analyzed to see if differences could be found with respect

to the level of assistance a person received. Analysis revealed that the level of

assistance was not associated with socio-demographics (age, race/ethnicity, gender,

SES), the number of services respondents reported receiving, or the gaps reported. This

indicates that the level of assistance respondents received did not affect the outcome of

interest in any meaningful way.

<u>Institutional Review Boards (IRB)</u>

As this study involved patient from multiple institutions across LAC, approval from the following IRBs was obtained:

- Los Angeles County Department of Public Health (LACDPH)

- University of Southern California

- Dignity Health

- Olive View Medical Center

- Charles Drew Medical Center

- Harbor UCLA Medical Center

Most institutions where recruitment took place fell under the direct purview of LACDPH IRB. A data sharing agreement between the LACDPH IRB and the Division of HIV and STD Programs was also obtained, allowing use of this dataset for the purposes of this investigation. Additionally, approval was obtained from the UCLA IRB.

Section 5.2: Key variables

For analysis purposes, many variables were dichotomized or polytomized when either too few respondents were available in one category for meaningful analysis of effect. Chapter six below show all relevant sample sizes for all variables of interest.

<u>Dependent (Outcome) Variable: Service Gaps</u>

For each of the 47 service categories, participants were asked if they were aware of that service, if they needed the service and if they received the service. A table of the sequence of questions can be found in Appendix C. For services that clients stated they received, respondents were asked if the service met their needs, if they were satisfied with the service, and if they had any problems related to access. If a participant claimed

they needed a service but did not receive it, this was considered a service gap (Kahn, 2003). The primary dependent outcome variable to be analyzed is if a respondent reported any service gap. Logistic (dichotomous outcomes) and Poisson (count outcome) regression analyses were used to analyze results.

Independent Predictor Variable: Substance Use

Participants were asked if they had used any of the following substances in the past six months: Amphetamine/Methamphetamine (crystal, tina, speed), Marijuana (ex: cannabis, pot), Heroin, Other opiates/analgesics (ex: codeine, dilaudid, oxycontin, vicodin, percodan), sedatives, hypnotics or tranquilizers (ex: sleeping pills, quaaludes, xanax, GHB), Hallucinogens (ex: PCP, ecstasy, X, LSD, mushrooms), Other substance. These substances were further classified into general categories of substance (stimulants, depressants, opiates, marijuana and other). If participants reported yes to using any of these substances they were classified as substance users. All others were classified as non-substance users. Distributions of reported substances used can be found in aim 1 below.

Control Variables: Predisposing Characteristics

Age

All LACHNA-Care participants were asked their date of birth for screening purposes. Age at the time of interview is presented for all participants and was based on the date of the interview. The mean age reported was 44.7 years (median=46 and mode=48 years) and ranged from 18-74 years old. For comparison to the Ryan White sample this variable was collapsed into five mutually exclusive categories (18-24, 25-29, 30-39, 40-49, 50+). For the remainder of the analysis, this variable was treated as continuous or grouped into 10-year age increments for greater interpretability.

Gender

Gender was measured using the two-question approach recommended by the UCSF Center for Excellence (Sausa, Sevelius, Keatley, Iñiguez, Reyes, 2009). This method is considered more effective at identifying transgender individuals in surveys. Participants were asked their biological sex (sex at birth) and gender (how they perceive themselves now). Males were defined as individuals who identify as male at birth and also as their current gender. Females were defined in the same way (female at birth and female gender). Individuals were classified as transgender if they: 1) identified their gender as transgender on the questionnaire or, 2) there was discordance between sex at birth and current gender (e.g., identified their sex at birth as male and gender as female). For analysis purposes, this variable was considered a polytomous nominal variable.

Race/Ethnicity

Race and ethnicity were measured using standardized categories established by the U.S. Office of Management and Budget (OMB), which include American Indian/Alaskan Native, Asian/Pacific Islander, Black/African American, and White (OMB, 2014). These categories are consistent with both the US Census as well as local surveillance reporting. Respondents were not limited in the number of groups with which they could identify. Additionally, Hispanic/Latino ancestry was considered separate from the racial group with which they identified. A combined race/ethnicity variable was created for this analysis that combines responses of ethnicity with those of race. Persons were classified into one of the following mutually exclusive categories: White/Caucasian, Black/African American, Hispanic/Latino, Other/Multi-racial. These categories are consistent with what is reported by the Department of Public Heath's Ryan White reporting system and thus, allow for comparisons to be made. Please note,

a small number of individuals identified with more than one racial group (n=13); these individuals were classified into a multi-racial category. This variable was treated as a polytomous nominal variable.

Sexual Identity/Orientation

All participants were asked if they perceived themselves to be homosexual/gay/lesbian, heterosexual/straight or bisexual. This variable was treated as a polytomous nominal variable for analysis purposes.

Educational Attainment

Participants were all asked what the highest level of education (based on US standard educational attainment categories) they completed was, based on several mutually exclusive options. For analysis purposes categories were collapsed into three mutually exclusive categories (less than high school education, high school graduate/GED and beyond high school) of nearly identical size. This variable was treated as a polytomous nominal variable.

Interview Language

Interviews were conducted in either English or Spanish. Additionally, participants were asked what their primary language of choice was ("which language do you speak most often at home or with friends"). For the latter question, most` respondents chose either English or Spanish, with a small minority (5%) choosing another language. Although not shown, these two variables have considerable overlap (Pearsons r=0.73, p<001). Due to this fact, the language of interview was used as the primary variable for analysis and was treated as a dichotomous nominal variable.

Lapse in Medical Care

All participants were asked if they had ever experience a lapse in care (a period where they didn't see a doctor for HIV care specifically) for at least a year or longer since they had tested positive for HIV. For analysis purposes this variable was treated as

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nominal and dichotomized into two mutually exclusive categories (0=reported a lapse in care, 1=didn't report a lapse in care).

Control Variables: Enabling Resources

Travel Time

All participants were asked the amount of time (in minutes) it usually takes them to get to their doctors appointments in the last 12 months. The mean travel time reported was 42.2 minutes (median/mode=30 minutes) and ranged from 1-240 minutes. This variable was treated as continuous in nature or (as with age) be separated into 10-minute segments to ease interpretability for analysis purposes.

Employment Status

Participants were asked about their current employment status based on several mutually exclusive options. Persons could identify if they were currently employed (full or part time), unemployed, retired, or disabled/student/ homemaker. For analysis purposes, this variable was collapsed into approximately equal sized three-category polytomous nominal variable (employed, unemployed or retired/disable/student).

Mental Health Status

All participants were asked a series of questions to assess their overall mental health status as it related to: depression, anxiety, bipolar disorders and schizophrenia. These questions were developed specifically for this survey. If participants reported ever been diagnosed with either of these four conditions there were then asked a series of follow up questions for each: a) ever been prescribed medication to treat this condition, b) are they currently (past 6 months) taking medication for this condition, and c) if they experienced symptoms of these conditions in the past six months. These questions were intended to identify both lifetime and current mental health status, and to gauge the current severity of their condition in a very general way.

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From this information two new variables were created, one to capture lifetime history of a mental health condition and another to capture recent (past 6 months) history. Participants who report a lifetime diagnosis of any of these four conditions were dichotomized (0=no history of mental health disorders, 1=history of mental health disorders). Respondents who reported recently taking medication for any of the four mental health conditions, or reported experiencing recent symptoms, were also dichotomized (0=no recent history of mental health disorders, 1=recent history of mental health disorders). Both new variables were treated as nominal in nature. Though not shown, there is substantial overlap between these two variables (Pearsons r=0.68, p<0.01). Preliminary analyses demonstrated that current mental health was a better predictor variables than lifetime, for this reason all results presented are for persons reporting current mental health conditions.

Insurance Status

All respondents were asked about their insurance status. Uninsured participants are those who reported not having any insurance in the past 12 months. Publicly insured respondents were participants who reported receiving either: Medi-Cal, Medicare, Indian Health Services (IHS), or VA/CHAMPS Coverage in the past 12 months. The majority of respondents in this category reported receiving Medi-Cal, Medicare or a combination of both. A small number of participants (n=11, unweighted) reported having private insurance. For analysis purposes, respondents were categorized into one of three mutually exclusive groups: no insurance, public insurance and private insurance. This was treated as a polytomous nominal variable.

Federal Poverty Guideline

The Federal Poverty Guidelines (FPG) was used as a proxy measure for the socioeconomic status. FPG is a standardized calculation from the federal government to determine the economic status of a person based on income and number of dependents

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(DHHS, 2011). A participant who's FPG is at or below the federal standards is classified as having low economic status. For analysis purposes, this variable was dichotomized (0=at or below FPG, 1=above FPG) and was treated as an interval variable.

Mode of Transportation

All participants were asked how they usually have gotten to their doctors or social services appointment in the past 12 months, and selected one answer from the following list: I drive myself, a friend or family member drives me, taxi/hired driver, bus or other public transportation, walk/bike, clinic provides transportation, other. These responses were dichotomized into one of two choices, public transport (bus or other public transportation, walk/bike) or private car (I drive myself, a friend or family member drives me, taxi/hired driver, clinic provides transportation). This variable was treated as a nominal for analysis purposes.

Residency Status

All participants were asked about their residency status (undocumented, US citizen or legal resident). For analysis purposes, this nominal variable was polytomized (0=US citizen or legal resident, 1=undocumented, 2=not reported).

Rival Independent Variables

Incarceration History

All participants were asked if they were incarcerated (in jail or prison) for longer than 24 hours in the past 12 months. Those who responded yes were recorded as having a recent incarceration history. This variable is dichotomous and nominal.

Housing Status and Homelessness

California has the largest homeless population in the United States, and Los Angeles County has the largest concentration of homeless individuals in the state (LAHSA, 2009; Tepper, Simpson, Huang, 2004). The federal definition, from the

Department of Housing and Urban Development (HUD, 2013), was used to classify

respondents as being currently homeless. A respondent was considered currently

homeless if they listed their current residence as: car or other vehicle, abandoned or

vacant building, outside (street, park, beach, or underpass), emergency shelter or

mission, transitional housing or hotel without a lease. A separate category, chronically

homeless, were respondents who reported four or more episodes of homelessness

(living in any of the situations listed above) in the past three years, or report continuously

living in one of the above-mentioned locations for one year or more within the past three

years was also created. A considerable overlap between these two categories

(Pearsons r=0.61; p≤0.01) was reported, but they are not considered interchangeable.

Preliminary analysis using both of these variables revealed that the currently homeless

variable had greater predictive power compared to chronic homelessness persons. For

analysis purposes, individuals were be dichotomized by reported current homelessness

(0=homeless, 1=not homeless) and treated as nominal in nature.

<u>Moderating Variable</u>

<u>Barriers to Care</u>

Once a service gap was identified (participant reported needing a service but did

not report receiving it) they were asked to identify the major reason to why they were not

able to receive this service (barrier). A list of possible barriers was presented for each

service gap identified. For analysis purposes, responses were grouped into two mutually

exclusive categories, named *Information* and *Systems* barriers:

- Information Barriers
    - I was not aware that a service or treatment was available to me
    - I was not aware of a location of the service(s)
    - I was not aware of whom to ask for help

- o The organization did not provide the right referrals to the services I needed)

- Systems Barriers

  - o The service provider or persons providing services was/were insensitive to my issues and concerns

  - o The amount of time that I had to wait to get an appointment was too long

  - o The amount of time that I had to wait in a waiting room before I received the service(s) was too long

  - o Too much paperwork or red tape

  - o Too many rules and regulations

  - o Using drugs

Approximately 20% of responses to these questions were write-in, and when possible these responses were re-classified into one of the above-mentioned categories.

Once barrier categories were identified, the proportion of barriers that were either information or systems based for each respondent was determined. From this two new dichotomous variables were created based on what the majority of barriers identified were: 1) Majority ($\geq$50%) information barriers, 2) Majority ($\geq$50%) systems barriers. These two variables were used to stratify the analysis.

Conditional Relationship

Type of Use

Substance using participants was dichotomized into two groups based on reported stimulant use (1=reported stimulant use, 0=no stimulant use reported). Persons reporting use of amphetamine/methamphetamines or cocaine/crack was categorized as stimulant users.

<u>Number of Substances Used</u>

A new count variable (range 1-5) was created to capture the number of substances a person reported using in the past 6 months. Factors such as route of administration, frequency of use and number of substances used have all been used as proxies for severity of addiction (Anthony, Warner, Kessler,1994; Samaha & Robinson, 2005; Des Jarlais, Des, Arasteh, Perlis, Hagan, Heckathorn, Mcknight, 2007; Chen, Kandel, Davies, 1997; Chen & Kandel, 2002). As none of these were captured by this dataset, this new count variable was created to account for intensity of use. The effects the number of substances used were explored among substance users.

Section 5.3: Analysis Plan

All analysis was conducted using SAS v9.2 (SAS Corp, NC) and SUDAAN (RTI International, NC). To fulfill aim 1, 2 and 4 analysis was conducted on the entire LACHNA-Care sample (n=400 unweighted; N=18,951 weighted). Analysis for aim 3 was restricted to substance-using participants only (n=119 unweighted, n=5,743). Staff of the LA County Department of Public Health who collected the data has conducted extensive data cleaning. The majority of variables of interest have already been transformed appropriately, and both validation checks and review of important SAS code has been conducted to verify the accuracy of transformed variables. When appropriate, "don't know" or "refused to state" responses were removed, replaced with dummy responses (9) or imputed (see Table 5.3 below). This maximizes the number of respondents included in regression by avoiding complete case analysis (only analyzing respondents who have no missing responses for any model variables), which reduces the sample size. The numbers of missing or imputed responses for key variables is identified in footnotes as appropriate.

Several statistical tests were used to analyze results, including t-tests, ANOVA and risk ratios (RR). Statistical methods used include Poisson and logistical regression. Unless otherwise specified, standard cutoff values ($p \leq 0.05$) identify important correlations between dependent and independent variables and will generally be referred to as *highly correlated.* Additionally, values with $p \leq 0.10$ were referred to as *marginally correlated* to explore potential emerging trends. There is an ongoing robust scientific debate regarding language surrounding the interpretation of scientific results involving human subjects (Rothman & Greenland, 2005; Pool, 2001; Greenland, 1990; Rothman, 1987). Terms such as "statistically significant" will not be used in this dissertation as it they can be confusing, arbitrary and were never intended as hard cutoff value for determining causality (Fisher, 1956). Equal attention will also be given to measurement precision (i.e., confidence limits) as well as stated p-values, as some think that an overemphasis of p-values in research can lead be misleading (Pool, 2001; Rothman, 1978).

As this is a retrospective sample (all participants were asked if they experienced a gap in the past 12 months), RR derived from the both Poisson and logistic regression analysis of weighted data was used to better understand the relationships between dependent and independent variables (Reichenheim & Coutinho, 2010; Barros et al., 2003; Greenland, 1987; Stromberg, 1995; Thompson et al., 1998). Logistic regression is used when an outcome of interest is dichotomous (reporting on the presence or absence of a service gap). Poisson regression is applied when the outcome of interest is a count variable and has a finite number of responses (the number of service gaps reported). For reporting purposes, means are presented with variances; β coefficients are accompanied by their subsequent standard errors and p-values; and RR's accompany 95% confidence limits.

Although this analysis is based on the elaboration model approach, this method is best suited for linear regression (when the outcome of interest is continuous in nature) and not logit or probit based models used in logistic regression (Aneshensel, 2013; Karlson, Holm, Breen; 2012; Kohler, Karlson, Holm, 2011; Mood, 2010). This is due to the issues of re-scaling that take place when variables are added sequentially to an existing model, or as stated by Aneshensel (2013),

> "…changes in the coefficient for a variable across nested models as variables are added to the model reflect both the influence of the added variables and the rescaling of the coefficients. The change in scale make comparison of the coefficients meaningless" (pg 363).

In regression analysis total variance is comprised of both explained and residual (unobserved) variance. In logit models the residual variance is fixed (mean=0 and variance=$\pi^2/3$ or ~3.29), so when variables are added only increased explained variance is observed, creating rescaling. Put another way, if added variables have an independent (or indirect) effect on the dependent (outcome) variable this relationship isn't accounted for, as all observed changes are calculated as direct effects. This rescales the estimated relationships between independent and dependent variables between nested models. The true influence on the residual variance from added variables is unknown and may differ between nested models (Kohler et al., 2011; Karlson et al., 2012).

This concern isn't new (Winship & Mare, 1984), but only recently have techniques for correcting this error been incorporated into standard statistical packages (Buis, 2010; Kohler et al., 2011). Several fixes to this problem have been discussed in the literature, including y-standardization (Winship & Mare, 1984), average partial effect or APE (Wooldridge, 2002), linear probability model or LPM (Karelson et al., 2012) and KBH (Kohler et al. 2011; Karlson et al. 2012). There is little scientific consensus

regarding the best method to address this issue. Methods such as y-standardization severely limit the interpretability of outcomes of interest, and other methods have not been widely tested. For this reason limited logistic regression model comparisons were made. Comparisons of individual variables between models were anecdotal at best, and no model statistics (such a pseudo-R^2) were compared.

It should be noted that both logistic and Poisson regression rely on what is called a link function so they can be approximated to a linear model. As outcomes of interest for these models are either dichotomous (logistic) or count (Poisson), a transformation by the link function must be performed. The reason for this transformation is so the estimated residual errors can be normally distributed across values of X. With logistic regression the outcome (Y) has only two possible values (0 or 1), this limits the possible values for residual error to these two values, meaning that they cannot be normally distributed. Because of this limitation an assumption is made that the true underlying distribution are logistically distributed (S-shaped distribution) and are transformed by what is called a logit. For Poisson the link function is logarithmic in nature.

As Poisson models are based on a logarithmic link function, they do not suffer from the same constraints as a logistic approach. Issues related to re-scaling have yet to be resolved with Poisson, and the literature is currently unclear if such an approach is statistically sound. As statistical theory is unclear in this area (A, Afifi, personal communication, October 8, 2014), an elaboration-type approach was used to compare both variables and overall model fitting (using the likelihood ratio statistic- LR(χ^2)) across nested models. This will include comparisons of individual variables across nested regression models. For reasons explained below pseudo-R^2 values will not be compared.

Between nested models risk ratios (RR) of individual variables were compared by using standard percent change calculations (equation 1 below). Additionally, changes in

the strength of the association were reported by either changes in the overall p-value or width of RR 95% confidence intervals. Both of these tools were used to see how sets of added variables influence each other as the model is being built.

$$[(RR_2 - RR_1)/RR_2] *100 \qquad \text{Equation 1}$$

Pseudo-R^2

Another traditional elaboration approach is to evaluate changes in the coefficient of determination (R^2) between nested models as a proxy interpretation of improvements in explained variance. In traditional linear regression R^2 values are a goodness of fit measure having many interpretations: 1) explained variance of variables; 2) proportional improvement in the fit of the model based on the null; or 3) correlation between the predictive values and actual values of model variables (UCLA ATS, 2010). This measure is a ratio sum of squares measure between actual and predicted y values (Equation 2):

$$R^2 = 1 - \frac{\sum_{i-1}^{N}(y_i - \hat{y}_i)^2}{\sum_{i-1}^{N}(y_i - \overline{y})^2} \qquad \text{Equation 2}$$

$\sum_{i-1}^{N}(y_i - \hat{y}_i)^2$ = sum of squared difference between actual and predicted y

$\sum_{i-1}^{N}(y_i - \overline{y}_i)^2$ = sum of squared differences between actual y and their means

Logistic and Poisson results do not produce traditional R^2 values as with linear regression. Instead pseudo-R^2 measures are generated. Pseudo-R^2 values are derived using a maximum likelihood iterative process that is not analogous to traditional R^2 and does not have the same interpretability as traditional R^2 (Mittlböck, 2002). For both logistic and Poisson regression several types of pseudo-R^2 values can be derived, all with different interpretive capabilities (UCLA ATS, 2010). For the logistic analysis an adjusted pseudo-R^2 based on an adjusted method by McFadden was used (Windmeijer,

1995). This value can be thought of as analogous to a proportional comparison between the likelihood estimates ($LR(\chi^2)$) of both the empty (intercept) and full regressions models. It also takes into account the number of variables in the full model (*K*), as a large number of variables compared to sample size can produce overinflated values (Equation 3):

$$R^2_{adj} = 1 - \frac{Ln\hat{L}\left(M_{Full}\right) - K}{Ln\hat{L}\left(M_{Intercept}\right)} \qquad \text{Equation 3}$$

$Ln\hat{L}\left(M_{Full}\right)$ = likelihood estimate of the full regression model

$Ln\hat{L}\left(M_{Intercept}\right)$ = likelihood estimate of the empty (intercept only) model

K = number of variables in full model

For Poisson, a similar deviance test has been shown to be the most effective statistic that can be used as an approximation of explained variance (Mittlböck & Waldhör, 2000; Mittlböck & Heinzl, 2001; Mittlböck, 2002). As with logistic regression, Poisson can also produce inflated pseudo-R^2 values if the number of variables in the model is high relative to the number of observations measured (Mittlböck, 2002). For this reason, a comparison based on the deviance test of likelihood was performed (Equation 4).

$$R^2_{adj} = 1 - \frac{Ln\hat{L}\left(M_{Full}\right) - (K/2)}{Ln\hat{L}\left(M_{Intercept}\right)} \qquad \text{Equation 4}$$

These calculations are analogous to measuring the proportional improvements in the fitting of the full and empty models, but as they are not based on goodness-of-fit approaches any comparisons of pseudo-R^2 between nested regression models is inappropriate. They can be used along with the likelihood ratio test to support that the model is a better fit when compared to an empty model, disproving the overall null that the models isn't a good fit for the data.

<u>Interpretation of Results</u>

As this analysis involves regression with multiple variables added sequentially as well as stratified models several distinct types of relationships may be revealed that must be carefully interpreted (Aneshense, 2013; Rosenberg, 1968). With the addition of selected variables the strength and direction of associations may change depending on interactions with additional items. Multiple types of relationships have been described in the literature, but the terminology is not always uniform (Aneshensel, 2013; Rothman & Greenland, 1989; Rosenberg, 1968).

Nested Regression Analysis:

The addition of multiple third variables will assist in understanding if the focal relationship is truly unique or merely an artifact of another hidden association. Rosenberg (1968) identified several types of effects of third variables when applied to a focal relationship. These include: extraneous (also referred to as confounding in other literature), components, intervening (also referred to as mediators in other literature), antecedents, suppressors, distorters and specification (moderators) variables. For the purposes of this analysis, and due to limitations of nested regression models, only effects from confounding (extraneous), suppressor or distorter variables can be examined.

It should be noted that extraneous and intervening variables have the same effect when analyzed using regression; which is to either diminish or eliminate previously robust relationships. The reason for this effect is that the added third variable is now accounting for either part, or the entirety, of a previously observed robust relationship. This is either achieved by the third variable acting independent, in that it is competing with (extraneous or confounding effect), or acting as an intermediate step along the causal pathway (intervening or mediating effect), of the primary focal relationship. The other relationship of interest is the suppressor, which has the effect of masking a robust

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relationship that was once not present. Finally, distorters, which have the effect of switching the direction of influence (from positive to negative), may also be observed.

Though multivariate regression analysis controls for all variables present, it may be difficult to pinpoint the exact variable causing the effect as they are added in groups as dictated by the theoretical model. Below are the guidelines that used to interpret observed results:

1. <u>Elimination or partial elimination:</u> A previously strong correlation is eliminated or substantially weakened when a third variable is added. This could be due to the effects of a variable being either extraneous (confounding), or intervening (mediating).
2. <u>Suppression:</u> A weak correlation becomes more robust upon addition of a third variable.
3. <u>Distorter:</u> A correlation switches direction in the presence of a third variable.
4. <u>No Effect:</u> Added variables have no effect on the focal relationship (also referred to as replication in the literature).

Stratified Regression Analysis:

Stratified analysis (splitting the model based on the level of a modifier variable, in this case the modifier is barrier type) has also been described as conditional analysis in other literature (Aneshensel, 2013). The added advantage is to observe changes in a focal relationship within strata (levels) of your third variable to detect effect modification. Interpreting effect modification using regression with stratified analysis has been well described in the epidemiology literature (Rothman & Greenland, 1989). Stratified analysis can also be useful in determining if a variable is a confounder (extraneous). Determining effects is achieved by comparing stratified results to that of the crude (or unstratified) model. Below are general guidelines used to interpret stratified results:

1. <u>No effect:</u> Both crude and stratum-specific estimates remain similar
2. <u>Confounding:</u> Stratum-specific measures are similar to each other but differ from the overall crude analysis by >10%.
3. <u>Effect Modification:</u> Stratum-specific estimates differ greatly from one another and but the crude estimate is in between the stratified estimates.
4. <u>Both Effect Modification and Confounding:</u> Stratum-specific estimates differ and but are both either greater or less than the crude

While none of these interpretations are infallible due to possible effects from unobserved heterogeneity (Aneshensel, 2013; Rothman & Greenland, 1989; Rosenberg, 1968), they are general guidelines for understating observed changes in relationships.

<u>Factor Analysis</u>

Tetrachoric exploratory factor analysis (EFA) was conducted to determine if naturally occurring groups (or clusters) of service gaps exist. Traditional factor analysis assumes that analyzed variables are continuous in nature, this leads to potential bias when dichotomous variables are used because the range of Pearson correlation coefficients is limited with dichotomous outcomes (Lee, Poon, Bentler, 1995). For this reason an adjustment must be made (tetrachoric adjustment), which assumes that the underlying distribution of variables is normal.

First, tetrachoric factor analysis will identify potential factors of interest. Kaiser criterion (eigenvalues >1.0), and subsequent scree plots determined which factors would be retained for further analysis (Afifi, 2004). Then, to maximize factor loading an oblique rotational method (promax) was applied to retained factor variables to include into new groups of service clusters. Promax rotations are the most appropriate rotation method to use as it assumes factors may be correlated in some way (Afifi, 2004). As all variables of interest are related to the availability of specific RW services, this is an acceptable assumption.

Once established, a factor scores were generated for each respondent for each factor that's retained. Factor scores are composite standardized coefficients that allow for an evaluation of an individual's placement on each factor of interest (DiStefano, Zhu, Mîndrilă, 2009). These scores can then be used to determine if factor scores differ between groups by using simple t-tests or ANOVA (DiStefano et al., 2009; Afifi, 2004). While several types of methods exist for creating factor scores, a linear standardization method values will used (Equation 5).

$$\text{Factors score 1} = (\,\bar{x}\,)(z_1) + (\,\bar{x}\,)(z_2) \ldots (\,\bar{x}\,)(z_a) \qquad \text{Equation 5}$$

$$\bar{x} = \text{standardized coefficient}$$

$$z_1 = \text{individual loading score for variable 1 on factor 1}$$

As you can see, factor score coefficients are a linear combination of standardized factor loading values. Such a procedure allows for robust analysis, as it includes influences of all variables (regardless of their loading) when generating individual score coefficients. It also allows for inclusion of cross-loaded variables in the analysis, as in traditional factor analysis variables that don't load onto a particular variable are disregarded when generating factors of interest (Afifi, 2004). Once completed, factor scores were compared between substance users and non-users to see if substance use affected reporting of service gaps within each newly formed cluster.

Analysis Plan Per Specific Aim

Aim 1: To describe the socio-demographic and service utilization characteristics of Los Angeles Coordinated Needs Assessment Care study (LACHNA-Care) survey respondents.

To address this aim, the following research questions have been identified:

1. How do socio-demographic characteristics of LACHNA-Care participants compare to the Ryan White population?

2. Describe the service utilization characteristics of this sample, including their awareness of services, service needs, utilization of services, and the extent to which respondents reported needing services that they did not receive (i.e., service gaps).

3. What are the differences between LAHCAN respondents who report ancillary service gaps compared to those who don't?

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4. Do both the aforementioned socio-demographic and service utilization characteristics differ between substance users and non-substance users?

Univariate analysis was conducted to address several of these research questions. First, to determine if this sample is an appropriate representation of the RW populations, chi-square analysis was conducted to compare demographic variables from the sample to that of the entire Ryan White population (Table 5.2 below). As Ryan White only reports proportions, and not actual raw numbers of participants, analysis was performed on the proportions reported from each sample.

Next, service utilization characteristics (including awareness, need, utilization and service gaps) were described for the entire sample of RW participants. This was intended to give a description of how services were utilized by respondents. Next, previously described demographic variables were stratified by substance use. Finally, a similar analysis based on reporting service gaps will also be undertaken. Unless otherwise specified, either t-tests and/or ANOVA statistical tests were performed to detect differences between groups. This will establish that substance users are a unique group within the sample. In addition, service utilization characteristics were presented for substance using participants.

Aim 2: To examine whether substance use plays a central role relative to reporting an ancillary service gap among a representative sample of RW recipients in LAC.
To address this aim the following research questions were identified:

1. Is substance use associated with reporting a service gap among respondents?

2. Is the strength of this relationship altered with the introduction of other competing variables (potential confounders and rival independent variables)?

3. Is this relationship moderated by the type of barriers a respondent reports?

This aim examines the main focal relationship between ancillary service gaps and substance use. Both logistic and Poission regression were used to examine how substance use (independent variable) influences service gaps (dependent variable) while taking into account other variables of interest (e.g., control and rival independent variables).

Once the focal relationship was established, the strength of this association was tested as additional control (e.g., potential confounders) and rival independent variables were added to the model. These analyses establish whether substance use represents a unique and independent factor with respect to reported ancillary service gaps. The potential moderating effects of barrier types reported by respondents were also explored. This was accomplished by conducting a stratified analysis of the full analytic model. Some have suggested that such a conditional analysis is better undertaken by conducting interaction analysis, where the moderator is treated as an interaction applied to all variables of interest (Aneshensel, 2013). As this process would be prohibitively complex given the number of variables to be analyzed, a better approach was to conduct two separate subgroup analyses stratified on the moderator. The systematic analytic method used is as follows:

Model 1: Restricted (focal relationship):

y(service gap)$=\beta_0 + \beta_1$(substance use)

Model 2a: Control Variables (predisposing characteristics):

y(service gap)$=\beta_0 + \beta_1$(substance use) $+ \beta_2$(age) $+ \beta_3$(gender) $+ \beta_4$(race/ethnicity) $+ \beta_5$(sexual orientation) $+ \beta_6$(education) $+ \beta_7$(language) $+ \beta_8$(lapse in care)

Model 2b: Control Variables (predisposing characteristics + enabling resources):

y(service gap)=β_0 + β_1(substance use) + β_2(age) + β_3(gender) + β_4(race/ethnicity)

+ β_5(sexual orientation) + β_6(education) + β_7(language) + β_8(lapse in care) +

β_9(travel time) + β_{10}(employment) + β_{11}(mental health) + β_{12}(insurance status) +

β_{13}(FPG) + β_{14}(transportation) + β_{15}(residency status)

Model 3: Full model (control + rival independent variable):

y(service gap)= β_0 + β_1(substance use) + β_2(age) + β_3(gender) + β_4(race/ethnicity)

+ β_5(sexual orientation) + β_6(education) + β_7(language) + β_8(lapse in care) +

β_9(travel time) + β_{10}(employment) + β_{11}(mental health) + β_{12}(insurance status) +

β_{13}(FPG) + β_{14}(transportation) + β_{15}(residency status) + β_{16}(incarceration status)

+ β_{17}(homelessness)

In above referenced models y is equal to the risk of experiencing a service gap. β_0 represents the intercept or the risk of experiencing a service gaps when all the other variables in the model are zero. All predictor variables are represented by β_1 to β_{17} representing the risk of reporting a service gap given a specific characteristic while holding the remaining factors constant. This model represents all control (predisposing characteristics and enabling resources) and rival independent variables explored by the analysis, not shown are any interaction terms and the moderating variable (barrier type).

Aim 3

To analyze the effects that both type and number of substance use have on the number of reported service gaps among the subset of substance users.

This aim addresses the following research questions:

1. Does use of stimulants (vs. other substances) affect the number of service gaps reported among substance users specifically?

2. Does the number of substances used affect the number of service gaps reported?

This aim examined the effects that specific substance use characteristics have on the number of reported service gaps reported. These characteristics include both the type of substance used (i.e., stimulants) and the number of different substances used. This aim represents what has been described as a conditional relationship (Aneshensel, 2013), as it only involved analyses of a subset of the sample (i.e., self-reported substance using participants). To answer these research questions the before mentioned substance using characteristics became the independent (predictor) variables in separate analyses. The outcome of interest for this aim is the number of reported service gaps. As this outcome of interest is the number of service gaps reported, Poisson regression was used to analyze the focal relationship. This type of analysis is appropriate when the outcome of interest is a count variable.

To answer the first research question substance using respondents were dichotomized into two categories, stimulant users vs. non-stimulant users. To analyze the second research question a new count variable was created (range 1-5) capturing the number of substances respondents reported using in the past six months. Once the focal relationships have been established analyses was conducted similar to those for aim 2, where the effects of control and rival independent variables were examined for their effects on the primary focal relationship. This aim will examine whether factors such as type and number of substances used plays an important role in determining the number of gaps reported by substance users.

Aim 4

To determine if substance users and non-users identify similar clusters of service gaps.

This aim addressed with the following research questions:

1. Are there specific clusters of service gaps reported by respondents?

2. Do substance users have a greater probability of reporting gaps for certain clusters of services compared to non-substance users?

This aim examined if substance users and non-substance users have a similar probability of reporting gaps for the same types of services. Tetrachoric EFA was applied to all services where a gap was identified. Then an oblique rotational method (promax) was applied to retained factors. Once new factors were established, factor scores were generated for further analysis. Finally, differences between substance users and non-users were explored to analyze if substance use affected reporting of service gaps within newly formed clusters.

Section 5.4: Model Assumptions, Validation and Manipulation

As previously stated, aim 2 and 3 use regression analysis (both Poission and logistic). The fundamental assumption of logistic regression is that the link function (known as the logit or ln(odds)) is linearly related to the independent (x) variables of interest (Afifi, 2004). In traditional regression analysis, where the dependent (y) variable is continuous, several assumptions of this variable and its relationship to independent variables (x) must be met, these include: linearity, normality, homoscedasticity and independence of observations. In logistic regression no such assumptions are made with regards to the distribution of the independent (x) variables.

The fundamental assumption of Poisson regression is that the outcome of interest is a count variable and follows a Poisson distribution. Unlike logistic regression, the link function in Poisson is logarithmic. Figure 5.2 shows the distribution of the outcome variable. Although several types of Poisson regression are possible (negative binomial or zero-inflated), for these analyses traditional Poisson is the most appropriate given the parameters of the dataset. Negative binomial Poisson is applied when the outcome of interest is highly dispersed (variance greatly exceeds the mean); as this is not the case (mean=4.1, variance=4.5), this approach isn't necessary. Zero-inflated Poisson regression is best when the outcome of interest contains a large proportion of zero values. An exact designation cutoff proportion of zero values isn't identified in the literature. As only 20% of the sample contains zero values this type of analysis is considered unnecessary (A, Afifi, personal communication, October 8, 2014).

Figure 5.2: Distribution of Number of Service Gaps Reported by Proportion
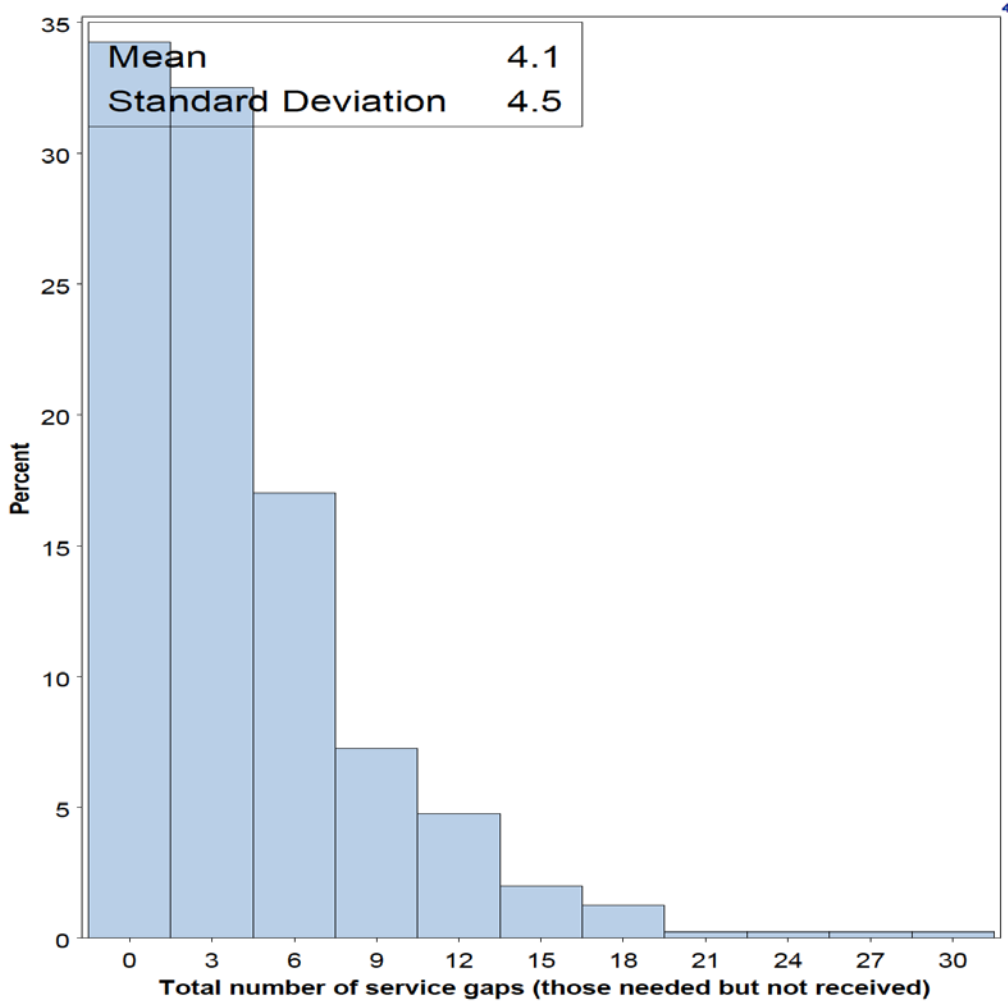
One important factor that must be explored affecting both these regression types is multicollinearity. Multicollinearity occurs when two or more independent predictor variables are highly correlated, causing unstable and inaccurate estimates with inflated standard errors (Affifi, 2004). One method of investigating possible correlations is to examine the correlation matrix for all variables of interest. Other methods of examining these effects are to examine the Variance Inflation Factor (VIF) of each variable, or the tolerance (inverse of VIF).

$$VIF = \frac{1}{1 - R_i^2} \qquad\qquad \text{Equation 5}$$

R_i^2 = coefficient of determination of the regression equation

Table 5.2 below displays the full Pearson correlation matrix for each of variables to be included in the analytic models. Note that the absolute value of the range of correlations between variables is from 0.01-0.60, or put another way correlations between variables ranged from below 0.1% to 60%. The highest correlations were found between immigrations status and language of interview (0.60), language of interview and race/ethnicity (0.40) and race/ethnicity and immigration status (0.29). While there is no set rule for when a correlation is potentially problematic, correlations of 80% or higher are considered potentially problematic (Tabachnick & Fidell, 2001). Additionally, the VIF for each variable was also performed. Although not shown, VIF values did not exceed 10, which would indicate potentially problematic multicollinearity (Der & Everitt, 2006). Given these results, no problematic effects due to multicolliniarity between variables of interest are expected.

Table 5.2: Correlation Matrix of Variables of Interest

Independent Variables	Service Gap	Subst. Use	Age	Gender	Race/ Eth.	Sexual ID	Edu. Level	Empl. Status	Mental Health	Lan- guage	Insur- ance	FPG
Service Gap	1											
Substance Use	0.12*	1										
Age	-0.02	-0.13**	1									
Gender	-0.03	-0.13**	0.06	1								
Race/Ethnicity	-0.02	0.09	0.11*	-0.07	1							
Sexual ID	0.03	-0.03	0.07	0.13**	<-0.01	1						
Edu. Level	0.01	0.10*	0.01	-0.11**	0.20**	-0.06	1					
Empl. Status	0.01	-0.09	0.21**	0.10*	0.15**	0.13**	-0.03	1				
Mental Health	0.10*	0.12*	0.05	-0.03	0.10*	0.07	0.02	0.23**	1			
Language	-0.02	-0.26**	0.04	0.12*	-0.40**	-0.01	0.26**	-0.16**	-0.14**	1		
Insurance	-0.08	-0.05	0.14**	0.08	0.17**	0.01	0.12*	0.25**	<-0.01	-0.09	1	
FPG	0.04	-0.06	-0.12	0.01	-0.09	0.08	-0.19*	-0.02	-0.09	0.10*	-0.05	1
Travel Time	0.05	-0.03	0.07	0.04	-0.08	0.06	0.02	0.04	0.01	0.12**	-0.02	0.04
Transportation	0.12*	0.03	0.03	0.04	<0.01	0.02	-0.12*	0.20**	0.08	0.03	-0.05	-0.05
Residency	0.01	-0.19**	-0.03	0.10	-0.29**	-0.02	-0.17**	-0.18**	-0.16**	0.59**	-0.15**	-0.15**
Incarceration	0.15**	0.07	0.01	-0.08	0.13**	0.13*	-0.08	0.06	0.08	-0.17**	-0.07	0.09
Homelessness	0.09	-0.03	-0.01	<0.01	0.03	0.05	-0.04	0.12*	0.20**	-0.11**	-0.03	0.03
Lapse in Care	0.09	0.14**	-0.06	0.03	0.06**	0.06	0.04	0.04	0.07	-0.17**	0.01	-0.04

*=p≤0.05, **=p≤0.01

Table 5.2: Correlation Matrix of Variables of Interest Continued

Independent Variables	Travel Time	Trans- portation	Residency	Incarceration Status	Home- lessness	Lapse in Care
Travel Time	1					
Transportation	0.28**	1				
Residency	0.11*	0.05	1			
Incarceration	-0.09	0.11*	-0.10*	1		
Homelessness	-0.01	0.19**	0.01	0.17**	1	
Lapse in Care	-0.04	0.12*	-0.05*	0.08	0.146	1

Individual level weights were generated with the assistance of CDC

representatives (C. Johnson, personal communication, March 10, 2013). Weights were

based on known sampling probabilities at both the facility and patient level (Lynn, 2005).

Multiple adjustments were made to create accurate weights, including non-response and

multiplicative corrections (Frankel, McNaghten, Shapiro, Sullivan, Berry, Johnson, Flagg,

Morton, Bozzette, 2012; Burt & Hing, 2007; Kalton & Brick, 1995). First, design weights

were applied to each individual. Design weights are the inverse of a participant's

selection probability and took both sampling frames into account (Haus-Vaughn, 2005).

Second, adjustments to account for non-response bias were made. Due to the high

response rate (94%), non-response adjustments yielded non-significant alterations of

weighted probabilities and were not used. Finally, multiplicative adjustments were made

to account for repeated service utilization of subjects during the sampling period. This

included adjustments based on the number of times a subject accessed similar services

at a sampled facility, and the number of visits to other sampled facilities during the

surveillance period. Ryan White Casewatch was the data source for these variables; see

Table 5.3 below.

Table 5.3: Multiplicative Adjustments for Sample Weights

Variable	Min	Max	Median	Lower Quartile	Upper Quartile
Visits to sample facility	1	231	6	1	15
Other Facilities visited	0	52	2	1	3
Visits to all facilities	0	464	14	2	40

As the range of these variables is wide, adjustments based on trimmed interquartile

(IQR) ranges (median ± 2*IQR) were made to. These adjustments resulted in an

adjusted sample size of 18,951 persons, very similar to the 19,915 RW recipients in Los

Angeles County (LAC) during the surveillance period according to Casewatch. Among

substance using participants this increased the effective sample size from n=119 to

N=5,743.

<u>Imputation</u>

Multiple imputation was used to impute several variable of interest. Table 5.4

describes all imputations performed and how they affected each variable of interest.

Much research using regression analysis relies on complete-case analysis (only persons

where values for all variables of interest are included in the analysis), which has the

effect of reducing the sample size when multiple logistic or Poisson regression is used.

To account for this missing data, many different types of imputation have been employed

to fill in missing values of interest. A common tool includes a technique where mean

values for the variable of interest are substituted in place of missing ones (Klebanoff &

Cole, 2008). This method has been shown to bias results (Greenland & Finkle, 1995;

Vach & Blettner, 1991). Instead, imputation based on maximum likelihood regression

techniques was used to account for missing values (Truxillo, Paper 111-30). This

technique has been shown to reduce bias when compared to less sophisticated

techniques even when data is completely missing at random (Yang, 2011; Greenland,

1995). Overall, the number of missing values imputed for each variable was low (range

1-13 records per variable), so the overall effect of imputation is limited. All variable

weighting was conducted on imputed variables.

Table 5.4: Individual Variable Imputation Effects, LACHNA-Care 2011 (n=400)

Variable	Number of missing records	Pre-imputation distribution	Post-imputation distribution
Travel Time to Doctor Office	9	Mean = 42.9 Stdev = 37.7	Mean = 42.4 Stdev = 37.5
Sexual Identification	3	Lesbian/Gay =196 Heterosexual = 149 Bisexual = 52	Lesbian/Gay =199 Heterosexual = 149 Bisexual = 52
Federal Poverty Guidelines	7	At or Below FPG = 260 Above FPG = 133	At or Below FPG = 264 Above FPG = 136
Employment Status	1	Full/Part time = 101 Unemployed = 149 Retired/Disabled = 149	Full/Part time = 101 Unemployed = 150 Retired/Disabled = 149
Race/Ethnicity	6	Latino = 189 White = 80 African American = 97 Other/Multi = 28	Latino = 193 White = 81 African American = 98 Other/Multi = 28
Transportation method	7	Provided = 126 Public/walking = 267	Provided = 132 Public/walking = 268
Insurance Status	13	Uninsured = 220 Insured = 167	Uninsured = 229 Insured = 171
Lapse in HIV care	7	No = 318 Yes = 75	No = 325 Yes = 75

CHAPTER 6: RESULTS

In this chapter results for aim's 1-4 (and all accompanying research questions) are presented. As described previously, the goal of these aim's are to better understand the relationship between substance use and ancillary service gaps. Each specific aim and associated research questions are presented first, followed by detailed results for each question. This includes tables, graphs and associated explanations/discussions accompany each research questions; explanations of all statistical tests used and limitations are also presented if appropriate.

Section 6.1: AIM 1

To describe the socio-demographic and service utilization characteristics of Los Angeles Coordinated Needs Assessment Care study (LACHNA-Care) survey respondents.

Research Questions

1. How do socio-demographic characteristics of survey participants compare to the entire Ryan White population?

2. Describe the service utilization characteristics of this sample, including their awareness of services, service needs, utilization of services, and the extent to which respondents reported needing services that they did not receive (i.e., service gaps).

3. What are the differences between LAHCAN-Care respondents who report ancillary service gaps compared to those who don't?

4. Do both the aforementioned socio-demographic and service utilization characteristics differ between substance users and non-substance users?

Question 1: Comparison of LACHNA sample to RW population

   Table 6.1.1 describes the socio-demographic variables associated with this sample. Note that both the unweighted and weighted values and proportions are present. When possible, comparisons were made to the RW 2011 Casewatch utilization report (DHSP, 2013) and LACHNA sample. Please note that the RW only reports proportions of variable of interest, so a direct compared of raw numbers between the RW population and weighted LACHAN sample could not be performed.

   Chi-square analysis revealed no statistical differences in proportions between the weighted and unweighted LACHNA sample. Additionally, there were very few differences between the proportions of weighted LACHNA samples and the Ryan White population, signifying that the LACHNA dataset is a fair representation of the target population. The few exceptions were differences found in FPG (where a slightly higher proportions of survey respondents had higher FPG compared to RW), current housing status (a larger proportion of LACHNA participants reported recent homelessness) and care status (more LACHNA participants are currently in HIV medical care compared to the entire RW sample).

Table 6.1.1: Demographic Characteristics of LACHAN Survey Respondents and RW Clients, January-June 2011

	LACHNA Participants		Ryan White Clients (N=19,915)[ab]
	Unweighted (n=400)	Weighted (N=18,951)	
	n (%)	N (%)	%
Gender			
Male	308 (77)	15,138 (80)	85
Female	75 (19)	3,098 (16)	13
Transgender[c]	17 (4)	715 (4)	2
Age Group			
18-24 yrs	12 (3)	484 (3)	4
25-29 yrs	24 (6)	900 (5)	8
30-39 yrs	79 (20)	4,086 (21)	22
40-49 yrs	155 (39)	7,383 (39)	37
50+ yrs	130 (32)	6,098 (32)	29
Race/Ethnicity			
Latino(a)	193 (48)	8,537 (45)	48
African-American	98 (25)	5,130 (27)	23
White	81 (20)	3,903 (21)	25
Other/Multi-racial	28 (7)	1381 (7)	4
Sexual Orientation			
Homosexual/Gay	199 (50)	9,561 (50)	--[†]
Bisexual	52 (13)	2,661 (14)	--[†]
Heterosexual/Straight	149 (37)	6,729 (36)	--[†]
Education			
Less than High School	124 (31)	5,992 (31)	--[†]
High School Graduate/GED	111 (28)	5,065 (27)	--[†]
Any Higher Education	165 (41)	7,894 (42)	--[†]
Current Employment Status			
Employed (full or part time)	101 (25)	4,239 (22)	--[†]
Unemployed	150 (38)	7,376 (39)	--[†]
Retired/Disabled/Student	149 (37)	7,336 (39)	--[†]
Residency			
US citizen/legal resident	89 (22)	4,025 (21)	--[†]
Undocumented	58 (15)	2,050 (11)	--[†]
Refused to state	253 (63)	12,876 (68)	--[†]
Current Mental Health Condition			
Yes	157 (39)	7,612 (40)	--[†]
No	243 (61)	11,339 (60)	--[†]
Recent Incarceration History			
Yes	35 (9)	1,856 (10)	--[†]
No	365 (91)	17,095 (90)	--[†]

Primary Language Spoken			
English	289 (72)	14,381 (76)	--[†]
Spanish	106 (27)	4,331 (23)	20
Insurance Status			
No Insurance	229 (57)	10,385 (55)	62
Private Insurance	11 (3)	587 (3)	5
Public Insurance	160 (40)	7,979 (42)	32
Federal Poverty Guidelines (FPG)[λ]			
At or Below FPG	264 (65)	11,919 (63)	66
101-200% of FPG	95 (23)	4,856 (26)	24
201-300% of FPG	15 (4)	687 (3)	6
301-400% of FPG	11 (3)	464 (2)	2
>400% of FPG	12 (3)	703 (4)	1
Unknown	7 (2)	322 (2)	1
Transportation			
Personal/provided transport	132 (33)	6,193 (33)	--[†]
Public	268 (67)	12,326 (67)	--[†]
Travel Time			
<60 min	336 (84)	15,959 (84)	--[†]
³60 min	64 (16)	2,992 (16)	--[†]
Reported Recent Substance Use			
Yes	281 (70)	13,208 (70)	--[†]
No	119 (30)	5,743 (30)	--[†]
Current Housing Status[f]			
Homeless[d]	49 (12)	2,748 (14)	5
Not Homeless	351 (88)	16,203 (86)	95
In Care[ef]			
Yes	390 (97)	18,318 (97)	85
No	10 (3)	633 (3)	15
Reported at least One Service Gap			
Yes	325 (81)	15,236 (80)	--[†]
No	75 (19)	3,715 (20)	--[†]
Barrier Type[g]			
Majority Information Based	144 (44%)	7,013 (44%)	--[†]
Majority Systems Based	183 (56%)	8,791 (56%)	--[†]

[a] Office of AIDS Programs and Policy, Los Angeles County Department of Public Health, HIV Care and Treatment Service Utilization: 2011 Year End Report, March 2013

[b] Casewatch only reports population proportions (%) and not actual sample sizes

[c] Includes LACHNA Participants who identified as either Transgender, or reported a discordance between biological sex at birth and current gender

[e] Listed current residence: a car or other vehicle, abandoned or vacant building, outside (street, park, beach, or underpass), emergency shelter or mission, transitional housing or hotel without a lease

[e] defined as at least one care visit in the pas 12 months

[f] p≤0.05

[g] Only among persons reporting service gaps (n=237) unweighted

[†] Information not reported to Casewatch

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It is also important to note that some of the proportional breakdowns of some variables will change in later analysis. For comparison purposes some variables were kept consistent with RW reporting proportions, but to ensure adequate sample sizes in regression analyses variables such as FPG were dichotomized (at or below vs. above). Also age and travel time were treated as continuous in later analyses.

In addition to the above referenced socio-demographic variables, a geographic comparison of LACHNA participants to the entire HIV population in LAC by SPA also conducted (Table 6.1.2). Chi-square analysis revealed no statistical differences between home addresses of participants and the geographic distribution of HIV in LAC by Service Planning Area (SPA) for this population. For homeless persons the nearest intersection identified as the location they spend the majority of time was substituted for an address. A map of the LAC SPA distributions can be found in Appendix D.

Table 6.1.2: Comparison of Proportions of PLWHA in LAC by Service Planning Area (SPA) (N=42,295)[1] to the LACHNA-Care Sample by Service Site Location (n=49) and Number of Interviews Completed (unweighted n=400; weighted n=18,951)

SPA	Distribution of Epidemic[1] N (%)	Service Sites Sampled[2] n (%)	Distribution of Interviews n (%) unweighted	weighted
1. Antelope Valley	534 (1)	<5 (-)[†]	<5 (-)[†]	144 (1)
2. San Fernando	5,870 (14)	7 (15)	50 (11)	2,710 (15)
3. San Gabriel	2,886 (7)	<5 (-)[†]	23 (5)	1,491 (8)
4. Metro	16,445 (39)	15 (32)	171 (38)	5,792 (31)
5. West	2,339 (6)	<5 (-)[†]	31 (7)	509 (3)
6. South	4,420 (10)	7 (15)	59 (13)	2,687 (14)
7. East	2,636 (6)	<5 (-)[†]	41 (9)	1,673 (9)
8. South Bay	7,165 (17)	10 (21)	72 (16)	3,686 (19)

[1]HIV Epidemiology Program, Los Angeles County Department of Public Health, 2010 Annual HIV Surveillance Report, 2011
[2]Some sites are in multiple locations that are not necessarily located in the same SPA; 36 agencies were selected and 49 service sites were sampled
[†] Too few to report (n<5)

According to the results presented above, LACHNA care participants are a fair representation of both RW recipients specifically, and of the HIV epidemic in LAC generally, making this an acceptable sample to conduct the remaining analyses, and appropriate for weighting.

Question 2: Describing service utilization characteristics

Table 6.1.3 describes service utilization of the LACHNA sample. This includes the awareness, utilization, need and service gaps for each of the 47 available RW services asked of respondents. Please note that both unweighted and weighted values are present, as well as 95% confidence limits for weighted values.

Of note is that some services (e.g., Skilled Nursing Care and Childcare) had very low utilizations among participants. Also, for some service categories more participants reported receiving it than were actually aware of it. An example of this is for medical outpatient services, n=359 persons reported receiving it, but only n=351 reported being aware it was available to them. This is an artifact of how the questionnaire was administered, as each category (need, awareness, received) was asked independently. As described previously, a service gap was derived from subtracting service need from services received per participant; all service gaps are positive (more people needed than received them).

Table 6.1.3: Total Number and Proportion of the Awareness, Needs, Receipt and Gaps in Care for all Ryan White Services for LACHNA-Care Participants 2010-11 (unweighted n=400; weighted N=18,951)

Services	Awareness			Need			Received			Gaps		
	unweighted n	weighted N (%)	CL*	unweighted n	weighted N (%)	CL*	Unweighted n	weighted N (%)	CL*	unweighted n	weighted N (%)	CL*
Medical Outpatient	351	4912 (85.3)	78.2-92.9	373	17351 (91.6)	86.8-96.6	359	16732 (96.4)	94.3-98.6	14	619 (3.3)	1.3-5.3
Medical Specialty	182	2706 (47.1)	37.7-56.5	157	6458 (34.1)	27.5-40.6	110	4806 (25.4)	20.0-30.7	47	1652 (8.7)	5.4-12.0
Oral Health Care	291	4107 (71.5)	62.7-80.4	330	14877 (78.5)	73.6-83.4	196	8106 (54.5)	48.0-61.0	134	6771 (35.7)	29.8-41.6
Mental Health, Psychiatry	288	4581 (79.8)	96.0-90.5	186	8995 (47.5)	41.5-53.4	148	6773 (35.7)	29.2-42.2	38	2222 (11.7)	7.5-15.9
Local Pharmacy Program/Drug Reimbursement	167	2422 (42.7)	36.5-48.9	138	7100 (37.5)	31.3-43.7	87	4162 (22.0)	16.9-27.0	51	2938 (15.5)	10.7-20.3
AIDS Drug Assistance Program (ADAP)	322	15304 (80.8)	74.5-87.0	300	14070 (74.2)	68.6-79.8	273	12506 (66.0)	59.5-72.5	27	1564 (8.3)	4.7-11.8
Substance Abuse, Treatment – Methadone	82	4105 (21.7)	16.8-26.6	9	424 (2.2)	0.4-4.0	7	334 (1.8)	0.1-3.5	2	90 (0.5)	0.0-1.2
Substance Abuse, Treatment – Outpatient	161	7867 (41.5)	35.2-47.9	40	2479 (13.1)	8.0-18.1	24	1676 (8.8)	5.0-12.7	16	803 (4.2)	1.8-6.7
Medical Nutrition Therapy	271	12604 (66.5)	59.0-74.0	219	10031 (52.9)	46.3-59.5	146	6211 (32.8)	27.0-38.5	73	3820 (20.2)	15.3-25.0
Home Health Care	122	5960 (31.4)	25.1-37.8	32	1890 (10.0)	6.2-13.8	15	957 (5.0)	2.4-7.7	17	933 (4.9)	1.7-8.1
Hospice	74	3230 (17.0)	12.8-21.3	11	781 (4.1)	1.1-7.1	4	202 (1.1)	0.5-1.6	7	579 (3.1)	1.5-6.1
Skilled Nursing	83	3718 (19.6)	15.1-24.1	13	761 (4.0)	2.1-5.9	5	305 (1.6)	0.0-3.2	8	456 (2.4)	0.4-4.4
Rehabilitation	80	3571 (18.8)	14.0-23.7	35	2000 (10.6)	6.0-15.1	17	918 (4.8)	2.3-7.4	18	1082 (5.7)	2.6-8.8

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Service	N	n (%)	CI	N	n (%)	CI	N	n (%)	CI	N	n (%)	CI
Counseling and Testing in Care Settings	275	13354 (70.5)	65.0-95.9	77	3901 (20.6)	15.1-26.1	50	2371 (12.5)	7.6-17.4	27	1530 (8.1)	5.0-11.1
Health Education/Risk Reduction	231	11415 (60.2)	53.5-67.0	78	4126 (21.8)	16.0-27.5	45	2242 (11.8)	8.1-15.5	33	1884 (9.9)	5.8-14.1
Treatment Education	162	7523 (39.7)	33.8-45.6	52	2499 (13.2)	9.4-17.0	20	990 (5.2)	2.4-8.0	32	1509 (8.0)	4.9-11.0
Psychosocial Case Management	340	15984 (84.3)	79.4-89.3	314	14947 (78.9)	73.8-84.0	273	12964 (68.4)	61.8-75.0	41	1983 (10.5)	6.2-14.8
Transitional Case Management – Jails	109	5614 (29.6)	22.7-36.6	23	1457 (7.7)	4.6-10.8	15	1049 (5.5)	2.7-8.4	8	408 (2.2)	0.3-4.1
Transitional Case Management – Youth	112	5763 (30.4)	23.8-37.0	15	768 (4.1)	1.8-6.3	8	434 (2.3)	0.3-4.2	7	334 (1.8)	0.3-3.2
Home-based Case Management	108	5242 (27.7)	23.3-32.0	17	1059 (5.6)	2.2-9.0	10	573 (3.0)	1.0-5.0	7	486 (2.6)	0.3-4.8
Housing Case Management	236	11340 (59.8)	54.0-65.7	120	6164 (32.5)	27.6-37.5	61	3335 (17.6)	12.7-22.5	59	2829 (14.9)	10.5-19.3
Medical Case Management	137	6927 (36.6)	31.1-42.0	38	2192 (11.6)	7.4-15.7	26	1512 (8.0)	4.8-11.1	12	680 (3.6)	1.5-5.7
Medical Transportation – Taxi Voucher	177	9274 (48.9)	42.8-55.1	93	5459 (28.8)	22.9-34.8	35	2359 (12.4)	8.0-16.9	58	3100 (16.4)	11.6-21.1
Medical Transportation – Bus Tokens	219	10509 (55.5)	49.3-61.6	105	6028 (31.8)	15.6-38.0	62	3601 (19.0)	12.4-25.6	43	2427 (12.8)	7.6-18.0
Medical Transportation – Bus Passes	287	13600 (71.8)	66.1-77.5	269	12559 (66.3)	61.6-72.1	199	9090 (48.0)	41.7-54.3	70	3579 (18.9)	14.2-23.6
Short Term Rent, Mortgage, Utility	154	7793 (41.1)	34.9-47.3	100	4865 (25.7)	20.6-30.8	19	1056 (5.6)	2.6-8.5	81	3809 (20.1)	15.2-25.0
Rental Assistance	260	12598 (66.5)	61.1-71.8	196	9429 (49.8)	44.3-55.2	85	4063 (21.4)	16.6-26.3	111	5366 (28.3)	23.4-33.2
Substance Abuse, Residential	153	7213 (38.1)	32.1-44.1	35	2398 (12.7)	7.4-17.9	23	1684 (8.9)	4.4-13.4	12	714 (3.8)	0.9-6.6
Emergency Shelter	197	9494 (50.1)	43.3-56.9	46	2715 (14.3)	8.5-20.2	21	1107 (5.8)	3.0-8.7	25	1608 (8.5)	4.5-12.5

Transitional Housing	187	9044 (47.7)	41.5-54.0	63	3946 (20.8)	15.6-26.0	34	2097 (11.1)	7.2-14.9	29	1849 (9.8)	5.9-13.6
Transitional Residential Care Facility	90	4450 (23.5)	18.1-28.9	18	800 (4.2)	1.5-7.0	7	325 (1.7)	0.0-3.6	11	475 (2.5)	0.7-4.3
Residential Care Facility for Chronically Ill	104	5011 (26.4)	20.9-32.0	17	877 (4.6)	1.5-7.7	10	459 (2.4)	0.6-4.3	7	418 (2.2)	0.2-4.2
Permanent Supportive Housing	123	5939 (31.3)	25.8-36.9	56	3066 (16.2)	11.5-20.9	17	844 (4.5)	2.3-6.6	39	2222 (11.7)	7.7-15.8
Health Insurance Premiums and Cost Sharing	145	6888 (36.3)	30.9-41.8	104	5581 (29.4)	23.8-35.1	56	2963 (15.6)	10.9-20.4	48	2618 (13.8)	9.8-17.8
Benefits Specialty	152	7429 (39.2)	33.5-44.9	97	5708 (30.1)	23.7-36.6	45	2785 (14.7)	10.1-19.3	52	2923 (15.4)	11.2-19.7
Outreach	143	6971 (36.8)	31.3-42.2	42	2240 (11.8)	8.5-15.1	19	1000 (5.3)	2.7-7.8	23	1240 (6.5)	3.6-9.5
Referrals	139	7372 (38.9)	34.2-43.6	45	2692 (14.2)	9.8-18.6	26	1518 (8.0)	4.9-11.1	19	1174 (6.2)	2.0-10.4
HIV LA Directory	210	10012 (52.8)	47.4-58.2	110	5039 (26.6)	20.1-33.1	66	3039 (16.0)	11.7-20.4	44	2000 (10.6)	6.4-14.7
Mental Health, Psychotherapy	210	10080 (53.2)	46.3-60.1	120	5748 (30.3)	25.0-35.6	76	3761 (19.8)	14.8-24.8	44	1987 (10.5)	7.5-13.5
Peer Support	217	10146 (53.5)	48.3-58.8	120	5731 (30.2)	25.3-35.2	78	3584 (18.9)	14.1-23.7	42	2147 (11.3)	7.2-15.4
Nutrition Support – Food Bank	284	13440 (70.9)	65.7-76.1	241	11355 (59.9)	55.0-64.9	162	7887 (41.6)	35.2-48.1	79	3468 (18.3)	13.4-23.2
Nutrition Support – Home Delivered Meals	208	10553 (55.7)	50.0-61.4	54	2654 (14.0)	9.9-18.1	26	1391 (7.3)	4.3-10.4	28	1263 (6.7)	3.8-9.5
Legal	157	7703 (40.6)	34.9-46.4	39	2008 (10.6)	6.9-14.3	9	295 (1.6)	0.4-2.7	30	1713 (9.0)	5.4-12.7
Language/Interpretation	102	4906 (25.9)	20.9-30.9	15	588 (3.1)	1.1-5.1	7	266 (1.4)	0.1-2.7	8	322 (1.7)	0.1-3.3
Child Care	80	3983 (21.0)	16.4-25.7	7	226 (1.2)	0.1-2.3	4	121 (0.6)	0.0-1.4	3	105 (0.6)	<0.1-1.3

Respite Care	71	3504 (18.5)	13.8-23.2	8	470 (2.5)	0.6-4.4	5	268 (1.4)	0.1-2.7	3	202 (1.1)	<0.1-2.5
Workforce Entry/Re-entry	118	5584 (29.5)	25.2-33.7	46	2048 (10.8)	7.2-14.5	10	524 (2.8)	0.7-4.8	36	1524 (8.0)	5.4-10.7

* CL= 95% Confidence Limit of the weighted percent

From Table 6.1.3 you can see that the awareness, utility, need and gaps fluctuate greatly across the 47 services offered across the RW system. Table 6.1.4 summarizes some univariate statistics per category from the weighed sample. First, ranges of the percent reporting are shown. This is followed by the mean standard deviation services for participants. For example, the proportion aware of individual service categories ranged from 17%-87% for the sample. The highest ranked services by awareness were medical outpatient (85%), while hospice care (17%) was the lowest. The average number of services respondents were aware of was 20.9 (sd=12.3) among respondents.

Table 6.1.4: Univariate Statistics of Service Utilization Categories for all 47 Ryan White services (unweighted n=400; weighted N=18,912)		
	% Range	Mean (sd)
Awareness	17-85	20.9 (12.3)
Need	1-92	11.6 (6.5)
Utilization	0.6-96	7.5 (4.8)
Gap	0.6-36	4.1 (4.5)

Note that the while the proportional ranges varies greatly between these different categories, the means decreased, signifying that awareness is much higher overall than actual need or utilization of services. Also, the mean proportion of gaps matches the individual calculation for deriving reported gaps (gap=need-awareness). Table 6.1.5 lists the top 10 service gaps reported. It should be noted that for some services rankings are based on the unweighted results only. As shown, both Oral Health and Section 8 Housing assistance were the most underutilized services in the RW system at the time of this investigation.

Table 6.1.5: Ranking of Reported Service Gaps among LACHNA Participants (unweighted n=400; weighted n=18,912)			
		GAP n (%)	
Service Category	Rank	unweighted	weighted
Oral Health Care	1	134 (34)	6,771 (36)
Rental Assistance (Section 8)	2	111 (28)	5,366 (28)
Short Term Rent, Mortgage, Utility	3	81 (20)	3,809 (20)
Nutrition Support – Food Bank	4	79 (19)	3,468 (18)
Medical Nutrition Therapy	5	73 (18)	3,820 (20)
Medical Transport – Bus Passes	6	70 (18)	3,579 (18)
Housing Case Management	7	59 (15)	2,829 (15)
Medical Transport – Taxi Vouchers	8	58 (15)	3,100 (16)
Benefits Specialty	9	52 (13)	2,923 (15)
Pharmacy Drug Reimbursement	10	51 (13)	2,938 (16)

Question 3: Comparing Respondents by Independent Variable (Reporting Gaps)

Table 6.1.6 describes both socio-demographic variables (both weighted and unweighted) based on reporting an ancillary service gap (independent variable). It should be noted that the majority of the sample (81%) reported as least one service gap. Chi-square and t-tests revealed few statistical differences among the unweighed sample. More differences were found when weighted samples were compared, but this is primarily due to the difference in sample size. Specifically, for the unweighted analysis incarceration status was significant at the $p \leq 0.05$ level, but it should be noted that all recently incarcerated persons reported at least one ancillary service gap.

Among the weighted sample, differences were found by service gap by age, employment, incarceration, lapse in care, housing and substance use. Most of these variables were significant at the $p \leq 0.01$ level, but this finding isn't surprising given the large sample sizes. When an additional chi-squared analysis was performed comparing proportions (and not raw numbers) no significant findings below the 0.05 level were detected. This indicates that restricted analysis (among participants who reported service gaps) proposed in aim 2 and 3 should provide a fair approximation of the entire sample.

Table 6.1.6.: Demographic Characteristics LACHNA-Care participants by Service Gap Reporting, January-June 2011

	No service gaps reported		Service gaps reported	
	Unweighted (n=73)	Weighted (N=3,147)	Unweighted (n=327)	Weighted (N=15,804)
	n (%)	N (%)	n (%)	N (%)
Gender				
Male	54 (74)	2,494 (79)	254 (78)	12,644 (80)
Female	16 (22)	575 (18)	59 (18)	2,523 (16)
Transgender	3 (4)	78 (3)	14 (4)	673 (4)
Age				
[μ (sd)] or [μ (95% CI)] [†]	45.1 (11.3)	47.0 (43.6-50.4)	44.6 (10.1)	44.6 (43.2-45.8)
Race/Ethnicity				
Latino	35 (48)	1,637 (52)	158 (48)	6,900 (44)
African-American	19 (26)	737 (23)	79 (24)	4,393 (28)
White	10 (14)	431 (14)	71 (22)	3,472 (22)
Mixed/Other	9 (12)	342 (11)	19 (6)	1,039 (7)
Primary Language Spoken				
English	55 (75)	2,285 (73)	255 (78)	13,003 (82)
Spanish	18 (25)	862 (27)	72 (22)	2,801 (18)
Citizenship				
US citizen/legal resident	19 (26)	918 (29)	70 (21)	3,107 (20)
Undocumented	10 (14)	251 (8)	48 (15)	1,799 (11)
Not reported	44 (60)	1,978 (63)	209 (64)	10,898 (69)
Sexual Orientation				
Homosexual/Gay	38 (52)	1,516 (49)	161 (49)	8,000 (51)
Bisexual	11 (15)	540 (17)	41 (13)	5,683 (36)
Heterosexual/Straight	24 (33)	1,046 (34)	125 (38)	2,121 (13)
Insurance Status				
No Insurance	38 (52)	1,306 (42)	191 (58)	9,079 (57)

Private Insurance	2 (3)	96 (3)	9 (3)	491 (3)
Public Insurance	33 (45)	1,745 (55)	127 (39)	6,234 (39)
Current Employment Status[¥]				
Employed	23 (32)	895 (28)	78 (24)	3,344 (21)
Unemployed	18 (25)	778 (25)	132 (40)	6,598 (42)
Retired/Disabled/Student	32 (44)	1,474 (47)	117 (36)	5,862 (37)
Education Completed				
Less than High School	21 (29)	818 (26)	103 (42)	5,174 (32.7)
High School/GED	23 (31)	1,143 (36)	88 (27)	3,922 (24.8)
Any Higher Education	29 (40)	1,186 (38)	136 (41)	6,708 (42.5)
Federal Poverty Guidelines (FPG)				
At or Below FPG	42 (58)	1,737 (55)	222 (68)	10,360 (67)
Above FGP	31 (42)	1,410 (45)	105 (32)	5,444 (34)
Transportation[†]				
Personal/provided	32 (44)	1,628 (52)	100 (31)	4,875 (31)
Public	41 (56)	1,519 (48)	227 (69)	10,929 (69)
Travel Time (minutes)				
[m (sd)] or [m (95% CI)][†]	36.6 (30.5)	35.5 (26.9-44.2)	43.7 (38.9)	43.1 (37.4-48.9)
Recent Incarceration (past 12 months)[§†]				
Yes	0	--	35 (11)	1,856 (12)
No	73 (100)	3,147 (100)	292 (89)	13,948 (88)
Lapse in Care[†]				
Yes	8 (11)	206 (7)	67 (20)	3,509 (23)
No	65 (89)	2,941 (93)	260 (80)	12,295 (67)
Substance use[†]				
Yes	13 (18)	405 (14)	106 (32)	5,336 (34)
No	60 (82)	2,472 (86)	221 (68)	10,466 (66)
Current Housing Status[§]				

Homeless	7 (10)	292 (9)	60 (18)	3,208 (20)
Not Homeless	66 (90)	2,855 (91)	267 (82)	12,596 (80)

* for weighed analysis, 95% CI are reported with continuous variables
[¥] p≤0.10
[§] p≤0.05
[†] p≤0.01

Table 6.1.7 describes demographic characteristics of LACHAN participants by substance use. Note that both unweighted and weighted values are presented. Most values are presented as proportions with a few exceptions where mean values were presented (age and number of reported service gaps), as they are continuous in nature. Chi-square and t-test analysis of weighted data revealed several differences between groups, with most being significant at the p≤0.05 level. For example, employment status was significant at the p≤0.10 level, indicating that a trend may be evident (more unemployment being reported by substance users). Several variables (insurance, education, transportation and travel time) did not differ between groups. Observed differences were consistent for both unweighted and weighted comparisons.

Compared to non-substance users, substance users are more likely to be male, white, younger, speak English, identify as homosexual/gay, and are less likely to be homeless. These differences indicate that substance use is an important factor in need of further scientific exploration with respect to the number of service gaps reported among a sample of HIV-infected Ryan White recipients.

Table 6.1.7.: Demographic Characteristics LACHNA-Care participants by Substance Use, January-June 2011

	Non-substance users		Substance users	
	Unweighted (N=281)	Weighted (N=13,208)	Unweighted (N=119)	Weighted (N=5,743)
	n (%)	n (%)	n (%)	n (%)
Gender[†]				
Male	203 (72)	10,027 (76)	105 (88)	5,111 (89)
Female	67 (24)	2,730 (21)	8 (7)	368 (6)
Transgender	11 (4)	451 (3)	6 (5)	264 (5)
Age[†]				
[m (sd)] or [m (95% CI)][*]	45.5 (10.1)	45.8 (44.3-47.3)	42.8 (10.3)	42.7 (40.8-44.6)
Race/Ethnicity[†]				
Latino	149 (54)	6,353 (50)	40 (34)	1,954 (34)
African-American	69 (25)	3,558 (25)	28 (24)	1,450 (25)
White	36 (13)	1,883 (15)	44 (37)	1,936 (34)
Mixed/Other	21 (8)	978 (8)	7 (5)	413 (7)
Primary Language Spoken[†]				
English	198 (70)	9,765 (74)	112 (94)	5,523 (96)
Spanish	83 (30)	3,443 (26)	7 (6)	220 (4)
Citizenship[†]				
US citizen/legal resident	228 (81)	11,294 (86)	114 (96)	5,607 (98)
undocumented	53 (19)	1,914 (14)	5 (4)	136 (2)
Sexual Orientation[†]				
Homosexual/Gay	125 (45)	5,857 (44)	71 (60)	3,614 (63)
Bisexual	30 (11)	1,598 (12)	25 (21)	1,063 (19)
Heterosexual/Straight	124 (44)	5,687 (43)	23 (19)	1,042 (18)
Insurance Status				
No Insurance	153 (57)	6,566 (53)	67 (57)	3,279 (57)

Private Insurance	7 (3)	439 (3)	4 (4)	148 (3)
Public Insurance	110 (40)	5,466 (44)	46 (39)	2,239 (40)
Current Employment Status¥				
Employed	68 (25)	2,825 (21)	33 (28)	1,414 (25)
Unemployed	99 (35)	4,713 (36)	50 (42)	2,643 (46)
Retired/Disabled/Student	113 (40)	5,650 (43)	36 (30)	1,686 (29)
Education Completed				
Less than High School	100 (36)	4,689 (36)	24 (20)	1,303 (23)
High School/GED	74 (26)	3,254 (24)	37 (31)	1,811 (31)
Any Higher Education	107 (38)	5,265 (40)	58 (49)	2,629 (46)
Federal Poverty Guidelines (FPG)§				
At or Below FPG	194 (73)	8,957 (68)	66 (56)	2,962 (52)
Above FGP	82 (27)	4,251 (32)	51 (44)	2,661 (48)
Transportation				
Personal/provided	91 (33)	4,416 (34)	35 (30)	1,777 (31)
Public	186 (67)	8,534 (66)	81 (70)	3,729 (69)
Travel Time (minutes)†				
[m (sd)] or [m (95% CI)]*	44.1 (39.0)	44.6 (38.3-51.1)	38.4 (33.7)	35.4 (28.1-42.5)
Received Case Management				
Yes	209 (74)	10,010 (76)	91 (76)	4,385 (76)
No	72 (26)	3,198 (24)	28 (24)	1,358 (24)
Current Housing Status†				
Homeless	37 (18)	2481 (19)	12 (8)	419 (7)
Not Homeless	244 (82)	10,727 (81)	107 (92)	5,324 (93)

* for weighed analysis, 95% CI are reported for continuous variables
¥ $p \leq 0.10$
§ $p \leq 0.05$
† $p \leq 0.01$

Table 6.1.8 details specific substance use characteristics of LACHNA participants. Respondents reported using a variety of substances, with the majority reporting either marijuana or stimulant use. Majorities also reported only one class of substance (66% unweighted, 67% weighted). Very few (n=19 unweighted, N=1,165 weighted) respondents reported engaging in IDU behavior.

Table 6.1.8. Substance Use Characteristics of LACHNA-Care participants January-June 2011

	Unweighted (n=119)	Weighted (N=5,743)
	n (%)	n (%)
Type of Use*		
Stimulants[1]	64 (54)	3,393 (59)
Depressants[2]	15 (13)	881 (15)
Opiates[3]	9 (8)	128 (2)
Marijuana	74 (62)	3,046 (53)
Other[4]	21 (18)	1,034 (18)
Number of Different Types of Substances Used		
One	78 (66)	3,675 (64)
Two	25 (21)	1,207 (21)
Three	11 (9)	587 (10)
Four or more	5 (4)	274 (5)

* not mutually exclusive categories
[1] includes: amphetamine, methamphetamine (crystal), cocaine, crack
[2] includes: sedatives, hypnotics or tranquilizers (ex: sleeping pills, quaaludes, xanax)
[3] includes: heroin, opiates, analgesics (ex: codeine, dilaudid, oxycontin, vicodin)
[4] includes: hallucinogens, inhalants (poppers)

Table 6.1.9 details the service use and utilization characteristics of substance users specifically. Proportionally, there are many similarities between substance users and non-users (when compared to Table 6.1.8 above), with a few exceptions.

Table 6.1.9: Total Number and Proportion of the Awareness, Needs, Receipt and Gaps in Care for Substance Using Ryan White Services for LACHNA-Care Participants 2010-11 (unweighted n=119; weighted n=5743)

Services	Awareness			Need			Received			Gaps		
	unweighted n	weighted N (%)	CL*	unweighted n	weighted N (%)	CL*	Unweighted n	weighted N (%)	CL*	unweighted n	weighted N (%)	CL*
Medical Outpatient	105	4912 (85.3)	78.2-92.9	113	5409 (94.2)	88.6-99.7	109	5205 (96.2)	92.1-100	4	204 (3.6)	<0.1-7.5
Medical Specialty	56	2706 (47.1)	37.7-56.5	39	1666 (29.0)	17.9-40.1	22	954 (16.6)	8.1-25.2	17	712 (12.4)	4.5-20.3
Oral Health Care	88	4107 (71.5)	62.7-80.4	105	5097 (88.7)	81.9-95.6	55	2483 (48.7)	37.5-60.0	50	2614 (45.5)	33.6-57.4
Mental Health, Psychiatry	96	4581 (79.8)	96.0-90.5	58	2679 (46.6)	36.3-57.0	43	1818 (31.7)	22.2-41.1	15	861 (15.0)	6.6-23.4
Local Pharmacy Program/Drug Reimbursement	47	2422 (42.7)	32.7-51.6	43	2518 (43.8)	35.6-52.1	23	1253 (21.8)	13.7-29.9	20	1265 (22.0)	14.4-29.7
AIDS Drug Assistance Program (ADAP)	102	4852 (84.5)	75.7-93.3	90	4387 (76.4)	67.9-84.9	77	3436 (59.8)	50.6-69.0	13	951 (16.6)	8.8-24.3
Substance Abuse, Treatment – Methadone	30	1458 (25.4)	15.8-35.0	6	249 (4.3)	<0.1-8.7	4	159 (2.8)	<0.1-6.3	2	90 (1.6)	<0.1-3.9
Substance Abuse, Treatment – Outpatient	57	2681 (46.7)	37.1-56.2	21	1143 (19.9)	8.1-31.7	9	569 (9.9)	1.7-18.1	12	547 (10.0)	4.3-15.7
Medical Nutrition Therapy	81	3780 (65.8)	53.6-78.4	62	2697 (47.0)	37.7-56.3	40	1695 (29.5)	21.8-37.2	22	3820 (17.4)	9.2-25.7
Home Health Care	37	1912 (33.3)	22.0-44.6	6	380 (6.6)	1.1-12.1	5	332 (5.8)	0.6-11.0	1	48 (0.8)	<0.1-2.5
Hospice	23	916 (16.7)	10.3-23.1	2	110 (1.9)	<0.1-4.7	2	110 (1.9)	<0.1-4.7	0	--	--
Skilled Nursing	25	1335 (23.2)	13.6-32.8	4	177 (3.0)	<0.1-6.8	1	63 (1.1)	<0.1-3.3	3	114 (2.0)	<0.1-4.9
Rehabilitation	21	1056 (18.4)	10.5-26.3	12	598 (10.4)	4.2-16.6	6	284 (4.9)	0.6-9.3	6	314 (5.5)	1.0-9.9

Service	n			n			n			n		
Counseling and Testing in Care Settings	88	4400 (76.6)	67.3-85.9	25	1305 (22.7)	14.1-31.4	15	753 (13.1)	5.0-21.2	10	552 (9.6)	3.9-15.4
Health Education/Risk Reduction	74	3592 (62.5)	52.2-72.8	22	995 (17.3)	9.4-25.2	10	486 (8.5)	2.5-14.5	12	509 (8.9)	3.9-13.9
Treatment Education	48	2425 (42.2)	30.8-53.7	19	783 (12.9)	6.5-19.2	5	226 (3.9)	0,3-7.5	14	512 (8.9)	3.9-13.9
Psychosocial Case Management	107	4958 (86.3)	76.5-96.1	97	4691 (81.7)	73.3-90.1	83	3818 (66.5)	56.5-76.5	14	873 (15.2)	7.1-23.3
Transitional Case Management – Jails	32	1473 (25.6)	15.8-35.5	7	571 (9.9)	4.3-15.5	5	441 (7.7)	2.2-13.1	2	130 (2.3)	<0.1 -5.6
Transitional Case Management – Youth	38	1645 (28.6)	19.3-38.0	9	505 (8.8)	3.6-14.0	5	268 (4.7)	0.2-9.1	4	273 (4.1)	<0.1 -8.5
Home-based Case Management	34	1561 (27.2)	19.0-35.4	3	217 (3.8)	1.4-6.1	2	185 (3.2)	1.2-5.2	1	32 (0.6)	<0.1 -1.7
Housing Case Management	73	3387 (59.0)	47.3-70.7	37	1840 (32.0)	23.4-40.7	14	854 (14.9)	7.2-22.5	23	986 (17.2)	9.3-25.0
Medical Case Management	43	1992 (34.7)	24.1-45.2	13	579 (10.0)	4.0-16.1	11	515 (9.0)	3.2-14.8	2	64 (1.1)	<0.1 -2.6
Medical Transportation – Taxi Voucher	42	2418 (42.1)	31.3-53.0	31	1791 (31.2)	20.7-41.7	11	856 (14.9)	5.6-24.2	20	935 (16.3)	10.5-22.1
Medical Transportation – Bus Tokens	62	3267 (56.9)	47.3-66.5	38	1995 (34.7)	23.7-45.7	20	1140 (19.9)	10.2-29.5	18	855 (14.9)	8.4-21.4
Medical Transportation – Bus Passes	80	3772 (65.7)	56.2-75.1	80	4010 (69.8)	61.6-78.1	48	2575 (44.8)	35.7-53.9	32	1435 (25.0)	18.6-31.4
Short Term Rent, Mortgage, Utility	53	2417 (43.0)	32.2-53.8	31	1285 (22.4)	10.9-33.8	7	306 (5.3)	0.2-10.5	24	979 (17.0)	8.8-25.3
Rental Assistance	82	4207 (73.3)	63.8-82.7	59	2663 (46.4)	34.2-58.6	20	908 (15.8)	6.6-25.0	39	1755 (30.6)	22.0-39.1
Substance Abuse, Residential	47	2228 (50.3)	40.6-60.0	15	1074 (18.7)	8.2-29.2	10	794 (13.8)	5.0-22.7	5	280 (4.9)	<0.1 -9.8
Emergency Shelter	60	2886 (50.3)	40.6-60.0	18	924 (16.1)	6.8-25.4	9	506 (8.8)	2.6-15.1	9	418 (7.3)	1.8-12.7

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Service												
Transitional Housing	60	3007 (52.4)	42.9-61.8	23	1376 (24.0)	16.5-31.4	9	514 (9.0)	1.6-16.3	14	862 (15.0)	6.4-23.6
Transitional Residential Care Facility	26	1167 (20.3)	12.5-28.1	6	299 (5.2)	0.5-9.9	2	110 (1.9)	<0.1 -4.7	4	189 (3.3)	<0.1 -7.0
Residential Care Facility for Chronically Ill	32	1490 (25.9)	16.3-35.6	6	346 (6.0)	0.2-11.8	3	141 (2.6)	<0.1 -5.4	3	205 (3.6)	<0.1 -8.5
Permanent Supportive Housing	39	1973 (34.4)	25.2-43.5	21	1113 (19.4)	11.4-27.3	6	343 (6.0)	1.1-10.9	15	770 (13.4)	6.6-20.2
Health Insurance Premiums and Cost Sharing	51	2489 (43.3)	31.8-54.9	41	2060 (35.9)	26.7-45.1	21	1074 (18.7)	10.7-26.7	20	986 (17.2)	8.4-25.9
Benefits Specialty	52	2644 (46.0)	35.4-56.6	33	1978 (34.4)	24.8-44.1	14	999 (17.4)	10.2-24.5	19	979 (17.0)	9.8-24.3
Outreach	44	2224 (38.7)	28.7-48.8	16	1000 (17.4)	10.1-24.8	6	383 (6.7)	0.8-12.5	10	617 (10.7)	5.2-16.3
Referrals	41	2016 (35.1)	26.5-43.7	15	836 (14.6)	6.2-22.9	6	313 (5.5)	0.6-10.4	9	523 (9.1)	2.6-15.6
HIV LA Directory	58	2919 (50.8)	39.7-61.9	33	1564 (27.2)	17.0-37.4	17	849 (14.8)	7.9-21.7	16	715 (12.5)	5.8-19.1
Mental Health, Psychotherapy	67	3161 (55.0)	43.0-67.1	45	2306 (40.2)	30.9-49.4	27	1469 (25.6)	16.9-34.2	18	837 (14.6)	8.0-21.1
Peer Support	62	2855 (49.7)	38.5-61.0	32	1407 (24.5)	16.7-32.3	18	782 (13.6)	7.8-19.4	14	625 (10.9)	3.4-18.3
Nutrition Support – Food Bank	88	4222 (73.5)	66.0-81.0	78	3639 (63.4)	54.9-71.8	46	2087 (36.3)	27.7-45.0	32	1552 (27.0)	18.4-35.7
Nutrition Support – Home Delivered Meals	64	2665 (63.8)	51.3-76.3	19	1009 (17.6)	9.5-25.6	9	532 (9.3)	3.0-15.5	10	477 (8.3)	2.6-14.0
Legal	56	2754 (48.0)	37.9-58.0	11	573 (10.0)	3.1-16.9	3	158 (2.8)	<0.1 -6.0	8	415 (7.2)	1.3-13.2
Language/Interpretation	33	1627 (28.3)	19.2-37.5	3	169 (3.0)	<0.1 -6.4	1	63 (1.1)	<0.1 -3.3	2	106 (1.8)	<0.1 -4.5
Child Care	21	1076 (18.7)	11.0-26.5	2	130 (2.3)	<0.1 -5.7	1	63 (1.1)	<0.1 -3.3	1	67 (1.2)	<0.1 -3.6

Respite Care	29	1476 (25.7)	13.8-23.2	5	319 (5.6)	0.4-10.7	4	252 (4.4)	<0.1-8.7	1	67 (1.2)	<0.1-3.6
Workforce Entry/Re-entry	44	2102 (36.6)	28.1-45.0	18	872 (15.2)	9.6-20.6	4	194 (3.4)	<0.1-6.7	14	678 (11.8)	7.7-15.9

* CL= 95% Confidence Limit of the weighted percent

As with Table 6.1.3 that displays the utilization results from the full sample, the awareness, utility, need and gaps also fluctuated greatly across the RW system for substance users specifically. Table 6.1.10 compares univariate statistics by substance use per category from the weighed sample. Only a meaningful a statistical difference between numbers of service gaps reported is shown, with substance users reporting more unmet social service needs than non-substance users.

Table 6.1.10: Univariate Statistics of Service Utilization by Substance Use					
	Non-Substance users (N=13,208)		Substance Users (N=5,743)		p-value
	% Range	Mean (sd)	% Range	Mean (sd)	
Awareness	15-85	20.5 (12.4)	18-90	21.8 (12.1)	0.34
Need	1-92	11.2 (6.0)	2-95	12.4 (7.6)	0.11
Utilization	0.3-89	7.6 (4.5)	0.8-92	7.3 (5.6)	0.58
Gap	0-30	3.6 (3.9)	0-42	5.1 (5.4)	0.002

As with the entire sample (Table 6.1.4) the proportional ranges vary greatly between these different categories for both groups. Even though not statistically different, a definite trend is seen in that substance users seem to have slightly more awareness and need of services than non-substance users, but their utilization of the system is similar by this metric.

SECTION SUMMARY

The goal of this section was to answer specific aim 1 (and all subsequent research questions) by describing the socio-demographic and service utilization characteristics of survey participants. The first question was to determine if the LACHAN-Care sample adequately represents the Ryan White population and if the weighting scheme was appropriately applied. Based on available data, this objective was achieved, as few differences were found between samples. The only exceptions being that a larger proportion of homeless persons were enrolled in LAHCHNA compared to

the RW population and that RW recorded a much high proportion of persons out of care (no visits in past year) than were found in LACHA. The latter result isn't surprising as a large proportion of sampling took place at a medical facility (or a facility associated with medical care). Also, persons out of care may not use as many services as an in care population, meaning they may be difficult to target. Despite these results, the majority of variables were consistent between the two databases, indicating that when individual level weights are applied to the LACHNA sample, it can be thought of as fairly representative of the background population of interest. Analyses in aim's 2-3 were conducted on the weighted dataset.

Additionally, comparisons of the sample by both the proposed dependent (service gaps) and independent (substance use) variables of the focal relationship were performed. This was not only to get a sense of distribution of these variables by socio-demographic factors, but to also evaluate if further analysis was justified. While few differences were exposed by reported service gap, further analysis is still warranted as regression modeling may reveal important differences not revealed by simple bivariate analysis.

Differences by substance use were discovered for both bivariate and service utilization analyses. In general substance users were male, white, younger, speak English, identify as homosexual/gay, and are less likely to be homeless. They also reported more service gaps than non-substance users. Additionally, analysis among substance users revealed that the majority were using marijuana or stimulants (amphetamines/methamphetamines) and reported only using one class of substances in the past 6 months (66%). Both of these results show that there is sufficient sample size to conduct analysis for aim 3. In conclusion, these results indicate that exploration of the role of substance use as a predictor of service gaps is warranted and this analysis can

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and should continue. The remainder of this chapter will focus on answering the

remaining specific aim's and their subsequent research questions.

To examine the central role that substance use has on the reporting of a service gap among a representative sample of Ryan White recipients in Los Angeles County.

To address this aim the following research questions were answered:

1. Is substance use associated with reporting a service gap among respondents?

2. Is the strength of this relationship altered with the introduction of other competing variables (potential confounders and rival independent variables)?

3. Is this relationship moderated by the type of barriers a respondent reports?

Two separate analyses were conducted to answer these questions. First, a logistic regression analysis with the dependent (outcome) comparing respondents reporting any service gaps (range 1-31) to those reporting none. As reported previously, 81% of the sample reported at least one service gap. The second analyses involved investigating factors associated with the number of service gaps reported by using Poisson regression.

Question 1a: Is substance use associated with reporting service gaps

Logistic Regression

Table 6.2.1 shows the unadjusted risk of reporting any service gap among substance users, accompanied by the β and subsequent p value. Note that there is an almost four fold increase in the risk of reporting any service gaps among substance users. Based on this evidence substance use is associated with reporting any service gaps. Also important to note is the low p-value of the likelihood ratio, indicating that the null hypothesis that no relationship exists between the independent and dependent variables is rejected and analysis should continue.

Table 6.2.1: Unadjusted Risk of Reporting an Ancillary Service Gap by Substance Use; Logistic Regression Model 1 (N=18,951)

Independent Variable	RR (95% CI)	β (SE β)	p value
Focal Variable			
Substance use			
Yes	3.45 (1.64-7.29)	1.24 (0.38)	****
No	Referent	Referent	
Intercept	3.82 (2.78-5.24)	1.34 (0.16)	****
Model Statistics			
LR(χ^2)	68.77		****
df	1, 261		
pseudo-R^2	0.03		

*=p$\leq$0.1, **=p$\leq$0.05, ***=p$\leq$0.01, ****=p$\leq$0.001

Question 2a: Is the strength of this relationship altered by competing variables

The second research question investigates changes to the strength of the focal relationship when identified variables are introduced into the model. As described earlier, a series of nested regression models were build based on proposed theoretical models. First, predisposing variables were added, followed by enabling characteristics, rival independent variables and any important interaction terms. Finally, when appropriate, the full model was stratified by barrier type (information or structural).

Table 6.2.2 shows the second regression model in this analysis (model 2a), which containing the primary focal relationship as well as predisposing characteristic. When these factors were included the strength of the focal relationship decreased somewhat (model 1: RR=3.45, model 2a: RR=2.91).

Among the added variables, only past lapse in medical care (RR=3.40, p=0.007) was strongly associated with reporting a service gap. From model statistics you can see that the LR(χ^2) is still quite high 16.18 (p>0.001), indicating that the null hypothesis (that the combination of coefficients in the model have no relationship to the dependent variable) has been rejected. Additionally, the pseudo-R^2 increased from 0.03 in the restricted model to 0.09.

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Table 6.2.2: Factors Associated with Reporting an Ancillary Service Gap by Substance Use & Predisposing Characteristics; Logistic Regression Model 2a (N=18,951)

Independent variables	RR (95% CI)	β (SE β)	p value
Focal Variable			
Substance Use			
Yes	2.91 (1.35-6.27)	1.07 (0.39)	***
No	referent	referent	
Predisposing Characteristics			
Age (yrs)	0.98 (0.95-1.02)	-0.02 (0.02)	
Gender			
Female	0.97 (0.37-2.54)	-0.03 (0.49)	
Transgender	1.01 (0.25-4.06)	0.01 (0.71)	
Male	referent	referent	
Race/Ethnicity			
Latino	0.84 (0.34-2.04)	-0.18 (0.45)	
African American	1.10 (0.42-2.85)	0.09 (0.49)	
Other/Mulit-Racial	0.39 (0.11-1.33)	-0.95 (0.62)	
White	referent	referent	
Sexual Orientation			
Homosexual/Gay/Lesbian	0.82 (0.33-2.07)	-0.19 (0.47)	
Bisexual	0.55 (0.16-1.84)	-0.60 (0.62)	
Heterosexual/Straight	referent	referent	
Education Completed			
Less than High School	1.30 (0.57-2.94)	0.26 (0.42)	
High School/GED	0.63 (0.31-1.30)	-0.46 (0.37)	
Greater than High School	referent	referent	
Language of Interview			
Spanish	0.71 (0.24-2.12)	-0.34 (0.55)	
English	referent	referent	
Lapse in medical care			
Yes	3.40 (1.41-8.21)	1.22 (0.45)	***
No	referent	referent	
Intercept (constant)	11.37 (1.93-66.98)	2.43 (0.90)	****
Model Statistics			
LR(χ^2)	16.18		****
df	14, 261		
pseudo-R^2	0.09		

*=p≤0.1, **=p≤0.05, ***=p≤0.01, ****=p≤0.001

Table 6.2.3 shows the third model (Model 2b), containing the focal relationship, predisposing characteristics and enabling resources. The risk of reporting a service gap remains largely unchanged from the previous model (RR=2.87 vs. 2.91 respectively)

with no real change in the strength of the association. This suggests that the added enabling resources had little effect on the primary focal relationship.

Other results from model 2a remain largely unchanged when the additional variables (enabling resources) are included, with lapse in medical care remaining strongly associated with the outcome (RR=3.59, p=0.006). Additional factors associated with service gaps include reporting a current mental health diagnosis (RR=2.63, p=0.006) and being uninsured (RR=2.10, p=0.07). Again, the likelihood ratio is still highly significant.

Table 6.2.3: Factors Associated with Reporting an Ancillary Service Gap by Substance Use, Predisposing Characteristics & Enabling Resources; Logistic Regression Model 2b (N=18,951)

Independent variables	RR (95% CI)	β (SE β)	p value
Focal Variable			
Substance Use			
Yes	2.87 (1.23-6.71)	1.06 (0.43)	**
No	referent	referent	
Age (yrs)	1.01 (0.98-1.04)	0.01 (0.01)	
Predisposing Characteristics			
Gender			
Female	1.38 (0.56-3.38)	0.32 (0.45)	
Transgender	0.98 (0.24-4.03)	-0.02 (0.72)	
Male	referent	referent	
Race/Ethnicity			
Latino	0.54 (0.14-2.06)	-0.62 (0.68)	
African American	0.52 (0.18-1.54)	-0.65 (0.55)	
Other/Mulit-Racial	0.44 (0.08-2.42)	-0.82 (0.87)	
White	referent	referent	
Sexual Orientation			
Homosexual/Gay/Lesbian	1.09 (0.41-2.91)	0.09 (0.50)	
Bisexual	0.63 (0.19-2.09)	-0.47 (0.61)	
Heterosexual/Straight	referent	referent	
Education Completed			
Less than High School	1.23 (0.50-3.00)	0.20 (0.45)	
High School/GED	0.68 (0.29-1.60)	-0.38 (0.43)	
Greater than High School	referent	referent	
Language of Interview			
Spanish	0.43 (0.12-1.59)	-0.85 (0.66)	
English	referent	referent	
Lapse in medical care			
Yes	3.59 (1.46-8.82)	1.27 (0.46)	***
No	referent	referent	
Enabling Resources			
Travel Time to Doctors Office	1.00 (1.00-1.01)	0.00 (0.00)	
Employment Status			
Unemployed	1.51 (0.63-3.65)	0.41 (0.45)	
Retired/Disabled/Student	1.01 (0.39-2.60)	0.01 (0.48)	
Employed (full/part-time)	referent	referent	
Current Mental Health Diagnosis			
Yes	2.63 (1.31-5.27)	0.97 (0.35)	***
No	referent	referent	
Insurance Status			
Not Insured	2.10 (1.00-4.63)	0.74 (0.40)	*
Insured	referent	referent	
FPG			
At or Below FPG	1.26 (0.57-2.78)	0.23 (0.40)	
Above FPG	referent	referent	
Mode of Transportation			

Public Transport		1.77 (0.79-3.97)	0.57 (0.41)
Private Car		referent	referent
Residency Status			
Undocumented		1.97 (0.35-11.05)	0.68 (0.88)
Legal Resident		1.06 (0.26-4.30)	0.06 (0.71)
Not Reported		referent	referent
Intercept (constant)		1.31 (0.14-11.83)	0.27 (1.12)
Model Statistics			
	LR(χ^2)	8.97	****
	df	23, 261	
	pseudo-R^2	0.14	

*=p$\leq$0.1, **=p$\leq$0.05, ***=p$\leq$0.01, ****=p$\leq$0.001

Table 6.2.4 shows the fourth and final regression model in this analysis (model 3), containing the focal relationship, predisposing characteristics, enabling resources and rival independent variables. The risk of reporting a service gap among substance users increased slightly from the previous models, but the strength of the correlation remained unchanged (RR=3.13 vs. 2.87). Other results from model 2b were also largely unchanged. Factors such as lapse in medical care (RR=3.52, p=0.01), reporting a current mental health diagnosis (RR=2.42, p=0.02) and being uninsured (RR=2.02, p=0.10) all remained highly correlated with the outcome variable. The addition of housing status seemed to have little effect on either the focal relationship or other control variables of interest. Finally, the likelihood ratio remains largely unchanged from previous results (LR(χ^2)=10.48 vs. 8.97), indicating that the current models is a better fit than the null.

Table 6.2.4: Factors Associated with Reporting an Ancillary Service Gap by Substance Use, Predisposing Characteristics, Enabling Resources & Rival Independent Variables; Logistic Regression Model 3 (N=18,951)

Independent variables	RR (95% CI)	β (SE β)	p value
Focal Variable			
Substance Use			
Yes	3.13 (1.32-7.42)	1.14 (0.44)	***
No	referent	referent	
Predisposing Characteristics			
Age (yrs)	1.01 (0.98-1.04)	1.01 (0.98-1.04)	
Gender			
Female	1.68 (0.71-3.97)	0.52 (0.44)	
Transgender	1.28 (0.31-5.34)	0.25 (0.73)	
Male	referent	referent	
Race/Ethnicity			
Latino	0.48 (0.13-1.74)	-0.73 (0.65)	
African American	0.62 (0.20-1.87)	-0.48 (0.56)	
Other/Mulit-Racial	0.48 (0.09-2.62)	-0.73 (0.86)	
White	referent	referent	
Sexual Orientation			
Homosexual/Gay/Lesbian	1.20 (0.43-3.35)	0.18 (0.52)	
Bisexual	0.67 (0.20-2.19)	-0.41 (0.60)	
Heterosexual/Straight	referent	referent	
Education Completed			
Less than High School	1.04 (0.41-2.64)	0.04 (0.47)	
High School/GED	0.68 (0.29-1.56)	-0.39 (0.42)	
Greater than High School	referent	referent	
Language of Interview			
Spanish	0.52 (0.14-1.98)	-0.65 (0.67)	
English	referent	referent	
Lapse in medical care			
Yes	3.52 (1.36-9.10)	1.26 (0.48)	***
No	referent	referent	
Enabling Resources			
Travel Time to Doctors Office	1.00 (1.00-1.01)	1.00 (1.00-1.01)	
Employment Status			
Unemployed	1.32 (0.54-3.20)	0.28 (0.54)	
Retired/Disabled/Student	0.91 (0.36-2.34)	-0.09 (0.48)	
Employed (full/part-time)	referent	referent	
Current Mental Health Diagnosis			
Yes	2.42 (1.16-5.03)	0.88 (0.37)	**
No	referent	referent	
Insurance Status			
Not Insured	2.02 (0.93-4.36)	0.70 (0.39)	*
Insured	referent	referent	
FPG			
At or Below FPG	1.10 (0.49-2.47)	0.10 (0.41)	
Above FPG	referent	referent	
Mode of Transportation			

Public Transport	1.73 (0.76-3.91)	0.55 (0.42)
Private Car	referent	referent
Residency Status		
Undocumented	2.39 (0.46-12.37)	0.87 (0.83)
Legal Resident	1.28 (0.32-5.10)	0.25 (0.70)
Not Reported	referent	referent
Rival Independent Variables		
Incarceration Status		
Recently Incarcerated	--	--
Not Recently Incarcerated	referent	referent
Current Housing Status		
Homeless	1.01 (0.27-3.83)	0.01 (0.68)
Not Homeless	referent	referent
Intercept (constant)	1.15 (0.11-11.99)	0.04 (1.15)
Model Statistics		
LR(χ^2)	10.48	****
df	25, 261	
pseudo-R^2	0.16	

*=p≤0.1, **=p≤0.05, ***=p≤0.01, ****=p≤0.001

Question 3a: Effects of moderation

No moderation effects can be performed for this analysis as only persons with service gaps reported barriers.

SECTION SUMMARY

In the above logistic regression models substance users consistently had an increased risk of reporting at least one service gap, with RR ranging from 2.87-3.45 (overall 95% CI range: 1.23-7.42). This narrow range in both the relative risk point estimate and precision (as measured by CI) suggests that even with the addition of potential confounding and rival independent variables the strength of the focal relationship between substance use and reporting service gaps is strong. This finding supports the overall hypothesis presented here, that reported substance use has a powerful effect on the presence of service gaps among a sample of HIV-infected Ryan White recipients in Los Angeles County. It is also consistent with other work that

substance use can be a powerful predictor of service utilization among substance users (Wolfe et al., 2010).

Other variables of interest associated with an increased risk of a reporting service gap included reporting a past lapse in medical care and reporting a current mental health diagnosis. Non-adherence to an HIV medical regiment has been associated with recent incarceration, younger age, minority race/ethnicity, housing insecurity, substance abuse, less severe HIV illness and lower perceived social support (Catz, McClure, Jones, Brantley, 1999; Fontana & Beckerman, 2007). A longitudinal study of HIV-infected injection drug users (IDU) demonstrated that continued drug use, poor access to HIV medical care and incarceration were strong predictors of inconsistent HIV care adherence (Westergaard et al., 2013). Despite all these prior results, this is the first investigation to demonstrate that reporting a past lapse in medical care predicts current gaps in social services among RW recipients. This association may reveal an important predictor of both medical and social service gaps that could be used to screen patients with high probabilities of either falling out of care or receiving suboptimal services. Interestingly, even though substance use and a past lapse in medical care were independently predictive of reporting service gaps, the interaction of these two variable was not significant, indicating that substance users who reported a past lapse in medical care were no more likely to report social service gaps than non-substance users.

A robust body of evidence has shown that mental health has profound effects on linkage to HIV care post initial diagnosis, HIV care retention and HIV medication adherence (Fortenberry et al., 2012; McKinnon et al., 2002; White House, 2010a, b). Past research on ancillary services did not reveal an association between mental health status and either an increased need for ancillary services or decreased service utilization (Chan, et al. 2002), but that study didn't specifically investigate service gaps. Katz et al.

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(2000) did find that among a sample of RW recipients, increased case management and mental health counseling visits decreased the number of reported ancillary service gaps. In this investigation the risk of reporting a service gap was almost two and a half times greater (RR=2.36 and 2.42 depending on model) among persons reporting a current mental health condition. This finding supports past research demonstrating the importance of psychosocial support services for RW recipients experiencing mental health issues.

Surprisingly, many socio-demographic (SES, race/ethnicity, gender, insurance status) indicators had no effect on reporting service gaps among this sample. This finding is supported by other work looking at service utilization among HIV-infected populations (Wohl et al., 2011a). Past research has reported that predisposing factors do affect both the need for and utilization of RW service, as well as access to primary HIV medical care (Shapiro et al., 1999a). The lack of these factors as predictive of service disparities in more recent research (as well as results from this investigation) may show that predisposing factors may not play as robust a role in predicting health disparities as they once did.

Equally interesting was the lack of effect by housing status on service gaps. In past research housing has been shown to be a powerful predictor of both service need and utilization (White House, 2010a; Aidala el al., 2007; Smith, et al., 2000). An interaction between housing and substance use was not significant either, indicating that homeless substance users were just as likely to report service gaps as non-homeless substance users. The lack of significance findings for either result goes against some currently thinking about housing insecurity as an independent predictor of service utilization (Leaver, Bargh, Dunn, Hwang, 2007). Put another way, housing has little effect on the link between substance use and reported service gaps, despite the body of

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past research showing that housing insecurity is a unique barrier to obtaining services among HIV-infected individuals.

Question 1b: Is substance use associated with reporting service gaps

Poisson Regression

The previous section established an association between substance use and reporting any service gaps. In this section Poission regression was used to determine if substance use can also predict an increased risk based on the number of service gaps reported. In this analysis the outcome of interest is a count variable, where an increased risk for each additional gap reported were explored. Table 6.2.5 shows the unadjusted risk of reporting an additional service gaps among substance users, accompanied by the β and subsequent p value. Results indicate a weak correlation (p=0.08) between substance use and an increased risk in reporting an additional service gap. Despite this result the likelihood ratio is highly significant, indicating that the relationship between these two variables is not zero. Despite this finding, the suppressive influences of a third variable must be ruled out before this analysis can be abandoned (Aneshensel, 2013).

Table 6.2.5: Unadjusted Risk of Reporting Ancillary Service Gaps By Substance Use; Poisson Model 1 (N=18,951)

Independent Variables	RR (95% CI)	β (SE β)	p value
Focal Variable			
Substance Use			
Yes	1.30 (0.97-1.74)	0.26 (0.15)	*
No	Referent		
Intercept	4.05 (3.35-4.88)	1.40 (0.10)	****
Model Statistics			
LR(χ^2)	230.09		****
df	1, 261		

*=p$\leq$0.1, **=p$\leq$0.05, ***=p$\leq$0.01, ****=p$\leq$0.001

Table 6.2.6 shows the second Poisson regression model in this analysis (model 2a), which contains the primary focal relationship as well as the set of predisposing

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characteristics. When these variables were included the strength of the focal relationship weakened, with the RR decreasing by 17% (unadjusted: RR=1.30 vs. model 2a RR=1.08). Also, the precision (as measured by the p value) also decreased. Interestingly the LR decreased (LR(χ^2)=89.23) from the unadjusted model (LR(χ^2)= 230.09), indicating that the unadjusted model may be a better fit for the data than the expanded model.

Among newly added variables, only age and lapse in medical care demonstrated a strong correlation to the outcome. An inverse relationship between age and reporting an additional service gap was revealed. While holding all other variables constant, with each additional 10-year increase in age the risk of reporting an additional service gap decreased by 18% (p<0.001). Also, persons who reported a past lapse in medical care had a 53% greater risk (RR=1.53, p=0.006) of reporting additional service gaps.

Table 6.2.6: Factors Associated with Reporting Ancillary Service Gaps by Substance Use & Predisposing Characteristics; Poisson Model 2a (N=18,951)

Independent variables	RR (95% CI)	β (SE β)	p value
Focal Variable			
Substance Use			
Yes	1.08 (0.82-1.42)	0.07 (0.14)	
No	referent	referent	
Predisposing Characteristics			
Age (10 yrs)	0.82 (0.73-0.92)	-0.02 (0.01)	****
Gender			
Female	0.74 (0.51-1.08)	-0.30 (0.19)	
Transgender	1.17 (0.52-2.64)	0.16 (0.41)	
Male	referent	referent	
Race/Ethnicity			
Latino	0.81 (0.59-1.10)	-0.21 (0.16)	
African American	0.80 (0.58-1.09)	-0.23 (0.16)	
Other/Mulit-Racial	0.82 (0.41-1.61)	-0.20 (0.35)	
White	referent	referent	
Sexual Orientation			
Homosexual/Gay/Lesbian	0.72 (0.50-1.02)	-0.33 (0.18)	
Bisexual	0.78 (0.58-1.04)	-0.25 (0.15)	
Heterosexual/Straight	referent	referent	
Education Completed			
Less than High School	0.78 (0.58-1.04)	-0.24 (0.17)	
High School/GED	0.92 (0.69-1.23)	-0.08 (0.15)	
Greater than High School	referent	referent	
Language of Interview			
Spanish	0.89 (0.54-1.47)	-0.12 (0.25)	
English	referent	referent	
Lapse in medical care			
Yes	1.53 (1.13-2.08)	0.43 (0.16)	***
No	referent	referent	
Intercept (constant)	15.27 (7.19-32.45)	2.73 (0.38)	****
Model Statistics			
LR(χ^2)	89.23		****
df	14, 261		

*=p≤0.1, **=p≤0.05, ***=p≤0.01, ****=p≤0.001

Table 6.2.7 shows the third Poisson regression model in this analysis (model 2b) containing the primary focal relationship as well as all predisposing characteristics and enabling resources. Very little change in the focal relationship or LR(χ^2) between models 2a and 2b was observed, indicating that the added enabling characteristics had little effect on either the focal relationship or the overall model fit when compared to the null.

Among previously added predisposing characteristics, the risk of reporting additional service gaps among those reporting a past lapse in medical care increased by 48% (model 2a: RR=1.53; model 2b: RR=2.27), with little change in the strength of the correlation observed. Also, the inverse relationship between age and risk of additional service gaps persisted and remained largely unchanged between model 2a and 2b (RR=0.82 vs. RR=0.85 respectively). A weak protective correlation between persons who reported being bisexual and an increased risk of service gaps was also revealed (RR=0.77; p=0.09).

Among the newly added predisposing variables, persons with a current mental health condition are at 68% increased risk of reporting an additional service gap while holding all other variables constant (p<0.001). Also, the further a respondent has to travel to their doctor's office increased the risk of reporting an additional service gap, with each additional 10 miles of travel translating into a 3% increased risk of reporting an additional gap (p=0.006).

Table 6.2.7: Factors Associated with Reporting Ancillary Service Gaps by Substance Use, Predisposing Characteristics & Enabling Resources; Poisson Model 2b (N=18,951)

Independent variables	RR (95% CI)	β (SE β)	p value
Focal Variable			
Substance Use			
Yes	1.02 (0.78-1.32)	0.02 (0.13)	
No	referent	referent	
Predisposing Characteristics			
Age (10 yrs)	0.85 (0.76-0.97)	-0.02 (0.01)	***
Gender			
Female	0.91 (0.61-1.37)	-0.09 (0.21)	
Transgender	1.20 (0.52-2.79)	-0.19 (0.43)	
Male	referent	referent	
Race/Ethnicity			
Latino	0.86 (0.61-1.22)	-0.15 (0.17)	
African American	0.83 (0.61-1.14)	-0.18 (0.16)	
Other/Mulit-Racial	0.87 (0.50-1.54)	-0.14 (0.29)	
White	referent	referent	
Sexual Orientation			
Homosexual/Gay/Lesbian	0.81 (0.54-1.21)	-0.21 (0.21)	
Bisexual	0.77 (0.56-1.05)	-0.26 (0.16)	*
Heterosexual/Straight	referent	referent	
Education Completed			
Less than High School	0.81 (0.56-1.17)	-0.21 (0.19)	
High School/GED	0.98 (0.77-1.26)	-0.02 (0.13)	
Greater than High School	referent	referent	
Language of Interview			
Spanish	0.88 (0.55-1.42)	-0.12 (0.24)	
English	referent	referent	
Lapse in medical care			
Yes	2.27 (1.37-3.77)	0.38 (0.12)	***
No	referent	referent	
Enabling Resources			
Travel Time to Doctors Office	1.03 (1.01-1.06)	0.00 (0.00)	**
Employment Status			
Unemployed	1.04 (0.73-1.47)	0.04 (0.18)	
Retired/Disabled/Student	0.85 (0.53-1.34)	-0.17 (0.23)	
Employed (full/part-time)	referent	referent	
Current Mental Health Diagnosis			
Yes	1.68 (1.27-2.22)	0.52 (0.14)	****
No	referent	referent	
Insurance Status			
Not Insured	1.03 (0.78-1.38)	0.03 (0.15)	
Insured	referent	referent	
FPG			
At or Below FPG	0.89 (0.65-1.22)	-0.12 (0.15)	
Above FPG	referent	referent	
Mode of Transportation			

Public Transport	1.03 (0.76-1.38)	-0.03 (0.13)	
Private Car	referent	referent	
Residency Status			
Undocumented	0.90 (0.52-1.56)	-0.10 (0.28)	
Legal Resident	0.98 (0.68-1.42)	-0.02 (0.19)	
Not Reported	referent	referent	
Intercept (constant)	8.51 (3.07-23.56)	2.14 (0.52)	****
Model Statistics			
LR(χ^2)	83.31		****
df	23, 261		

*=p≤0.1, **=p≤0.05, ***=p≤0.01, ****=p≤0.001

Table 6.2.8 shows the fourth iteration of nested Poisson regression models in this analysis (model 3), which contains the primary focal relationship, predisposing characteristic, enabling resources and rival independent variables. Overall, results from this model differ very little from models 2a and 2b above. The strength of the primary focal relationship changed very little between models (RR=1.04, 1.02, 1.08 respectively). Finally, only very minor changes to the likelihood ratio were recorded (LR(χ^2)=90.60, 83.31, 89.23 respectively). This suggests that the addition of each variable group had no effect (such as suppression or elimination) on the strength of the focal relationship or the overall explanatory value of the regression models when compared to the null.

Most previously identified variables strongly correlated with the outcome (age, travel time and mental health) were also largely unchanged with the addition of the two rival independent variables. The risk of reporting additional service gaps among those reporting a past lapse in medical care did decrease by 38% (RR=1.40, p=0.01) compared to model 2b (RR=2.27, p=0.002) but is still quite strong. Of the new variables added, only incarceration status was strongly correlated, with persons with recent incarceration histories having an 80% (RR=1.80, p=0.01) increased risk of reporting an additional service gap.

Table 6.2.8: Factors Associated with Reporting Ancillary Service Gaps by Substance Use, Predisposing Characteristics & Rival Independent Variables; Poisson Model 3 (N=18,951)

Independent variables	RR (95% CI)	β (SE β)	p value
Focal Variable			
Substance Use			
Yes	1.04 (0.79-1.38)	0.04 (0.14)	
No	referent	referent	
Predisposing Characteristics			
Age (10 yrs)	0.85 (0.76-0.96)	-0.02 (0.01)	**
Gender			
Female	0.96 (0.64-1.43)	-0.05 (0.21)	
Transgender	1.34 (0.58-3.10)	0.30 (0.42)	
Male	referent	referent	
Race/Ethnicity			
Latino	0.91 (0.65-1.28)	-0.09 (0.17)	
African American	0.98 (0.67-1.42)	-0.02 (0.19)	
Other/Mulit-Racial	1.04 (0.59-1.83)	0.04 (0.29)	
White	referent	referent	
Sexual Orientation			
Homosexual/Gay/Lesbian	0.89 (0.58-1.36)	-0.12 (0.22)	
Bisexual	0.77 (0.54-1.10)	-0.26 (0.18)	
Heterosexual/Straight	referent	referent	
Education Completed			
Less than High School	0.79 (0.55-1.13)	-0.24 (0.18)	
High School/GED	0.96 (0.75-1.22)	-0.04 (0.12)	
Greater than High School	referent	referent	
Language of Interview			
Spanish	0.95 (0.60-1.50)	-0.05 (0.23)	
English	referent	referent	
Lapse in medical care			
Yes	1.40 (1.07-1.83)	0.34 (0.14)	**
No	referent	referent	
Enabling Resources			
Travel Time to Doctors Office	1.04 (1.02-1.07)	0.00 (0.00)	***
Employment Status			
Unemployed	0.93 (0.65-1.34)	-0.07 (0.18)	
Retired/Disabled/Student	0.78 (0.49-1.24)	-0.25 (0.23)	
Employed (full/part-time)	referent	referent	
Current Mental Health Diagnosis			
Yes	1.68 (1.29-2.18)	0.52 (0.13)	****
No	referent	referent	
Insurance Status			
Not Insured	0.97 (0.71-1.31)	-0.03 (0.16)	
Insured	referent	referent	
FPG			
At or Below FPG	0.84 (0.60-1.17)	-0.18 (0.17)	
Above FPG	referent	referent	
Mode of Transportation			

Public Transport	1.02 (0.75-1.38)	0.02 (0.15)	
Private Car	referent	referent	
Residency Status			
Undocumented	1.00 (0.56-1.77)	0.00 (0.29)	
Legal Resident	1.04 (0.72-1.51)	0.04 (0.19)	
Not Reported	referent	referent	
Rival Independent Variables			
Incarceration Status			
Recently Incarcerated	1.80 (1.13-2.86)	0.59 (0.24)	**
Not Recently Incarcerated	referent	referent	
Current Housing Status			
Homeless	1.05 (0.78-1.41)	0.04 (0.15)	
Not Homeless	referent	referent	
Intercept (constant)	7.51 (2.64-21.40)	2.02 (0.53)	****
Model Statistics			
LR(χ^2)	90.60		****
df	25, 261		

*=p$\leq$0.1, **=p$\leq$0.05, ***=p$\leq$0.01, ****=p$\leq$0.001

Table 6.2.9 shows the fifth and final Poisson regression model in this analysis (model 4), which contains all previously reported variables of interest as well as two important interaction terms (substance use with both gender and residency status). Although neither of these variables were strongly correlated with the outcome in any previous models, the effects of substance use on each of these groups warrants further investigation. Research has shown that strong disparities exist in service deliver and HIV care among women (Gelberg et al., 2000; Andersen et al., 2005). For this reason an interaction term was created between substance use and gender to investigate the possibility of a suppression effect.

Research on immigration status, substance use and care utilization among HIV-infected persons is limited. Immigration status has been shown to negatively affect health care access generally (Giordano et al., 2009; Wolff, et al., 2009). It has also shown to affect social service delivery for HIV-infected immigrants specifically (Rajabiun et al., 2008), but the role of substance use has never been explored. For this reason an

interaction terms between residency status and substance use was generated to further explore this relationship.

According to this analysis, the focal relationship has flipped, with substance users having less risk in reporting additional service gaps (RR=0.89). Despite this the strength of the relationship is still very weak (p=0.46). Also of note is that the likelihood ratio did increase slightly (LR(χ^2)=109.37), indicating that the overall model is still a better fit than the null.

Most results from previous iterations of this model were unchanged; including age, travel time, mental health and recent incarceration status. The strength of the association between lapse in medical care and an increased risk of reporting additional service gaps decreased from models 2b (RR=2.27, p=0.006), 3 (RR=1.40, p=0.01) and 4 (RR=1.30, p=0.05). This represents overall decrease of 43% in the risk. This sharp drop indicates that the rival independent variables (housing status and recent incarceration) may be partially confounding this relationship.

Results from newly added interaction terms indicate a suppression effect by substance use. Though no association between either gender or residency status and risk of reporting additional service gaps was reported, once these terms were controlled by substance use results were very different. Female substance users had over a three fold increased risk of reporting an additional service gap (RR=3.00, p<0.001). Also, transgender substance users reported an increased risk as well (RR=2.42, p=0.04). This same discordant relationship can also be found among undocumented persons, as a group they were protected from reporting an increased number of service gaps but this correlation was very weak (p=0.32), but undocumented substance users reported an increased risk (RR=3.38, p=0.01). These results indicate that increased risk among certain groups of substance users can be easily masked. These findings are supported

by the literature, and show that substance use alone can be a powerful predictor of

service deficiencies for certain groups.

Table 6.2.9: Factors Associated with Reporting Ancillary Service Gaps by Substance Use, Predisposing Characteristics, Enabling Resources & Rival Independent Variables with Interaction Terms; Poisson Model 4 (N=18,951)

Independent variables	RR (95% CI)	β (SE β)	p value
Focal Variable			
Substance Use			
Yes	0.89 (0.65-1.21)	-0.12 (0.16)	
No	referent	referent	
Predisposing Characteristics			
Age (10 yrs)	0.81 (0.72-0.92)	-0.02 (0.01)	***
Gender			
Female	0.79 (0.53-1.17)	-0.24 (0.20)	
Transgender	0.75 (0.47-1.21)	-0.28 (0.24)	
Male	referent	referent	
Race/Ethnicity			
Latino	0.88 (0.64-1.23)	-0.12 (0.17)	
African American	0.91 (0.63-1.32)	-0.09 (0.19)	
Other/Mulit-Racial	0.95 (0.55-1.63)	-0.05 (0.28)	
White	referent	referent	
Sexual Orientation			
Homosexual/Gay/Lesbian	0.82 (0.56-1.20)	-0.20 (0.19)	
Bisexual	0.71 (0.52-0.97)	-0.35 (0.16)	**
Heterosexual/Straight	referent	referent	
Education Completed			
Less than High School	0.69 (0.48-1.00)	-0.37 (0.19)	*
High School/GED	0.95 (0.74-1.21)	-0.05 (0.12)	
Greater than High School	referent	referent	
Language of Interview			
Spanish	0.95 (0.60-1.51)	-0.05 (0.23)	
English	referent	referent	
Lapse in medical care			
Yes	1.30 (1.00-1.68)	0.26 (0.13)	**
No	referent	referent	
Enabling Resources			
Travel Time to Doctors Office	1.03 (1.01-1.06)	0.00 (0.00)	***
Employment Status			
Unemployed	0.93 (0.65-1.33)	-0.08 (0.18)	
Retired/Disabled/Student	0.80 (0.51-1.26)	-0.22 (0.23)	
Employed (full/part-time)	referent	referent	
Current Mental Health Diagnosis			
Yes	1.59 (1.24-2.05)	0.47 (0.13)	****
No	referent	referent	
Insurance Status			
Not Insured	1.02 (0.74-1.40)	0.02 (0.16)	
Insured	referent	referent	
FPG			
At or Below FPG	0.80 (0.58-1.10)	-0.22 (0.16)	
Above FPG	referent	referent	
Mode of Transportation			

Public Transport	1.09 (0.82-1.46)	0.09 (0.15)	
Private Car	referent	referent	
Residency Status			
Undocumented	0.77 (0.47-1.29)	-0.26 (0.27)	
Legal Resident	1.08 (0.72-1.62)	0.08 (0.20)	
Not Reported	referent	referent	
Rival Independent Variables			
Incarceration Status			
Recently Incarcerated	1.80 (1.04-2.45)	0.59 (0.23)	***
Not Recently Incarcerated	referent	referent	
Current Housing Status			
Homeless	1.09 (0.82-1.42)	0.08 (0.14)	
Not Homeless	referent	referent	
Interaction Terms			
Substance use*Gender			
Use*Female	3.00 (1.81-4.98)	1.10 (0.26)	****
Use*Transgender	2.42 (1.04-5.66)	0.88 (0.43)	**
Substance use*Residency			
Use*Undocumented	3.38 (1.31-8.74)	1.22 (0.48)	***
Use*Legal Resident	0.69 (0.405-1.19)	-0.37 (0.28)	
Intercept (constant)	9.56 (3.63-25.18)	2.26 (0.49)	****
Model Statistics			
LR(χ^2)	109.37		****
df	29, 261		

*=p≤0.1, **=p≤0.05, ***=p≤0.01, ****=p≤0.001

Table 6.2.10 shows the effect of moderation on the full model (model 4) presented above. As described previously, the moderator was generated by creating two new variables based on the proportion of barrier types respondents identified (information or systems barriers). Another important point is that when comparisons are made between the full model (model 4) and the stratified model (model 5a or b) the full model will be referred to as the crude analysis.

Compared to the crude analysis (model 4), the correlation between the focal relationship becomes slightly stronger and remained overall protective (RR=0.69, p=0.08) among those reporting information barriers, but remained mostly unchanged (RR=0.93, p=0.66) for those reporting systems barriers. Compared to the crude result from model 4, it appears that barrier type is acting as an effect modifier on the relationship between risk of reporting an additional service gap and substance use.

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Despite this effect, this is still an overall weak association based on both the crude and stratified results, indicting that no real relationship may be present. It should also be noted that the likelihood ratio for both stratified models increased slightly from the crude (information barriers: $LR(\chi^2)$=125.25; systems barriers: $LR(\chi^2)$=123.57), indicating that overall, both stratified models are superior to the null. Based on all results for this analysis, a persistently weak association between substance use and the risk of reporting additional service gaps exists. Upon stratification this weak association persists among those reporting information barriers but is absent among those reporting systemic barriers.

With respect to other variables of interest, in the presence of moderation results were mixed. Previous Poisson models consistently showed that recent mental health diagnosis, travel time to doctors' appointment and recent incarceration were all positively associated with an increased risk of reporting additional service gaps. Those reporting a mental health diagnosis were still strongly positively correlated for both barrier types (systems barriers: RR=1.64, p=0.002; information barriers: RR=1.46, p=0.01) upon stratification compared to the crude (RR=1.59, p=0.001). As the reported moderated risks fall between the crude risk, this is an indication that barrier type may act as an effect modifier on the relationship between mental health diagnosis and risk of reporting an additional service gap. It should be pointed out that the changes in risk upon stratification are modest at best, so the strength of this effect is quite weak. In a practical sense it appears that persons reporting a recent mental health diagnosis have similar risks regardless of what types of barriers they might be experiencing.

With respect to moderation effects on travel time to doctors appointments, very little change is seen in the actual risk when the crude risk (RR=1.03, p=0.005) was stratified by information barriers (RR=1.02, p=0.24) and systems barriers (RR=1.03, p=0.03). What is apparent is that the strength of these correlations decrease slightly

from the crude, as observed by both the decrease in p-values as well as the confidence limits of the RR (crude: 1.01-1.06; information barriers: 0.99-1.06; systems barriers: 1.00-1.06). As observed changes are so subtle it is difficult to determine if this is a sign of potential confounding or not.

Another consistent finding across nested models is the inverse relationship between age and increased risk for reporting additional service gaps, with younger individuals reporting greater risk (RR range: 0.81 to 0.84). When stratified the strength of this relationship increased for those reporting information barriers (RR=0.77, p=0.001), but was much weaker among those reporting systems barriers (RR=0.91, p=0.06). This is another example of effect modification by barrier type. It appears that among youth, knowledge about available services may be a much stronger predictor of why these individuals are experiencing an increased number of service gaps.

As previously reported, the strength of the positive relationship between a reported past lapse in medical care and risk of additional service gaps has been decreasing as groups of variables are added. In the previous (crude) model this association was modest (RR=1.30, p=0.05). Stratification did indicate that barrier type may be acting as an effect modifier (systems barriers: RR=1.22, p=0.06; Information barriers: RR=1.37, p=0.10), but the influence of barrier type is modest at best, and the strength of the correlations is weaker as indicated by changes in both the p-values and confidence limits (crude: 1.00-1.68; information barriers: 0.92-2.03; systems barriers: 0.99-1.50). This indicates that barrier type may have little influence on why persons who previously reported a lapse in medical care experience an increasing number of service gaps.

The relationship between gender and service gaps also yielded mixed results. No real association between transgender identity and risk was previously reported, but upon stratification this relationship became increasingly protective among information barrier

respondents (RR=0.13, p<0.001), but no relationship was found among persons who reported systems barriers (RR=0.97, p=0.86). Transgender substance users did report an increased risk with respect to the number of service gaps in the crude analysis (RR=2.31, p=0.003), a trend that continued among information barriers respondents (RR=6.81, p=0.002), but not among systems barriers (RR=1.75, p=0.16). It should be noted that the confidence interval for information barriers was extremely wide (CI: 2.06-22.52), indicating a lack of precision in this result.

A similar trend was noted among women as well, with female substance users reporting increased risks in the crude analysis (RR=2.65, p<0.001), and remaining highly correlated (although somewhat weaker) for persons information barriers only (RR=2.15, p=0.03). It should also be noted that no substance abusing women reported systems barriers, so no comparative analysis can be performed to evaluate the effects of confounding or effect modification. These results do indicate generally that both biological female and transgender substance users report lacking the necessary information to obtain needed services.

Another finding was that even though no strong correlations between sexual orientation and the outcome variable was previously reported, when stratified these associations became much stronger and protective among those reporting information based (bisexual: RR=0.59, p=0.02; gay/lesbian: RR=0.66, p=0.02) barriers only. As the comparison group for both of these are heterosexually identified persons, these finding may indicate that these individuals may have increased risk of reporting service gaps due to lack of information about available services.

Similar results were reported for respondents based on education level, and FPG. With education, no strong correlation was reported among persons with a less than a high school (<HS) education in the crude analysis, but when stratified <HS was moderately protective among systems barriers respondents (<HS: RR=0.63, p=0.04).

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Additionally, when FPG was taken into account a similar inverse relationship between FPG and risk of reporting additional service gaps among persons reporting information barriers (RR=0.64, p=0.008) was observed. Together these inverse relationships might indicate that these groups may be better at navigating the RW system than those of their respective referent groups.

This trend was also evident based on residency status, with undocumented persons reporting no increased risk unless they also reported substance use in the crude analysis (RR=3.38, p=0.01). When stratified this correlation increased among those reporting systems barriers (RR=4.83, p<0.001), with no results based on information barriers reported as there were too few respondents. This indicates that undocumented substance users report structural barriers as the main obstacle to obtaining additional needed services.

Finally, persons reporting recent incarceration consistently reported an increased risk of reporting additional services gaps (model 3 and model 4: RR=1.80, p=0.01). Upon stratification this risk increased among those reporting information barriers (RR=2.01, p=0.005) only, but decreased among those reporting systems barriers (RR=1.20, p=0.40). This indicates effect modification based on barrier type. From a practical perspective it also indicating that upon release, recently incarcerated persons may lack appropriate information on available services, a finding consistent with the literature (Wakeman et al., 2009; Harzke et al., 2006).

Table 6.2.10: Factors Associated with Reporting Ancillary Service Gaps by All Reported Variables with Moderation by Barrier Type; Poisson Models 5a (n=6,849) & 5b (n=8,441)

Independent variables	Model 5a: Systems Barriers			Model 5b: Information Barriers		
	RR (95% CI)	β (SE β)	p value	RR (95% CI)	β (SE β)	p value
Focal Variable						
Substance Use						
Yes	0.69 (0.46-1.05)	-0.37 (0.21)	*	0.93 (0.65-1.31)	-0.08 (0.18)	
No	referent	referent		referent	referent	
Predisposing Characteristics						
Age (10 yrs)	0.91 (0.80-1.03)	-0.01 (0.01)	*	0.77 (0.65-0.90)	-0.03 (0.01)	****
Gender						
Female	0.98 (0.60-1.61)	-0.02 (0.25)		0.63 (0.39-1.03)	-0.46 (0.24)	*
Transgender	0.97 (0.70-1.34)	-0.03 (0.16)		0.13 (0.05-0.34)	-2.03 (0.49)	****
Male	referent	referent		referent	referent	
Race/Ethnicity						
Latino	0.77 (0.51-1.17)	-0.26 (0.21)		1.03 (0.68-1.55)	0.03 (0.21)	
African American	0.78 (0.55-1.11)	-0.24 (0.18)		0.96 (0.56-1.65)	-0.04 (0.27)	
Other/Mulit-Racial	0.56 (0.28-1.15)	-0.57 (0.36)		1.22 (0.62-2.40)	0.20 (0.34)	
White	referent	referent		referent	referent	
Sexual Orientation						
Homosexual/Gay/Lesbian	1.08 (0.80-1.46)	0.08 (0.15)		0.66 (0.47-0.92)	-0.42 (0.17)	**
Bisexual	0.75 (0.51-1.10)	-0.29 (0.20)		0.59 (0.38-0.91)	-0.53 (0.22)	**
Heterosexual/Straight	referent	referent		referent	referent	
Education Completed						
Less than High School	0.63 (0.41-0.97)	-0.46 (0.22)	**	0.75 (0.49-1.14)	-0.29 (0.22)	
High School/GED	1.05 (0.75-1.47)	0.05 (0.17)		1.13 (0.75-1.70)	0.12 (0.21)	
Greater than High School	referent	referent		referent	referent	
Language of Interview						
Spanish	1.53 (0.89-2.62)	0.42 (0.27)		1.76 (0.69-4.54)	0.57 (0.48)	
English	referent	referent		referent	referent	
Lapse in medical care						
Yes	1.22 (0.99-1.50)	0.20 (0.11)	*	1.37 (0.92-2.03)	0.31 (0.20)	

No	referent	referent		referent	referent	
Enabling Resources						
Travel Time to Doctors Office	1.03 (1.00-1.06)	0.00 (0.00)	**	1.02 (0.99-1.06)	0.00 (0.00)	
Employment Status						
Unemployed	1.22 (0.85-1.75)	0.20 (0.18)		0.74 (0.51-1.09)	-0.30 (0.20)	
Retired/Disabled/Student	0.93 (0.59-1.48)	-0.07 (0.23)		0.95 (0.60-1.48)	-0.06 (0.23)	
Employed (full/part-time)	referent	referent		referent	referent	
Current Mental Health Diagnosis						
Yes	1.64 (1.20-2.26)	0.50 (0.16)	***	1.46 (1.09-1.95)	0.38 (0.15)	**
No	referent	referent		referent	referent	
Insurance Status						
Not Insured	1.23 (0.85-1.78)	0.21 (0.19)		0.79 (0.56-1.12)	-0.23 (0.17)	
Insured	referent	referent		referent	referent	
FPG						
At or Below FPG	1.03 (0.75-1.41)	0.02 (0.16)		0.64 (0.46-0.89)	-0.45 (0.17)	***
Above FPG	referent	referent		referent	referent	
Mode of Transportation						
Public Transport	0.86 (0.66-1.13)	-0.15 (0.14)		1.12 (0.80-1.57)	0.11 (0.17)	
Private Car	referent	referent		referent	referent	
Residency Status						
Undocumented	0.48 (0.26-0.86)	-0.74 (0.30)	**	0.55 (0.21-1.41)	-0.60 (0.48)	
Legal Resident	0.74 (0.46-1.19)	-0.30 (0.24)		1.22 (0.75-2.00)	0.20 (0.25)	
Not Reported	referent	referent		referent	referent	
Rival Independent Variables						
Incarceration Status						
Recently Incarcerated	1.20 (0.78-1.86)	0.19 (0.22)		2.01 (1.23-3.28)	0.70 (0.25)	***
Not Recently Incarcerated	referent	referent		referent	referent	
Current Housing Status						
Homeless	1.08 (0.75-1.56)	0.08 (0.18)		1.27 (0.97-1.67)	0.24 (0.14)	*
Not Homeless	referent	referent		referent	referent	
Interaction Terms						
Substance use*Gender						
Use*Female	--	--		2.15 (1.09-4.23)	0.76 (0.34)	**
Use*Transgender	1.75 (0.80-3.86)	0.56 (0.40)		6.81 (2.06-22.52)	1.92 (0.61)	***

Substance use*Residency						
Use*Undocumented	4.83 (2.03-11.50)	1.57 (0.44)	****	--	--	
Use*Legal Resident	1.08 (0.49-2.37)	0.08 (0.40)		0.63 (0.33-1.20)	-0.47 (0.33)	
Intercept (constant)	5.96 (2.60-13.64)	1.79 (0.42)	****	26.60 (11.10-63.76)	3.28 (0.44)	****
Model Statistics						
LR(χ^2)	125.25		****	123.57		****
df	28, 261			27, 261		

*=p≤0.1, **=p≤0.05, ***=p≤0.01, ****=p≤0.001

SECTION SUMMARY

In the above analysis substance use alone was not predictive with respect to a one-unit change in the number of reported service gaps among a sample of Ryan White recipients in Los Angeles County. This weak association was not altered by the addition of any competing variables or in the presence of a moderator. This indicates that although substance use may predict if Ryan White respondents report any gaps, it doesn't strongly predict the number of gaps reported.

Although the primary focal relationship wasn't predictive, stratification by barrier type (moderator) did reveal important differences by factors such as gender and residency status. Transgender substance users had over twice the risk of reporting an additional service gap. This risk jumped substantially to almost seven times the risk among those who reported information barriers. Similar trends were found for biological women (regardless of LGB status), but findings were less robust than for transgender individuals. It should be noted that this finding only applies to transgender women (male-to-female or MTF), as no female-to-male (FTM) transgender persons were interviewed. This finding is consistent with the literature, as MTF are disproportionately represented among HIV-infected persons as they engage in more high risk sexual behavior compared to their FTM counterparts (Rohde-Bowers, et al, 2011). What is new here is that barrier type moderates this relationship, revealing that lack of information about services among this population is strongly associated with an increased risk of reporting more service gaps.

This analysis also revealed other important factors strongly associated with a one-unit change in reported service gaps. Consistent with the previous logistic regression model, the inverse relationship between age and service gaps was replicated. Within the context of this analysis, for each additional 10-year increase in age there is an almost 20% reduction in the risk of reporting an additional service gap. This

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relationship intensified among persons reporting information barriers (23% reduction) but decreased among systems barriers respondents (9%). This indicates that younger persons are more likely to report that they lacked information about where to get appropriate services. The relationship between age and HIV care/treatment adherence is well documented (Shapiro, et al, 1999a). Ashman et al. (2002) showed a correlation between older age and both receipt and retention in primary care among RW recipients, and Chan et al. (2002) demonstrated that persons over 35 who received a high number of ancillary RW services were more likely to engage in HIV primary medical care.

This is the first analysis to link younger age and an increased number of service gaps. This finding has important policy implications, as health care utilization among youth is lower than that of adults for a variety of conditions (Lau, Adams, Boscardin, Irwin, 2014; Chua, Schuster, McWilliams, 2013). While much of this analysis focuses on the effects of costs and insurance status as the primary drivers of disparities, this is the first such analysis to show lack of knowledge as a more powerful predictor than other system or structural factors. This finding is important as youth in LAC are among the fastest growing population of HIV-infected persons, especially among minority populations. This may be a situation that is unique to Ryan White funded programs, or HIV-infected populations but more investigation is needed before more definitive answers can be given.

Also important was the association between housing status, with homeless persons at almost twice the risk of reporting a one-unit increase in the number of service gaps compared to those with housing. Interestingly when stratified by barrier type this association decreased substantially, suggesting that the types of barriers experienced by this group has little effect on the number of gaps reported. As this is the first such analysis to look specifically at the role of barriers among this population, the reason for such an increased risk for gaps must be due to another unmeasured factor or set of

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factors. An interaction term between homelessness and substance use didn't reveal any significant findings, suggesting that substance use among homeless RW recipients may not be strongly associated with an increased risk of reporting more service gaps.

This analysis revealed many findings inconsistent with past literature, such as lower education and federal poverty guideline (FPG) is protective for reporting additional service gaps (McMahon et al., 2010). Most investigations have shown that HIV-infected populations with lower education and SES may experience more barriers to obtaining needed services. These analyses suggest the opposite, that person's with advanced education and those living above the FPG may be more likely to experience service gaps. This finding may be the most pronounced among those with higher education reporting system barriers. This suggests that RW may be over-targeting the most disenfranchised persons in the system, while others may be slipping through the cracks. Persons with higher SES may be unable to obtain certain types of services (like case management) due to income requirements, indicating that they may be unaware of other available services they may be eligible for. Policy makers may want to take this into account when setting certain guidelines for service delivery.

To analyze the effects that both type and number of substance use have on the number of reported service gaps among the subset of substance users.

To address this aim the following research questions were answered:

1. Does use of stimulants (vs. other substances) affect the number of service gaps reported among substance users specifically?

2. Does the number of substances used affect the number of service gaps reported?

Two conditional Poisson regression analyses involving only substance using respondent were conducted to answer this aim. First, the role of stimulant use (independent variable) and service gaps (dependent variable) was investigated. Then, how the number of substances used (independent variable) affected the number of service gaps reported (dependent variable) was explored. As with aim 2, results from a series of nested Poisson regression models will assist in answering these research questions, and both analyses will include moderation by barrier type.

Question 1: Is stimulant use associated with reporting service gaps

Stimulant Use

Table 6.3.1 shows the unadjusted risk for a one-unit increase in the number of reported service gaps stratified by stimulant use in a sample of substance users. Based on available data, a substantial correlation between stimulant use and an increased risk or reporting an additional service gap exists (RR=1.54, p=0.04). Put another way, stimulant users have a 54% increased risk of reporting an additional service gap compared to non-stimulant substance users. The low p-value of the likelihood ratio

signifies the null hypothesis (indicating no association exists between model variables) is

rejected.

Table 6.3.1: Unadjusted Risk of Reporting Ancillary Service Gaps By Stimulant Use among Substance Users; Poisson Model 1 (n=5,743)

Independent Variables	RR (95% CI)	β (SE β)	p value
Focal Variable			
Stimulant Use			
Yes	1.54 (1.02-2.32)	0.43 (0.21)	**
No	Referent	Referent	
Intercept	4.00 (2.99-5.35)	1.39 (0.14)	****
Model Statistics			
LR(χ^2)	124.48		****
df	1, 73		

*=p$\leq$0.1, **=p$\leq$0.05, ***=p$\leq$0.01, ****=p$\leq$0.001

Table 6.3.2 shows the second regression model in this analysis (model 2a), which contains the primary focal relationship as well as predisposing characteristics. When these additional variables were included the risk increased by 13% from RR=1.54 (p=0.04) in model 1 to RR=1.75 (p=0.02) in model 2a. This suggests that at least one of the set of predisposing characteristics may have been slightly suppressing the true strength of this relationship. It should also be noted that the likelihood ratio (LR(χ^2)) actually decreased, indicating that the fit of the model is actually slightly worse with the additional of these variables when compared to the unadjusted model alone. Despite these findings, the p value for both models is quite low, indicating that both are still far superior to that of the null.

Other findings to note among substance users were that women (RR=1.81, p=0.02) and those reporting a past lapse in medical care (RR=1.65, p=0.05) had increased risks of reporting additional service gaps. Interestingly, those with lower formal education (less than high school or <HS) reported a decreased risk (RR=0.49, p=0.03). Lastly, an inverse relationship between age and risk of reporting additional service gaps was revealed (RR=0.73, p<0.001).

Table 6.3.2: Factors Associated with Reporting Ancillary Service Gaps By Stimulant Use & Predisposing Characteristics among Substance Users, Poisson Model 2a (n=5,743)

Independent variables	RR (95% CI)	β (SE β)	p value
Focal Variable			
Stimulant Use			
Yes	1.75 (1.10-2.78)	0.56 (0.23)	**
No	referent	referent	
Predisposing Characteristics			
Age (10 yrs)	0.73 (0.61-0.88)	-0.03 (0.01)	****
Gender			
Female	1.81 (1.09-3.01)	0.59 (0.26)	**
Transgender	1.88 (0.85-4.14)	0.63 (0.40)	
Male	referent	referent	
Race/Ethnicity			
Latino	1.15 (0.73-1.82)	0.14 (0.22)	
African American	0.90 (0.53-1.53)	-0.10 (0.27)	
Other/Mulit-Racial	0.53 (0.23-1.22)	-0.64 (0.42)	
White	referent	referent	
Sexual Orientation			
Homosexual/Gay/Lesbian	0.79 (0.50-1.23)	-0.24 (0.22)	
Bisexual	1.04 (0.61-1.78)	0.04 (0.27)	
Heterosexual/Straight	referent	referent	
Education Completed			
Less than high school	0.49 (0.26-0.93)	-0.72 (0.32)	**
high school/GED	0.75 (0.46-1.24)	-0.28 (0.25)	
Greater than high school	referent	referent	
Language of Interview			
Spanish	2.12 (0.97-4.64)	0.75 (0.39)	*
English	referent	referent	
Lapse in medical care			
Yes	1.65 (1.00-2.71)	0.50 (0.25)	**
No	referent	referent	
Intercept (constant)	14.46 (5.92-35.28)	2.67 (0.45)	****
Model Statistics			
LR(χ²)	56.45		****
df	14, 73		

*=p≤0.1, **=p≤0.05, ***=p≤0.01, ****=p≤0.001

Table 6.3.3 shows the third Poisson regression model in this analysis (model 2b), which contains the primary focal relationship, as well as both predisposing characteristics and enabling resources. The addition of enabling resources has had little effect on the focal relationship (RR=1.62, p=0.03) compared to the previous model (RR=1.75, p=0.02), indicating that these variables have little effect on the focal

relationship. Despite the limited effect on the focal relationship, enabling factors did increase the overall fit of the model ($LR(\chi^2)$=122.98), indicating substantial improvement in its explanatory ability compared to the null.

With respect to other variables of interest, the addition of enabling resources increased the risk of reporting an additional service gap among female substance users by 88% (2a: RR=1.81, p=0.02; 2b: RR=3.42, p<0.001), an indication of possible suppression by one of the added variables. The protective relationship between <HS education and risk of reporting an additional service gap remained unchanged from the previous model (RR=0.47). Although the risk remained fairly constant, both the p-value and confidence interval decreased somewhat between models (2a: 95% CI=0.26-0.93; 2b: 95% CI=0.29-0.83), indicating an increase in the overall precision of this result. Conversely, while the relationship between age and risk of reporting an additional service gap was also mainly unchanged between models (2a: RR=0.73; 2b: RR=0.75) the strength of the correlation actually seemed to weaken (2a: 95% CI=0.61-0.88; 2b: 95% CI=0. 0.60-0.93), indicating a decrease in the precision of this result. Still, despite these changes the inverse relationship between age and service gaps is quite robust. It should also be noted that previously reported correlations between monolingual Spanish language and lapse in medical care were substantially weakened with the introduction of enabling resources.

Among the newly added enabling characteristics, a strong correlation was detected between insurance status and risk of additional service gaps, with uninsured persons reporting a 69% (RR=1.69, p=0.05) increased risk of reporting an additional service gap.

Table 6.3.3: Factors Associated with Reporting Ancillary Service Gaps By Stimulant Use, Predisposing Characteristics & Enabling Resources among Substance Users; Poisson Model 2b (n=5,743)

Independent variables	RR (95% CI)	β (SE β)	p value
Focal Variable			
Stimulant Use			
Yes	1.62 (1.06-2.49)	0.49 (0.21)	**
No	referent	referent	
Predisposing Characteristics			
Age (10 yrs)	0.75 (0.60-0.93)	-0.03 (0.01)	**
Gender			
Female	3.41 (2.05-5.65)	1.23 (0.25)	****
Transgender	1.63 (0.70-3.78)	0.49 (0.42)	
Male	referent	referent	
Race/Ethnicity			
Latino	1.10 (0.63-1.95)	0.10 (0.28)	
African American	0.82 (0.51-1.32)	-0.20 (0.24)	
Other/Mulit-Racial	0.57 (0.35-0.93)	-0.56 (0.24)	**
White	referent	referent	
Sexual Orientation			
Homosexual/Gay/Lesbian	0.91 (0.57-1.46)	-0.10 (0.24)	
Bisexual	1.03 (0.67-1.57)	0.03 (0.21)	
Heterosexual/Straight	referent	referent	
Education Completed			
Less than high school	0.49 (0.29-0.83)	-0.72 (0.26)	***
high school/GED	0.90 (0.60-1.35)	-0.11 (0.21)	
Greater than high school	referent	referent	
Language of Interview			
Spanish	2.02 (0.73-5.61)	0.71 (0.51)	
English	referent	referent	
Lapse in medical care			
Yes	1.37 (0.90-2.08)	0.32 (0.21)	
No	referent	referent	
Enabling Resources			
Travel Time to Doctors Office	1.02 (0.97-1.07)	0.00 (0.00)	
Employment Status			
Unemployed	1.64 (0.78-3.42)	0.49 (0.37)	
Retired/Disabled/Student	2.10 (0.92-4.78)	0.74 (0.41)	
Employed (full/part-time)	referent	referent	
Current Mental Health Diagnosis			
Yes	1.28 (0.88-1.86)	0.25 (0.19)	
No	referent	referent	
Insurance Status			
Not Insured	1.69 (1.01-2.84)	0.53 (0.26)	**
Insured	referent	referent	
FPG			
At or Below FPG	0.72 (0.46-1.12)	-0.33 (0.22)	
Above FPG	referent	referent	
Mode of Transportation			

Public Transport		1.04 (0.62-1.74)	0.03 (0.26)
Private Car		referent	referent
Residency Status			
Undocumented		1.41 (0.37-5.36)	0.34 (0.67)
Legal Resident		0.66 (0.40-1.08)	-0.42 (0.25)
Not Reported		referent	referent
Intercept (constant)		5.66 (1.26-25.36)	1.73 (0.75) **
Model Statistics			
	LR(χ^2)	122.98	****
	df	23, 73	

*=p≤0.1, **=p≤0.05, ***=p≤0.01, ****=p≤0.001

Table 6.3.4 shows the third Poisson regression model in this analysis (model 3), which contains the focal relationship, predisposing characteristics, enabling resources and rival independent variables. The overall risk among stimulant users decreased very slightly by 6% from the previous model (model 2b: RR=1.62, p=0.03; model 3: RR=1.52, p=0.05). Interestingly, when compared to the unadjusted analysis, the risk is quite stable (RR=1.54, p=0.04). Also, the overall fit of the model is slightly decreased from the model without rival independent variables (LR(χ^2)=107.47). In general, the addition of two rival independent variables had little effect on the focal relationship or on the overall fit of the model.

Results from previous iterations of this analysis were consistent with the model presented here. Variables such as age, education and gender are still strongly correlated with the outcome (service gaps). The strong inverse relationships between lower age and education level (<HS) with increased risk of reporting an additional service gap were unchanged when rival independent variables were added. Also, the risk among women decreased slightly (17%) from the previous model, but was still quite high (RR=2.82, p<0.001). This indicates that female substance users (compared to substance using men) have almost three times the risk of reporting an additional service gap.

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By contrast, the addition of rival independent variables greatly reduced previously reported correlation between Race/Ethnicity (other/mulit-racial) and insurance status (uninsured). Among the newly added rival independent variables, homeless substance users reported increased risk of reporting an additional service gap (RR=1.65, p=0.005).

Table 6.3.4: Factors Associated with Reporting Ancillary Service Gaps By Stimulant Use, Predisposing Characteristics, Enabling Resources & Rival Independent Variables among Substance Users; Poisson Model 3 (n=5,743)

Independent variables	RR (95% CI)	β (SE β)	p value
Focal Variable			
Stimulant Use			
Yes	1.52 (1.01-2.28)	0.42 (0.20)	**
No	referent	referent	
Predisposing Characteristics			
Age (10 yrs)	0.73 (0.58-0.90)	-0.03 (0.01)	***
Gender			
Female	2.82 (1.67-4.76)	1.04 (0.26)	****
Transgender	1.74 (0.83-3.66)	0.56 (0.37)	
Male	referent	referent	
Race/Ethnicity			
Latino	1.31 (0.77-2.23)	0.27 (0.27)	
African American	1.02 (0.60-1.75)	0.02 (0.27)	
Other/Mulit-Racial	0.67 (0.33-1.34)	-0.40 (0.35)	
White	referent	referent	
Sexual Orientation			
Homosexual/Gay/Lesbian	1.15 (0.69-1.91)	0.14 (0.26)	
Bisexual	1.06 (0.69-1.61)	0.06 (0.21)	
Heterosexual/Straight	referent	referent	
Education Completed			
Less than high school	0.52 (0.31-0.85)	-0.66 (0.25)	**
high school/GED	0.94 (0.66-1.34)	-0.06 (0.18)	
Greater than high school	referent	referent	
Language of Interview			
Spanish	1.85 (0.66-5.17)	0.62 (0.51)	
English	referent	referent	
Lapse in medical care			
Yes	1.33 (0.87-2.04)	0.28 (0.22)	
No	referent	referent	
Enabling Resources			
Travel Time to Doctors Office	1.03 (0.98-1.08)	0.00 (0.00)	
Employment Status			
Unemployed	1.43 (0.67-3.06)	0.36 (0.38)	
Retired/Disabled/Student	2.12 (0.94-4.79)	0.75 (0.41)	*
Employed (full/part-time)	referent	referent	
Current Mental Health Diagnosis			
Yes	1.28 (0.89-1.83)	0.25 (0.18)	
No	referent	referent	
Insurance Status			
Not Insured	1.44 (0.84-2.46)	0.53 (0.26)	
Insured	referent	referent	
FPG			
At or Below FPG	0.71 (0.45-1.11)	-0.35 (0.23)	
Above FPG	referent	referent	
Mode of Transportation			

Public Transport	0.89 (0.51-1.55)	-0.11 (0.28)	
Private Car	referent	referent	
Residency Status			
Undocumented	1.72 (0.48-6.22)	0.54 (0.64)	
Legal Resident	0.69 (0.44-1.09)	-0.37 (0.23)	
Not Reported	referent	referent	
Rival Independent Variables			
Incarceration Status			
Recently Incarcerated	1.36 (0.82-2.26)	0.31 (0.25)	
Not Recently Incarcerated	referent	referent	
Current Housing Status			
Homeless	1.65 (1.17-2.32)	0.50 (0.17)	***
Not Homeless	referent	referent	
Intercept (constant)	5.45 (1.22-24.29)	1.70 (0.75)	**
Model Statistics			
LR(χ^2)	107.47		****
df	73, 25		

*=p≤0.1, **=p≤0.05, ***=p≤0.01, ****=p≤0.001

Table 6.3.5 shows the fifth, and final or full, regression model in this analysis (model 4). All variables of interest (focal relationship, predisposing characteristics, enabling resources) along with important interaction terms (stimulant use interacted with gender and lapse in medical care) are presented. A strong correlation between gender and an increased risk of reporting an additional service gap has persisted throughout this analysis, for this reason an interaction term for this variable was created to test if this relationship was influenced differently by stimulant use. Lapse in care was strongly correlated with increased risk of reporting service gaps in aim 2, but among this subsample of substance users was not strongly correlated with the outcome. Research has shown that a past primary lapse in medical care is associated with a variety of poor health outcomes and forward HIV transmission (Cohen et al., 2013; Giordano et al., 2009; Christopolous et al., 2011), but its role as a predictor of social service gaps has never been explored. Additionally, the role of individual substances in predicting service gaps is novel. For this reason an interaction term was created to see if stimulant users who reported a past lapse in care to investigate this specific relationship.

In this model the overall risk among stimulant users increased by 11% between models (model 3: RR=1.52, model 4: RR=1.69) with very little change in the overall precision of this estimate. This indicates that one of the added interaction variables may have slightly suppressed this result. Also, the overall model fit increased to 397.30, indicating that the model with all included variables is a better fit than the null.

As with previous iterations of this model, findings based on age, gender and educational attainment (<HS) were all stable, indicating that interaction terms have little influence on these variables among a sample of substance users. The association between homelessness and reported service gaps increased by 29% between models (model 3: RR=1.65, p=0.005; model 4: RR=2.13, p<0.001), indicating that one of the interaction terms may have been suppressing this relationship.

Emerging from this analysis were positive associations between an increase risk of reporting service gaps by both retired/disabled persons and those reporting a past lapse in medical care. A moderate association between lapse in medical care and increase risk of service gaps was revealed previously in model 2a (RR=1.65, p=0.05) but became weaker in all other model iterations until model 4 below (RR=1.99, p=0.05), indicating that a weak association may be present but may have been slightly suppressed. Also, retired/disabled persons were weakly correlated with the outcome in model 3 above (RR=2.12, p=0.07) and model 4 below (RR=1.86, p=0.08). A protective relationship between service gaps and persons with low FPG was revealed, but the association is quite weak (RR=0.61, p=0.07) and doesn't appear in any other models.

Finally, among the added interaction terms, no correlation with the outcome was detected among stimulant users who also reported a past lapse in medical care. As stated in the above paragraph, stronger correlations were reported in models 2a and 4 above, but when stimulant user who reported a past lapse in medical care were highlighted no correlation was detected. Also, while it may appear that a robust

relationship exists between transgender stimulant users who report an almost 30 fold

increase in risk of reporting additional service gaps, (RR=30.87, p<0.001), this result

lacks precision (95% CI: 4.37-218.08) bringing its reliability into question.

Table 6.3.5: Factors Associated with Reporting Ancillary Service Gaps By Stimulant Use, Predisposing Characteristics, Enabling Resources & Rival Independent Variables with Interaction Terms among Substance Users; Poisson Model 4 (n=5,743)

Independent variables	RR (95% CI)	β (SE β)	p value
Focal Variable			
Stimulant Use			
Yes	1.69 (0.99-2.88)	0.52 (0.27)	*
No	referent	referent	
Predisposing Characteristics			
Age (10 yrs)	0.72 (0.59-0.88)	-0.03 (0.01)	***
Gender			
Female	1.47 (0.68-3.18)	0.39 (0.39)	
Transgender	0.77 (0.27-2.16)	-0.26 (0.52)	
Male	referent	referent	
Race/Ethnicity			
Latino	1.37 (0.81-2.33)	0.32 (0.27)	
African American	1.10 (0.66-1.83)	0.09 (0.26)	
Other/Mulit-Racial	0.82 (0.40-1.70)	-0.20 (0.37)	
White	referent	referent	
Sexual Orientation			
Homosexual/Gay/Lesbian	0.91 (0.51-1.61)	-0.10 (0.29)	
Bisexual	0.81 (0.51-1.29)	-0.21 (0.23)	
Heterosexual/Straight	referent	referent	
Education Completed			
Less than high school	0.52 (0.30-0.92)	-0.65 (0.28)	**
high school/GED	0.98 (0.68-1.40)	-0.02 (0.18)	
Greater than high school	referent	referent	
Language of Interview			
Spanish	0.97 (0.35-2.66)	-0.03 (0.51)	
English	referent	referent	
Lapse in medical care			
Yes	1.99 (1.02-3.91)	0.69 (0.34)	**
No	referent	referent	
Enabling Resources			
Travel Time to Doctors Office	1.02 (0.97-1.08)	0.00 (0.00)	
Employment Status			
Unemployed	1.14 (0.57-2.28)	0.13 (0.35)	
Retired/Disabled/Student	1.86 (0.93-3.72)	0.62 (0.35)	*
Employed (full/part-time)	referent	referent	
Current Mental Health Diagnosis			
Yes	1.19 (0.82-1.72)	0.17 (0.18)	
No	referent	referent	
Insurance Status			
Not Insured	1.37 (0.84-2.24)	0.31 (0.25)	
Insured	referent	referent	
FPG			
At or Below FPG	0.61 (0.36-1.05)	-0.49 (0.27)	*
Above FPG	referent	referent	

Mode of Transportation			
Public Transport	0.85 (0.53-1.38)	-0.16 (0.24)	
Private Car	referent	referent	
Residency Status			
Undocumented	0.50 (0.10-2.46)	-0.70 (0.80)	
Legal Resident	0.73 (0.46-1.15)	-0.32 (0.23)	
Not Reported	referent	referent	
Rival Independent Variables			
Incarceration Status			
Recently Incarcerated	1.26 (0.79-2.01)	0.23 (0.23)	
Not Recently Incarcerated	referent	referent	
Current Housing Status			
Homeless	2.13 (1.41-3.20)	0.75 (0.21)	****
Not Homeless	referent	referent	
Interaction Terms			
Stimulant use*Gender			
Female	1.58 (0.54-4.66)	0.46 (0.54)	
Transgender	30.87 (4.37-218.08)	3.43 (0.98)	***
Stimulant use*Lapse in medical care	0.55 (0.21-1.43)	-0.59 (0.48)	
Intercept (constant)	6.87 (1.57-30.19)	1.93 (0.74)	***
Model Statistics			
LR(χ^2)	397.30		****
df	27, 73		

*=p≤0.1, **=p≤0.05, ***=p≤0.01, ****=p≤0.001

Table 6.3.6 shows results when model 5 is stratified by barrier type (moderator). Upon stratification, the strength of the focal relationship was consistent with the crude analysis among persons reporting systems barriers (RR=1.62, p=0.03), but became much weaker for those who reported information barriers (RR=1.34, p=0.50). This signifies that stimulant users (compared to non-stimulant users) are experiencing structural barriers, as opposed to being unaware of their existence, when attempting to acquire needed services; a finding supported by the literature (Andersen et al., 2005; Rockett et al., 2005). Also, both stratified models were better fits for the data than the null.

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Overall, stronger correlations were reported among those reporting systems barriers, as opposed to information barriers among substance users. While some results were mixed, many results were replicated or those reporting systems barriers. First, the inverse relationship between age and increasing risk of reporting service gaps was replicated here and didn't vary substantially by barrier type (crude: RR=0.72, p=0.007; systems barriers: RR=0.67, p=0.001; information barriers: RR=0.75, p=0.04). This indicates that among youth, barrier type is not a strong factor in determining risk of reporting an additional service gap. This also holds true among substance using retired/disabled persons (crude: RR=1.86, p=0.08; systems barriers: RR=1.94, p=0.02; information barriers: RR=1.86, p=0.03).

It should be noted that homelessness was strongly associated with the outcome variable in the crude analysis (model 4: RR=2.13, p<0.001), but when stratified by barrier type no associations were reported (p>0.1 for both). This is a classic case of confounding, where stratification by a third variable causes a previously strong association to be eliminated (Rothman & Greenland, 1998). Substantial evidence has shown that HIV-infected homeless individuals experience high levels of barriers when attempting to obtain support services (Katz et al., 2000). Additionally, while it has been shown that a high numbers of barriers to care are linked to increased service gaps (Currie, Patterson, Moniruzzama, McCandless, Somers, 2014), it is less clear what types of barrier are involved (systems or informational). This evidence partially supports the finding presented here, that barrier type confounds the relationship between homelessness and an increased risk of reporting additional service gaps.

With respect to education, substance users who reported less than a high school education (<HS) were less likely to report additional service gaps in the crude analysis presented in model 4 (RR=0.52, p=0.02), a relationship that was replicated among those reporting systems barriers (RR=0.49, p=0.03) but was not present with those reporting

informational barriers (RR=0.76, p=0.53). Additionally, persons with a high school/GED education who reported information barriers had similar risk to those with <HS (RR=0.48, p=0.001), a result not found in the crude analysis (RR=0.98, p=0.90). Taken together, this indicates that systems barriers modify the relationship between education and risk of reporting additional service gaps.

With respect to lapse in medical care among this sample of substance users, a strong associated with the outcome was detected in the crude analysis (RR=1.99, p=0.05). Upon stratification no association was found (systems: RR=0.49, p=0.10; informational: RR=1.74, p=0.13), another case of possible confounding by the moderator. To further complicate this relationship, when an interaction term was introduced (stimulant users*past lapse in medical care) no association in the crude analysis was detected (RR=0.55, p=0.21), but upon stratification those reporting systems barriers experienced over a two and a half times greater risk (RR=2.66, p=0.01) of reporting an additional service gap, while information barrier respondents were unchanged from the null (RR=0.60, p=0.35). Taking all this evidence into account, it seems like the relationship between reporting a past lapse in medical care is confounded by barrier type unless you take stimulant use into account. Among stimulant users who report a past lapse in care, systems barriers seem to have a profound effect on the risk of reporting additional gaps.

Upon stratification many variables with no strong correlations in the crude analysis (model 4) became significant among those reporting systems barriers only. This included travel time to medical appointments (crude: RR=1.02, p=0.30; systems barriers: RR=1.13, p<0.001), being uninsured (crude: RR-1.37, p=0.21; systems barriers: RR=1.83, p=0.008), being unemployed (crude: RR=1.14, p=0.70; systems barriers: RR=3.61, p<0.001), being a legal resident (crude: RR=0.73; p=0.17; systems barriers: RR=1.59, p=0.02), identifying a Mulit/other racial group (crude: RR=0.82; p=0.59;

systems barriers: RR=0.33, p=0.006), and those using public transportation (crude: 0.85, p=0.51; systems barriers: RR=0.58, p=0.02). Results from information barriers varied very little from the crude analysis in all of the above results. Taken together, it indicates that among substance users, systems barrier are acting as a powerful effect modifier on the risk of reporting an additional service gap.

Few differences from the crude analysis were reported among respondents with information barriers. The only strong correlation reported was among recently incarcerated persons (crude: 1.26, p=0.32; information barriers: RR=2.22, p=0.02), a finding not found among those reporting systems barriers (RR=0.76, p=0.40). This indicates that barrier type is an effect modifier of the relationship between recent incarceration and risk of reporting additional service gaps, with those reporting information barriers being over twice the risk of reporting additional service gaps.

Table 6.3.6: Factors Associated with Reporting Ancillary Service Gaps Among Substance Users by All Reported Variables with Moderation by Barrier Type; Poisson Models 5a (n=2,592) & 5b (n=2,746)

Independent variables	5a: Systems Barriers			5b: Information Barriers		
	RR (95% CI)	β (SE β)	p value	RR (95% CI)	β (SE β)	p value
Focal Variable						
Stimulant Use						
Yes	1.62 (1.08-2.41)	0.48 (0.20)	**	1.34 (0.60-3.01)	0.29 (0.40)	
No	referent	referent		referent	referent	
Predisposing Characteristics						
Age (10 yrs)	0.67 (0.53-0.85)	-0.04 (0.01)	***	0.75 (0.57-0.99)	-0.03 (0.01)	**
Gender						
Female	--	--		1.29 (0.42-3.98)	0.25 (0.57)	
Transgender	1.91 (0.69-5.29)	0.65 (0.51)		2.97 (0.75-11.76)	1.09 (0.69)	
Male	referent	referent		referent	referent	
Race/Ethnicity						
Latino	1.49 (0.84-2.65)	0.40 (0.29)		1.72 (0.71-4.13)	0.54 (0.44)	
African American	1.38 (0.71-2.68)	0.33 (0.33)		0.66 (0.31-1.42)	-0.42 (0.39)	
Other/Mulit-Racial	0.33 (0.15-0.72)	-1.11 (0.40)	***	0.97 (0.52-1.82)	-0.03 (0.32)	
White	referent	referent		referent	referent	
Sexual Orientation						
Homosexual/Gay/Lesbian	1.31 (0.66-2.60)	0.27 (0.34)		0.74 (0.35-1.56)	-0.30 (0.38)	
Bisexual	1.15 (0.57-2.35)	0.14 (0.36)		0.96 (0.48-1.89)	-0.04 (0.34)	
Heterosexual/Straight	referent	referent		referent	referent	
Education Completed						
Less than high school	0.49 (0.25-0.94)	-0.72 (0.33)	**	0.76 (0.32-1.83)	-0.28 (0.44)	
high school/GED	0.48 (0.31-0.74)	-0.73 (0.22)	***	1.52 (0.81-2.87)	0.42 (0.32)	
Greater than high school	referent	referent		referent	referent	
Language of Interview						
Spanish	0.79 (0.38-1.63)	-0.24 (0.36)		--	--	
English	referent	referent		referent	referent	
Lapse in medical care						
Yes	0.49 (0.21-1.16)	-0.71 (0.43)	*	1.74 (0.84-3.59)	0.55 (0.36)	

No	referent	referent		referent	referent	

Enabling Resources						
Travel Time to Doctors Office	1.13 (1.00-1.20)	0.01 (0.00)	****	1.01 (0.94-1.08)	0.00 (0.00)	
Employment Status						
Unemployed	3.61 (1.84-7.10)	1.28 (0.34)	****	1.32 (0.75-2.35)	0.28 (0.29)	
Retired/Disabled/Student	1.94 (1.12-3.36)	0.66 (0.28)	**	1.86 (1.04-3.33)	0.62 (0.29)	**
Employed (full/part-time)	referent	referent		referent	referent	
Current Mental Health Diagnosis						
Yes	1.33 (0.81-1.63)	0.28 (0.25)		1.28 (0.79-2.06)	0.24 (0.24)	
No	referent	referent		referent	referent	
Insurance Status						
Not Insured	1.83 (1.17-2.86)	0.60 (0.22)	***	1.14 (0.66-1.97)	0.13 (0.28)	
Insured	referent	referent		referent	referent	
FPG						
At or Below FPG	1.36 (0.91-2.01)	0.30 (0.20)		0.54 (0.29-1.01)	-0.61 (0.31)	*
Above FPG	referent	referent		referent	referent	
Mode of Transportation						
Public Transport	0.58 (0.36-0.91)	-0.55 (0.23)	**	0.98 (0.65-1.48)	-0.02 (0.21)	
Private Car	referent	referent		referent	referent	
Residency Status						
Undocumented	1.09 (0.22-5.50)	0.09 (0.81)		--	--	
Legal Resident	1.59 (1.08-2.33)	0.46 (0.19)	**	0.55 (0.11-2.69)	-0.60 (0.80)	*
Not Reported	referent	referent		referent	referent	
Rival Independent Variables						
Incarceration Status						
Recently Incarcerated	0.76 (0.41-1.43)	-0.27 (0.32)		2.22 (1.16-4.25)	0.80 (0.33)	**
Not Recently Incarcerated	referent	referent		referent	referent	
Current Housing Status						
Homeless	1.09 (0.65-1.83)	0.09 (0.26)		1.07 (0.56-2.06)	0.07 (0.33)	
Not Homeless	referent	referent		referent	referent	
Interaction Terms						
Stimulant use*Gender						
Female	--	--		1.40 (0.41-4.78)	0.33 (0.62)	

Transgender	1.88 (0.36-9.80)	0.63 (0.83)		--	--	
Stimulant use*Lapse in medical care	2.66 (1.25-5.63)	0.98 (0.38)	**	0.60 (0.20-1.78)	-0.50 (0.54)	
Intercept (constant)	3.13 (1.09-8.96)	1.14 (0.53)	**	12.26 (2.18-68.92)	2.51 (0.87)	***
Model Statistics						
LR(χ^2)	139.01		****	154.72		*****
df	24, 73			24, 73		

*=p≤0.1, **=p≤0.05, ***=p≤0.01, ****=p≤0.001

SECTION SUMMARY

The above Poisson regression models were attempting to better understand the relationship between methamphetamine use and risk of reporting an additional service gap among a sample of substance using Ryan White (RW) recipients in Los Angeles County. Among this subset of RW recipients, stimulant use was consistently associated with an increased risk of reporting an additional service gap throught a series of nested regression models, with RR ranging from 1.54 to 1.75 (p value range: 0.02-0.06; 95% CI range: 0.99-2.88) over five models. These narrow ranges suggest that even with the addition of competing variables, the strength of this relationship is strong and its precision is sufficiently accurate to support these findings. Overall, these results support the overall hypothesis presented, that among a sample of substance users, those reporting stimulant use are about 50-75% more likely to report an additional service gaps. Also, this group is more likely to experience these service gaps because of reported system related barriers, and not due to a lack of information about available services. Literature has shown that stimulant use (primarily methamphetamine) can affect a variety of behaviors related to HIV risk and disease progression. This includes adherence to emergency PEP (post-exposure prophylaxis) treatment (Landovitz et al., 2012), sexual risk taking among HIV-infected men how have sex with men (Semple et al., 2006 a,b) and adherence to both antiretroviral medications (Carrico et al., 2011). This is the first such investigation to find that stimulant users are also at an increased risk for obtaining needed support services.

Some findings were inconsistent between models (e.g., employment status, lapse in medical care and gender). For example, a robust correlation between female gender and increased service gap risk was replicated until model 4, where the addition of interaction terms reduced the correlation from quite strong (model 3: RR=2.82, p<0.001) to weak (model 4: RR=1.47, p=0.32). Little research investigating factors

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affecting female stimulant users and support services exists. What has been reported is mixed, with female substance users reporting poorer quality of HIV care than their male counterparts (Korthuis et al., 2012) in some studies.

Some results seemed counterintuitive, such as the relationship between educational attainment and service gaps. Overall, the lower a person's educational level the lower their risk of reporting additional service gaps. When stratified by barrier type, this relationship became even more pronounced among system barriers respondents. This indicates that substance users with higher education may be experiencing more service gaps because they are encountering systemic barriers. Educational attainment has sometimes used as a proxy for socioeconomic status (Braverman et al., 2005). Lower SES has been linked to poor disease outcomes among HIV-infected persons generally (Cunningham et al., 2005), and among HIV-infected substance users specifically, lower SES has been associated with fewer services and poor treatment outcomes (Burnman et al., 2001). Although Burnman et al (2001) was only focused on substance abuse and mental health services, and didn't take into account other types of ancillary care.

Links between education level and service utilization are poorly described in the literature, and nothing specifically looking at substance users exists. In this sample though results based on educational attainment are not consistent with the currently literate on SES and service utilization. An explanation for this inconsistency is that educational attainment isn't a good proxy measure for SES in this sample. Table 5.3 indicates that education has low correlations with other measures of SES obtained from participants: FPG (r=0.19) and employment (r=-0.03). When separated from these other measures of SES, these results seem to indicate that substance using persons with higher education may have more difficulty navigating the RW system of care, but this conclusion needs to be independently substantiated.

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Other important results to highlight are the inverse relationships between age and risk of reporting additional service gaps was consistently upheld across all models (range RR=0.72-0.75). When stratification by barrier type, these results changed very little (systems barriers=0.67, information=0.75), indicating that even among a sample of substance users, younger persons are at a greater risk of reporting additional service gaps compared to older substance users, and stratification by barrier type has little effect on this relationship. As previously discussed, age is an important risk factor among both the HIV-infected and substance users, and has been used to predict poor service utilization among both groups (Shapiro et al, 1999a; Chan et al., 2002; Ashman et al, 2002). This is the first such instance to show it can be applied to substance using HIV-infected persons specifically.

Number of Substances Used

As described earlier, this set of analyses investigates how the number of reported different types of substances used affects the number of reported service gaps among a sample of HIV-infected substance users. Table 6.3.7 shows the unadjusted risk of reporting a one-unit increase the number service gaps by a one-unit increase in the number of substances reported using, accompanied by the β and p value. Results indicate that for an additional increase in the number of classes of substances used (herein known as *number used*) there is a 43% increased risk of reporting an additional service gap. Put another way, increased number of drug use is positively correlated with an increased risk of reporting additional service gaps. Also, $LR(\chi^2)$ indicates that the variables in the model are associated with the outcome of interest and a better fit than the null (no association) and that further analysis is warranted.

Table 6.3.7: Unadjusted Risk of Reporting Ancillary Service Gaps By Number of Substances used among Substance Users; Poisson Model 1 (n=5,743)

Independent Variable	RR (95% CI)	β (SE β)	p value
Focal Variable			
Number used	1.43 (1.15-1.77)	0.36 (0.11)	***
Intercept	2.82 (1.94-4.09)	1.04 (0.10)	****
Model Statistics			
$LR(\chi^2)$		172.56	****
df		1, 73	

*=p≤0.1, **=p≤0.05, ***=p≤0.01, ****=p≤0.001

Table 6.3.8 below displays the second Poisson regression model in this analysis (model 2a), containing the primary focal relationship as well as predisposing characteristics. When these factors were included there was no substantial change in strength of the focal relationship (RR=1.48, p<0.001). Indicating that the addition of these variables had little effect on the focal relationship. Also, the overall fit of the model did decrease somewhat it still outperformed the null.

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Among predisposing variables, the strongest correlation was detected for those reporting a past lapse in medical care (RR=1.95, p=0.006), who reported almost twice the risk of additional service gap compared to respondents who never experienced a service gap. Also, as reported in previous analyses, an inverse relationship between level of educational attainment and risk was reported (RR=0.52, p=0.03), with lower education being protective compared to those with some advanced education. Weaker correlations were reported for women (RR=1.92, p=0.07), and with age (RR=0.83, p=0.08).

Table 6.3.8: Factors Associated with Reporting Ancillary Service Gaps By Number of Substances Used & Predisposing Characteristics among Substance Users; Poisson Model 2a (n=5,743)

Independent variables	RR (95% CI)	β (SE β)	p value
Focal Variable			
Number used	1.48 (1.18-1.85)	0.39 (0.11)	****
Predisposing Characteristics			
Age (10 yrs)	0.83 (0.67-1.02)	-0.02 (0.01)	*
Gender			
Female	1.92 (0.95-3.88)	0.65 (0.35)	*
Transgender	1.15 (0.51-2.57)	0.14 (0.41)	
Male	referent	referent	
Race/Ethnicity			
Latino	1.32 (0.85-2.05)	0.28 (0.22)	
African American	1.07 (0.61-1.89)	0.07 (0.28)	
Other/Mulit-Racial	0.80 (0.30-2.15)	-0.23 (0.50)	
White	referent	referent	
Sexual Orientation			
Homosexual/Gay/Lesbian	0.69 (0.44-1.10)	-0.37 (0.23)	
Bisexual	0.92 (0.55-1.54)	-0.08 (0.26)	
Heterosexual/Straight	referent	referent	
Education Completed			
Less than high school	0.52 (0.29-0.94)	-0.65 (0.29)	**
high school/GED	0.72 (0.46-1.12)	-0.33 (0.22)	
Greater than high school	referent	referent	
Language of Interview			
Spanish	1.66 (0.78-3.55)	0.51 (0.38)	
English	referent	referent	
Lapse in medical care			
Yes	1.95 (1.22-3.10)	0.67 (0.23)	***
No	referent	referent	
Intercept (constant)	6.02 (1.88-19.22)	1.79 (0.58)	***
Model Statistics			
LR(χ^2)	75.02		****
df	14, 73		

*=p≤0.1, **=p≤0.05, ***=p≤0.01, ****=p≤0.001

Table 6.3.9 shows the third Poisson regression model in this analysis (model 2b), which containing the primary focal relationship as well as predisposing characteristics and enabling resources. The addition of enabling resources did increase the risk by about 5% (model 2a: RR=1.48, p<0.001; model 2b: RR=1.56, p<0.001), with no change to the strength of the correlation detected. This indicates that none of these added variable is exerting an effect on the focal relationship.

With the addition of enabling resources age was unaffected, while correlations for those reporting female gender, lapse in medical care and lower education level were all strengthened. Risk for females almost doubled (97%) between models (model 2a: RR=1.92, p=0.07; model 2b: RR=3.79, p<0.001). Increases in risk were noted among those reporting a past lapse in medical care (10%) and less than high school education (8%), but not as dramatic as what was reported for females.

Among the newly added enabling characteristics, increased risk was reported by persons who were retired/disabled (RR=2.12, p=0.04) and the uninsured (RR=1.80, p=0.002). Protective relationships were reported persons identifying as legal residents (RR=0.69, p=0.10) and persons living at or below the FPG (RR=0.60, p=0.04). Some relationships were either quite weak (legal residents) or only marginally correlated (FPG, disabled/retired), so additional data may reveal the true nature of these relationships once other factor are controlled for.

Table 6.3.9: Factors Associated with Reporting Ancillary Service Gaps By Number of Substances Used, Predisposing Characteristics & Enabling Resources among Substance Users; Poisson Model 2b (n=5,743)

Independent variables	RR (95% CI)	β (SE β)	p value
Focal Variable			
Number used	1.56 (1.31-1.87)	0.45 (0.09)	****
Predisposing Characteristics			
Age (10 yrs)	0.81 (0.66-1.00)	-0.02 (0.01)	*
Gender			
Female	3.79 (2.39-6.00)	1.33 (0.23)	****
Transgender	1.18 (0.52-2.67)	0.17 (0.41)	
Male	referent	referent	
Race/Ethnicity			
Latino	1.32 (0.80-2.18)	0.28 (0.25)	
African American	1.02 (0.63-1.67)	0.02 (0.24)	
Other/Mulit-Racial	1.01 (0.56-1.82)	0.01 (0.30)	
White	referent	referent	
Sexual Orientation			
Homosexual/Gay/Lesbian	0.71 (0.45-1.13)	-0.34 (0.23)	
Bisexual	0.86 (0.56-1.32)	-0.11 (0.21)	
Heterosexual/Straight	referent	referent	
Education Completed			
Less than high school	0.56 (0.35-0.89)	-0.58 (0.23)	***
high school/GED	0.93 (0.65-1.33)	-0.07 (0.18)	
Greater than high school	referent	referent	
Language of Interview			
Spanish	1.83 (0.69-4.85)	0.60 (0.49)	
English	referent	referent	
Lapse in medical care			
Yes	2.14 (1.16-3.97)	0.43 (0.20)	**
No	referent	referent	
Enabling Resources			
Travel Time to Doctors Office	1.02 (0.97-1.07)	0.00 (0.00)	
Employment Status			
Unemployed	1.44 (0.72-2.88)	0.36 (0.35)	
Retired/Disabled/Student	2.12 (1.05-4.28)	0.75 (0.35)	**
Employed (full/part-time)	referent	referent	
Current Mental Health Diagnosis			
Yes	1.23 (0.89-1.72)	0.21 (0.17)	
No	referent	referent	
Insurance Status			
Not Insured	1.80 (1.23-2.63)	0.59 (0.19)	***
Insured	referent	referent	
FPG			
At or Below FPG	0.60 (0.36-0.99)	-0.52 (0.25)	**
Above FPG	referent	referent	
Mode of Transportation			
Public Transport	1.06 (0.65-1.74)	0.06 (0.25)	
Private Car	referent	referent	

Residency Status			
Undocumented	1.02 (0.28-3.68)	0.02 (0.65)	
Legal Resident	0.69 (0.45-1.07)	-0.36 (0.22)	*
Not Reported	referent	referent	
Intercept (constant)	2.76 (0.68-11.28)	1.02 (0.71)	
Model Statistics			
LR(χ^2)	136.72		****
df	23, 73		

*=p≤0.1, **=p≤0.05, ***=p≤0.01, ****=p≤0.001

Table 6.3.10 shows the fourth Poisson regression model in this analysis (model 3), which contains the focal relationship, predisposing characteristics, enabling resources and the two rival independent variables. The strength of the focal relationship remained unchanged from the previous model (RR=1.50, p<0.001), indicating that the relationship between number of substances used and an increased number of service gaps continues to be robust even in the presence of rival independent variables. Additionally the overall fit of the model (LR(χ^2)=138.70) compared to the null changed very little from the previous model 2b (LR(χ^2)=136.72), this indicates that the addition of rival independent variables had very little effect on the overall explanatory value of the model.

Additionally, the addition of rival independent variables had little effect on many of the previously stated results. Slight decreases were observed in the risk of the relationships between female gender (9% decrease); age, living at or below FPG and less than HS education (2% decreases); employment status as retired/disables and legal residents (1% decreased).

Larger decreases in risk were observed based on insurance status and past lapse in medical care. A 10% decrease in risk was observed for individuals who were uninsured (Model 2b: RR=2.14, p=0.04; Model 3: RR=1.48, p=0.06). Also, the risk, as well as the overall correlation strength, of reporting an additional service gap decreased by 45% (Model 2b: RR=1.80, 0.002; Model 3: RR=1.63, p=0.03) for persons who

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reported a past lapse in medical care. Indicating that a portion of this effect may be accounted for by one of the rival independent variables added. Neither housing or incarcerations status were meaningfully associated with an increased risk of reporting an additional service gap, but their addition did seem to have an overall depressive effect on, except for the focal relationship.

Table 6.3.10: Factors Associated with Reporting Ancillary Service Gaps By Number of Substances Used, Predisposing Characteristics, Enabling Resources & Rival Independent Variables among Substance Users, Poisson Model 3 (n=5,743)

Independent variables	RR (95% CI)	β (SE β)	p value
Focal Variable			
Number used	1.50 (1.25-1.79)	0.40 (0.09)	****
Predisposing Characteristics			
Age (10 yrs)	0.79 (0.64-0.99)	-0.02 (0.01)	**
Gender			
Female	3.44 (2.12-5.58)	1.23 (0.24)	****
Transgender	1.26 (0.59-2.70)	0.23 (0.38)	
Male	referent	referent	
Race/Ethnicity			
Latino	1.41 (0.85-2.34)	0.34 (0.25)	
African American	1.12 (0.66-1.91)	0.12 (0.27)	
Other/Mulit-Racial	1.05 (0.53-2.09)	0.05 (0.34)	
White	referent	referent	
Sexual Orientation			
Homosexual/Gay/Lesbian	0.82 (0.50-1.36)	-0.20 (0.25)	
Bisexual	0.88 (0.58-1.35)	-0.13 (0.21)	
Heterosexual/Straight	referent	referent	
Education Completed			
Less than high school	0.57 (0.37-0.89)	-0.55 (0.22)	**
high school/GED	0.96 (0.68-1.35)	-0.04 (0.17)	
Greater than high school	referent	referent	
Language of Interview			
Spanish	1.77 (0.66-4.72)	0.57 (0.49)	
English	referent	referent	
Lapse in medical care			
Yes	1.48 (0.98-2.23)	0.39 (0.21)	*
No	referent	referent	
Enabling Resources			
Travel Time to Doctors Office	1.03 (0.97-1.08)	0.00 (0.00)	
Employment Status			
Unemployed	1.36 (0.66-2.82)	0.31 (0.36)	
Retired/Disabled/Student	2.10 (1.02-4.32)	0.74 (0.36)	**
Employed (full/part-time)	referent	referent	
Current Mental Health Diagnosis			
Yes	1.25 (0.90-1.74)	0.22 (0.17)	
No	referent	referent	
Insurance Status			
Not Insured	1.63 (1.07-2.50)	0.49 (0.21)	**
Insured	referent	referent	
FPG			
At or Below FPG	0.61 (0.37-0.99)	-0.50 (0.25)	**
Above FPG	referent	referent	
Mode of Transportation			
Public Transport	0.99 (0.59-1.66)	-0.01 (0.26)	

Private Car	referent	referent	
Residency Status			
Undocumented	1.17 (0.33-4.12)	1.27 (0.55)	
Legal Resident	0.70 (0.45-1.09)	-0.35 (0.22)	
Not Reported	referent	referent	
Rival Independent Variables			
Incarceration Status			
Recently Incarcerated	1.19 (0.77-1.82)	0.17 (0.21)	
Not Recently Incarcerated	referent	referent	
Current Housing Status			
Homeless	1.26 (0.92-1.74)	0.23 (0.16)	
Not Homeless	referent	referent	
Intercept (constant)	2.89 (0.70-11.85)	1.06 (0.71)	
Model Statistics			
LR(χ^2)	138.70		****
df	25, 73		

*=p≤0.1, **=p≤0.05, ***=p≤0.01, ****=p≤0.001

Table 6.3.11 shows the fifth, and final, Poisson regression analysis (model 4), which contains all variables of interest (focal relationship, predisposing characteristics, enabling resources and rival independent variables) along with two important interaction terms (number of substances used interacted with housing status and reported lapse in medical care). The interaction term for past lapse in medical care was generated as this variable was strongly associated with the outcome throughout all iterations of this model and its relationships with the number used variable should be further explored. Although homelessness was not strongly associated with the outcome, there is a strong correlation between homelessness and substance use (White House, 2010a, b). For this reason investigating the interaction between homelessness and number of substances use was explored.

Note that unlike previous models the strength of the focal relationship decreased somewhat (12%) with the addition of the interaction terms (model 4: RR=1.32, p=0.02; model 3: RR=1.50, p<0.001), but no real change in the overall strength of the association was observed. No change in the overall explanatory value of the model compared to the null was observed either.

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As with previous models, the introduction of interaction terms had the effect of decreasing both the risk and overall correlative strength of previously reported variables. The risk for women reporting additional gaps decreased by 19% from model 3 above, and 27% overall from model 2b (range of risks reported: 2.78-3.79). The same trend can be found among those who were retired/disabled, where risk between models 3 and 4 decreased by 12%, and 13% overall from model 2b (range of risk reported: 1.84-2.12). Also, between models 3 and 4 both the risk and overall strength of the correlation for FPG, insurance status and lapse in medical care decreased considerably, to the point were these variables would not be considered significantly correlated with the outcome based on their p-values (both >0.1). The only unchanged variable was the protective relationship between lower education (<HS).

For those reporting a past lapse in medical care a moderate increase in risk was reported in previous models (model 2a: RR=1.95, model 2b: RR=2.14 model 3: RR=1.48). Among these persons, once the number of substances used was taken into account (with the interaction term) those who reported a past lapse in care had a 34% increased risk of reporting an additional service gap with each additional class of illicit substance they reported using (RR=1.34, p=0.07). This indicates that among persons reporting a past lapse in medical care, the number of substances used has a strong effect on increased risk. This finding is partially supported by the literature, as substance use generally has been linked to poor retention in care, this is the first such investigation to show the effects of the number of substances used on social service utilization.

Table 6.3.11: Factors Associated with Reporting Ancillary Service Gaps By Number of Substances Used, Predisposing Characteristics, Enabling Resources & Rival Independent Variables with Interaction Terms among Substance Users; Poisson Model 4 (n=5,743)

Independent variables	RR (95% CI)	β (SE β)	p value
Focal Variable			
Number used	1.32 (1.05-1.65)	0.27 (0.11)	**
Predisposing Characteristics			
Age (10 yrs)	0.77 (0.60-1.00)	-0.02 (0.01)	*
Gender			
Female	2.78 (1.63-4.74)	1.02 (0.27)	****
Transgender	1.13 (0.47-2.71)	0.12 (0.44)	
Male	referent	referent	
Race/Ethnicity			
Latino	1.55 (0.93-2.60)	0.44 (0.26)	
African American	1.15 (0.67-1.98)	0.14 (0.27)	
Other/Mulit-Racial	1.29 (0.66-2.55)	0.26 (0.34)	
White	referent	referent	
Sexual Orientation			
Homosexual/Gay/Lesbian	0.76 (0.45-1.29)	-0.27 (0.26)	
Bisexual	0.93 (0.60-1.44)	-0.07 (0.22)	
Heterosexual/Straight	referent	referent	
Education Completed			
Less than high school	0.61 (0.39-0.94)	-0.50 (0.22)	**
high school/GED	1.01 (0.70-1.43)	0.01 (0.18)	
Greater than high school	referent	referent	
Language of Interview			
Spanish	1.52 (0.57-4.05)	0.42 (0.49)	
English	referent	referent	
Lapse in medical care			
Yes	0.93 (0.48-1.80)	-0.08 (0.33)	
No	referent	referent	
Enabling Resources			
Travel Time to Doctors Office	1.02 (0.97-1.08)	0.00 (0.00)	
Employment Status			
Unemployed	1.27 (0.65-2.49)	0.24 (0.34)	
Retired/Disabled/Student	1.84 (0.92-3.66)	0.61 (0.35)	*
Employed (full/part-time)	referent	referent	
Current Mental Health Diagnosis			
Yes	1.07 (0.54-2.13)	0.07 (0.34)	
No	referent	referent	
Insurance Status			
Not Insured	1.47 (0.92-2.36)	0.39 (0.24)	
Insured	referent	referent	
FPG			
At or Below FPG	0.69 (0.40-1.19)	-0.37 (0.27)	
Above FPG	referent	referent	
Mode of Transportation			
Public Transport	0.92 (0.55-1.56)	-0.08 (0.26)	

Private Car	referent	referent	
Residency Status			
Undocumented	0.87 (0.23-3.24)	-0.14 (0.66)	
Legal Resident	0.69 (0.47-1.03)	-0.36 (0.20)	*
Not Reported	referent	referent	
Rival Independent Variables			
Incarceration Status			
Recently Incarcerated	1.10 (0.68-1.78)	0.10 (0.24)	
Not Recently Incarcerated	referent	referent	
Current Housing Status			
Homeless	0.78 (0.30-2.01)	-0.25 (0.48)	
Not Homeless	referent	referent	
Interaction Terms			
Number used*Lapse in medical care	1.34 (0.98-1.83)	0.29 (0.16)	*
Number used*Homelessness	1.20 (0.81-1.78)	0.18 (0.20)	
Intercept (constant)	4.03 (0.98-16.56)	1.39 (0.71)	*
Model Statistics			
LR(χ^2)	1.89.12		****
df	28, 73		

*=p≤0.1, **=p≤0.05, ***=p≤0.01, ****=p≤0.001

Table 6.3.12 shows the stratified full model (model 5) presented above. As described earlier, stratification is based on reported barrier type (moderator). While the risk of the focal relationship decreased somewhat when stratified results were split. It remained strong (RR=1.24, p<0.001) among those who reported systems barriers, but correlation was revealed for those with information barriers (RR=1.05, p=0.85). Based on available results, while in the presence of a moderator, no real association between the number of substances used and increased risk for reporting additional service gaps exists among substance users reporting information barriers. Conversely, substance users reporting majority systems barriers are at a 24% increased risk of reporting an additional service gap for each additional incremental increase in the number of substances used. This indicates that among substance users, as the number of substance use increases the major reason these individuals are unable to obtain needed services has little to do with a lack of information, but may be drive by systems barriers they are experiencing.

With respect to other variables of interest, stronger correlations were reported among persons with systems barriers, as opposed to information barriers. Also, some variables where the correlation fluctuated between models were strongly associated with the outcome when stratified. An example of this includes insurance status. In models 2b and 3 uninsured persons reported increased risks of 80% and 63% respectively, with strong correlations with the outcome ($p<0.05$ for both). When interaction terms were added this dropped substantially (model 4: RR=1.47, $p>0.1$). Upon stratification, risk increased 44% from the crude among those reporting systems barriers (RR=2.12, $p<0.001$), but was not reported for those with information barriers (RR=1.21, $p=0.49$). This suggests that barrier type is an effect modifier of the relationships between insurance status and likelihood of reporting an additional service gap. It also suggests that substance users who are uninsured are more likely to face systems barriers when attempting to obtain needed services.

Further evidence of such a complex relationship can be found among those reporting a previous lapse in medical care. The decreasing strength of the correlation between lapse in medical care and risk of reporting additional service gaps was stated previously. In model 4 (crude analysis) no strong correlation was reported except with respect to its interaction with the number of substances used. As with the crude analysis, upon stratification, barrier type had no real moderating effect on the strength of this relationship except when the interaction term was taken into account. Among those reporting systems barriers, there was a 29% increased risk of reporting an additional service gap with each one-unit increase in the number of substances used (RR=1.29, $p<0.001$), no such increased risk was reported among those with information barriers (RR=1.48, $p=0.45$). These results suggest that among substance users, reporting both a past lapse in medical care and increased use have greater risks of reporting additional service gaps. Also, barrier type is acting as an effect modifier of this relationship.

Another example of effect modification by barrier type can be found among those reporting recent incarceration. While no measurable increased risk was reported in any previous models (model 3: RR=1.19, p=0.43; model 4=1.10, p=0.69). Upon stratification a protective relationship was revealed among those reporting systems barriers (RR=0.65, p=0.008), while an increased risk was revealed for those reporting information barriers (RR=1.87, p=0.04). Indicating that barrier type has a moderating effect on the likelihood recently incarcerated substance users will report service gaps. This is a good example of what has been referred to as a crossover effect, where the effects of the moderator reveal opposing risks by strata; it could also explain why no crude effect was found (Aneshensel, 2013). This finding is interesting as it is both supported and refuted by current literature. Research on incarcerated HIV-infected persons (regardless of substance use) cites both systems and information barriers as reasons these individuals are unable to get clinical care (Wakeman et al., 2009; Harzke et al., 2006). This is the first such analysis to actually show a split in the likelihood of reporting other social service gaps based on the type of barrier experienced.

In previous models persons with increased age and lower educational attainment (<HS) had lower risk of reporting additional service gaps, relationships that were upheld for those reporting systems barriers (age: RR=0.89, p=0.01; below HS education: RR=0.76, p=0.01), but not for information barriers (age: RR=0.93, p=0.66; below HS education: RR=1.33, p=0.56). Again, pointing to the robust role systems barriers play in obtaining in obtaining needed services among substance users.

Also, among substance using respondents reporting systems barriers, many variables where no measurable associations was reported in previous iterations of the analysis generated quite robust relationships upon stratification. This included increased risks for reporting additional service gaps among those with longer travel times to doctors appointments (RR=1.09, p<0.001), Latino(a)s (RR=1.73, p<0.001), African

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Americans (RR=2.06, p<0001) and unemployed persons (RR=2.80, p<0.001).

Interestingly, decreased risks were reported among persons of mixed race (RR=0.55, p=0.02), those identifying as homosexual (RR=0.76, p<0.001) or bisexual (RR=0.68, p=0.02) and persons relying on public transportation (RR=0.78, p=0.03). None of these factors were correlated with the outcome among persons with information barriers. These findings are good examples of suppression.

Another example of suppression revealed by stratification includes the observation that homeless substance users who reported increased number of substances used, a variable with no association with the outcome in previous models, displayed increased risks within both strata of the moderator: systems barriers: RR=1.82, p=0.001; information barriers: RR=2.41, p=0.003. This indicates that homeless substance users who reported an increased numbers of substances used also experience multiple types of barrier to obtaining needed services compared to those who used fewer substances.

Table 6.3.12: Factors Associated with Reporting Ancillary Service Gaps Among Substance Users by All Reported Variables with Moderation by Barrier Type; Poisson Models 5a (n=2,592) & 5b (n=2,746)

Independent variables	5a: Systems Barriers			Model 5b: Information Barriers		
	RR (95% CI)	β (SE β)	p value	RR (95% CI)	β (SE β)	p value
Focal Variable						
Number used	1.24 (1.14-1.35)	0.22 (0.04)	****	1.05 (0.64-1.71)	0.05 (0.25)	
Predisposing Characteristics						
Age (10 yrs)	0.83 (0.72-0.96)	-0.02 (0.01)	**	0.93 (0.69-1.26)	-0.01 (0.02)	
Gender						
Female	--	--		1.55 (0.71-3.36)	0.44 (0.39)	
Transgender	1.03 (0.74-1.43)	0.03 (0.16)		6.48 (1.48-28.41)	1.87 (0.74)	**
Male	referent	referent		referent	referent	
Race/Ethnicity						
Latino	1.73 (1.34-2.23)	0.55 (0.13)	****	1.96 (0.78-4.97)	0.67 (0.47)	
African American	2.06 (1.40-3.04)	0.72 (0.19)	****	0.67 (0.34-1.32)	-0.40 (0.34)	
Other/Mulit-Racial	0.55 (0.34-0.89)	-0.60 (0.24)	**	1.43 (0.69-2.94)	0.35 (0.36)	
White	referent	referent		referent	referent	
Sexual Orientation						
Homosexual/Gay/Lesbian	0.52 (0.39-0.70)	-0.65 (0.14)	****	0.80 (0.39-1.64)	-0.22 (0.36)	
Bisexual	0.68 (0.50-0.94)	-0.38 (0.16)	**	1.40 (0.70-2.82)	0.34 (0.35)	
Heterosexual/Straight	referent	referent		referent	referent	
Education Completed						
Less than high school	0.76 (0.62-0.95)	-0.27 (0.11)	**	1.33 (0.50-2.82)	0.29 (0.49)	
high school/GED	0.68 (0.53-0.88)	-0.38 (0.13)	****	2.01 (1.05-3.85)	0.70 (0.32)	**
Greater than high school	referent	referent		referent	referent	
Language of Interview						
Spanish	1.26 (0.89-1.78)	0.23 (0.17)		--	--	
English	referent	referent		referent	referent	
Lapse in medical care						
Yes	0.78 (0.54-1.11)	-0.25 (0.18)		1.48 (0.53-4.18)	0.39 (0.52)	
No	referent	referent		referent	referent	
Enabling Resources						
Travel Time to Doctors Office	1.09 (1.06-1.13)	0.01 (0.00)	****	1.03 (0.97-1.09)	0.00 (0.00)	

	OR (CI)	B (SE)		OR (CI)	B (SE)	
Employment Status						
Unemployed	2.80 (1.98-3.95)	1.03 (0.17)	****	1.07 (0.67-1.69)	0.06 (0.23)	
Retired/Disabled/Student	1.19 (0.86-1.64)	0.17 (0.16)		1.26 (0.69-2.30)	0.23 (0.30)	
Employed (full/part-time)	referent	referent		referent	referent	
Current Mental Health Diagnosis						
Yes	0.77 (0.38-1.56)	-0.26 (0.35)		1.43 (0.50-4.07)	0.36 (0.53)	
No	referent	referent		referent	referent	
Insurance Status						
Not Insured	2.12 (1.67-2.70)	0.75 (0.12)	****	1.21 (0.70-2.10)	0.19 (0.28)	
Insured	referent	referent		referent	referent	
FPG						
At or Below FPG	1.00 (0.76-1.33)	0.00 (0.14)		0.65 (0.35-1.21)	-0.43 (0.31)	
Above FPG	referent	referent		referent	referent	
Mode of Transportation						
Public Transport	0.78 (0.62-0.97)	-0.25 (0.11)	**	1.00 (0.62-1.61)	0.00 (0.24)	
Private Car	referent	referent		referent	referent	
Residency Status						
Undocumented	0.56 (0.30-1.05)	-0.58 (0.32)		--	--	
Legal Resident	0.96 (0.76-1.20)	-0.04 (0.12)		0.47 (0.27-0.81)	-0.76 (0.28)	**
Not Reported	referent	referent		referent	referent	
Rival Independent Variables						
Incarceration Status						
Recently Incarcerated	0.65 (0.47-0.89)	-0.43 (0.16)	**	1.87 (1.04-3.36)	0.62 (0.30)	**
Not Recently Incarcerated	referent	referent		referent	referent	
Current Housing Status						
Homeless	0.16 (0.07-0.38)	-1.84 (0.44)	****	0.20 (0.06-0.67)	-1.63 (0.62)	***
Not Homeless	referent	referent		referent	referent	
Interaction Terms						
Number used*Lapse in medical care	1.29 (1.13-1.47)	0.26 (0.07)	****	0.79 (0.41-1.53)	-0.23 (0.33)	
Number used*Homelessness	1.82 (1.28-2.58)	0.60 (0.24)	***	2.41 (1.37-4.24)	0.86 (0.28)	***
Intercept (constant)	2.46 (1.40-4.32)	0.90 (0.28)	***	4.02 (0.50-32.58)	1.39 (1.05)	
Model Statistics						
LR(χ^2)	112029.01		****	2914.51		****

	df	26, 73	26, 73

*=p≤0.1, **=p≤0.05, ***=p≤0.01, ****=p≤0.001

SECTION SUMMARY

The above Poisson regression models were designed to better understand the relationship between the number of different substances using in the past 6 months and service gaps among a sample of substance using Ryan White (RW) recipients in Los Angeles County. Among this subset of RW recipients, increased numbers of substances use was consistently associated with an increased risk of reporting an additional service gap through a series of nested regression models, with RR's ranging from 1.32 to 1.56 (95% CI range: 1.05-1.87) over five models. These narrow ranges suggests that even with the addition of competing variables, the strength of this relationship is strong and influenced little by potential confounding and rival explanatory variables.

Upon stratification, risk was strongly associated among substance users with increasing use who also reported systems barriers (RR=1.24, p<0.001), but was eliminated among those reporting information barriers (RR=1.05, p=0.85). Interpretation of such situations is complicated. Since both stratum are substantially different from each other and lower than the crude analysis presented in model 4 (RR=1.32, p=0.020), both confounding by barrier type and effect modification may be taking place simultaneously. Although the difference between the crude estimate and those reporting systems barriers is only 6%, lower than the traditional 10% cutoff generally used to interpret the presence of confounding. With respect to information barriers, a 20% reduction is present, but a very weak relationship is present. Also, the confounding relationship may be difficult to conceptualize given available data. Figure 3.1 below describes these issues in detail.

Figure 6.1: Crude vs. Confounded Relationship between Number of Substances Used and Service Gaps

Crude   Confounded

Barrier Type

Intensity   a   Service   Intensity   a'   Service
of use   Gaps   of use   Gaps

According to figure 6.1 above, evidence revealed by this analysis (as well as the literature) does support the concept that type and number of substance use is independently associated (through *a* and *a'*) with reporting service gaps (Ashman et al., 2002; Chan et al., 2002). Less evidence outside of this report exists to suggest the independent influence of barrier type on either the number of substances used (through *b*) or service gaps (through *c*). Additionally, the fact that systems barriers yielded a slightly depressed but still significant association with the outcome, but that information barriers did not, indicates that this confounding effect may be disproportionate. Perhaps substance users reporting information barriers are a unique subset from those experiencing systems barriers when it comes to those who report heavier use. This may be supported by the findings here, as systems barriers overall seemed to have a much more powerful effect on substance users in this sample for a variety of outcomes.

Overall, these finding supports the hypothesis presented, that among a sample of substance users those reporting more types of substances used are at an increased risk for reporting additional service gaps, with additional risks reported ranging between 30-55%. Also, some of this additional risk may be due to systems related barriers, and not due to a lack of information about available services. Literature investigating the severity of substance use generally focused on factors such as route of administration or

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frequency of use as standard markers, this is the first time that number of different classes of substances used has been used in this manner and its utility as a proxy for such measures should be further investigated.

Many other findings consistent throughout most of this analysis include increased risk for reporting additional gaps among female substance users. Although the strength and precision of the relationship did fluctuate somewhat with the addition of competing variables, (RR range: 1.92-3.79; 95% CI range: 0.95-6.00), an overall trend is evident. The literature on female substance users notes that women are a uniquely vulnerable population with respect to HIV risk (NIDA, 2010; Reynolds, Latimore, Fisher, 2008). Factors such as route of administration and frequency have been linked to increase rates of sexually transmitted infections, unsafe sexual practices (e.g., unprotected anal sex) and sex trade all lead to increased risk of infection (NIDA, 2010). Even though IDU accounts for about 7% of male HIV infections nationally, among women IDU accounts for up to 14% of new infections (NIDA, 2012). This data is consistent that previous work showing that women tend to underutilize HIV medical services (Sohler & Cunningham, 2009; Shapiro et al., 1999a), and that use of ancillary services among women can positively affect both medical car retention and ART medication adherence (Anderson et al., 2005).

This is the first such analysis to identify increased substance use as a potential predictor of why women underutilize these services. Previous research has identified factors such as stigma and low perceptions of risk as reasons why women don't test for HIV (Duffus et al., 2012), but no one has attempted to understand why HIV-infected women underutilize available ancillary services. It should be noted that upon stratification risk or reporting additional service gaps was suppressed among women reporting information barriers and no women reported systems barriers. While low response rates among female substance users make extrapolation of findings difficult

(unweighted: n=8, weighted: n=368) they are suggestive and merit further discussion and analysis.

Another interesting finding was that of insurance status (uninsured specifically). As competing variables were added to the model the overall risk for uninsured individuals dropped 18%, and was not correlated with the outcome (risk of reporting an additional service gap). Upon stratification this risk increased among those reporting systems barriers, but decreased for those with information barriers, indicating that barrier type may be acting as an effect modifier of the true risk. Among HIV-infected persons, and HIV-infected substance users specifically, lack of insurance been linked to both suboptimal patterns of medical care and underutilization of ancillary services (Cunningham, et al., 2006; Knowlton et al., 2001; Katz et al., 2000). This is the first analysis to identify that even among substance users, the number of substances used can affect access to ancillary services as well.

One unique result revealed was the inverse relationship between educational attainment and risk of reporting additional service gaps. Research on educational attainment as an indicator of HIV cares retention, or ancillary service utilization, is limited. Among HIV-infected persons lower educational attainment has been linked to increased overall mortality (Cunningham et al., 2005), but this finding may have little significance within the context of this analysis. No analysis has investigated the effects of education level independently on risk of ancillary service gaps among a sample of substance users.

Interestingly a protective relationship between level of educational attainment and risk of reporting an additional service gap was revealed by this analysis; with RR ranging from 0.52-0.61 among persons will less than a high school (<HS) education. Upon stratification both results were elevated from the crude analysis presented in model 4, but opposite results were reported, revealing a crossover effect. This

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combination of opposing findings upon stratification suggests that both effect modification and confounding may be present. This is another contextually difficult relationship to describe, it seems that individuals reporting systems barriers resembled the crude analysis (a decreased risk), while there was a substantial increased risk for persons reporting information barriers. This indicates that effect modification by barrier type may be a more powerful driver of observed differences, but verification of a confounding effect is not supported, as limited data exists with respect to an independent connection of barrier type to education level. What this does suggest is that persons with higher educational attainment (reference group) may be at a greater risk of reporting additional service gaps because they face systems barriers.

Finally, the overall stratification effect revealed that among this sample of substance users, the increased number of substance use effect the number of gaps reported among those experiencing systematic barrier more than information barriers. This trend has been discussed previously in this analysis. Substance uses, as a group, tend to report experiencing systems barriers as the main reasons they are unable to obtain needed services. This is consistent with existing data showing that substance users encounter multiple structural barriers in accessing HIV care and other support services (Canadian HIV/AIDS Legal Network, 1999; Metsch, Pereyra, Brewer, 2001; Sterk, Theall, Elifson, 2002). Issues such as disorganized life, difficulty navigating health systems and fear of prosecution have all been identified as structural factors associated with poor medical care retention among substance users. This analysis also supports data that shows co-location of medical and social-services is an effective intervention for reducing structural barriers and increasing utilization of support services among substance using populations (Strauss & Mino, 2011).

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SECTION 6.4: AIM 4

To determine if substance users and non-users report similar clusters of service gaps.

To address this aim the following research questions were answered:

1. Are there specific clusters of service gaps reported by respondents?

2. Do substance users have a greater probability of reporting gaps for certain clusters of services compared to non-substance users?

Question 1: Factor Analysis

Before factor analysis can begin a complete list of variables included, and their distributions, can be found in Appendix E. As Exploratory Factor Analysis (EFA) relies on variable correlations, a correlation analysis revealed that several variables with low utilization in the system were not correlating. Due to this, variables which where less than 5% of the population reported service gaps for were eliminated from the analysis. This reduced the number of variables from 47 to 31. This included the elimination of many types of case management services, as well as many substance abuse services as well. All subsequent analysis will only include this subset of 31 services.

EFA revealed several potential candidate factors that fulfilled Kaiser criterion (eigenvalues >1.0). Full list of all eigenvalues can be found in table 6.4.1. About 30 factors were able to explain 100% observed variance, with 11 meeting Kaiser criterion. Due to the large number the first four were retained for analysis, as these explained 33% of explained variance. Figure 6.2 shows the subsequent Scree plot that accompanies this.

Table 6.4.1: Complete list of Eigenvalue from EFA Correlation Matrix (n=31)

Eigenvalue	Difference	Proportion	Cumulative
5.28	**3.47**	**0.17**	**0.17**
1.81	**0.15**	**0.06**	**0.23**
1.66	**0.14**	**0.05**	**0.28**
1.52	**0.07**	**0.05**	**0.33**
1.45	0.19	0.05	0.38
1.26	0.00	0.04	0.42
1.25	0.11	0.04	0.46
1.14	0.07	0.04	0.50
1.07	0.02	0.03	0.53
1.05	0.04	0.03	0.56
1.02	0.05	0.03	0.60
0.97	0.04	0.03	0.63
0.92	0.07	0.03	0.66
0.85	0.03	0.03	0.69
0.83	0.03	0.03	0.71
0.80	0.06	0.03	0.74
0.74	0.02	0.02	0.76
0.73	0.02	0.02	0.79
0.70	0.01	0.02	0.81
0.69	0.08	0.02	0.83
0.62	0.03	0.02	0.85
0.58	0.02	0.02	0.87
0.56	0.01	0.02	0.89
0.55	0.02	0.02	0.90
0.53	0.03	0.02	0.92
0.50	0.03	0.02	0.94
0.47	0.06	0.02	0.95
0.41	0.03	0.01	0.97
0.38	0.02	0.01	0.98
0.35	0.03	0.01	0.99

Figure 6.2: Scree Plot of Eigenvalues for Orthoginal Promax Factor Rotation

Scree Plot of Eigenvalues
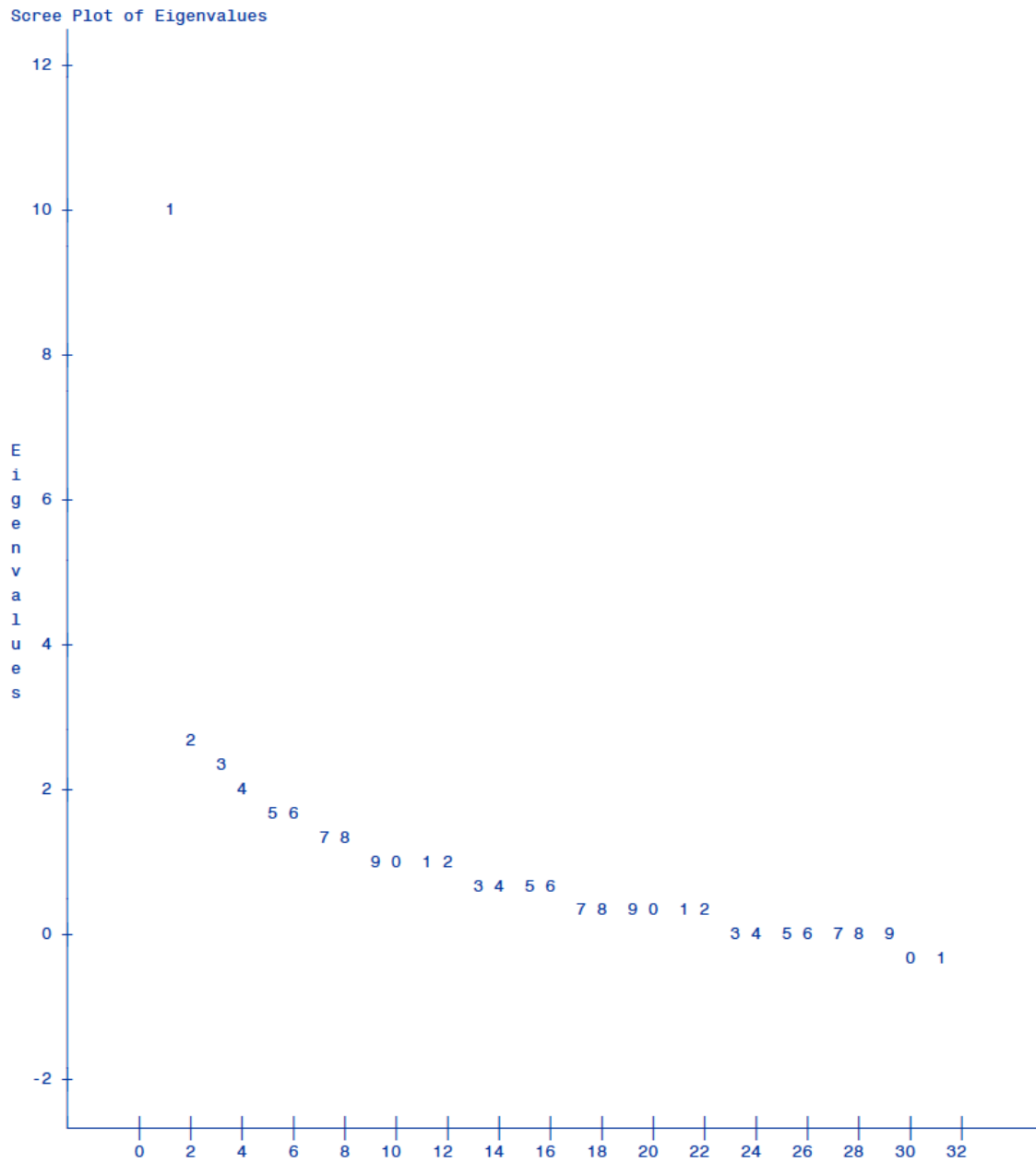
Table 6.4.2 displays the EFA un-rotated loading patterns for the four retained factors. As you can see, many variables load strongly onto factor one, which explains 10.2% of the observed variance. The remaining three factors explain between 2.6 and 1.8% of variance, with a moderate amount of variables loading on them. While there is no cutoff value for determining factor loading, generally a value of 0.40 or above is considered acceptable.

Table 6.4.2: EFA Un-rotated Factor Loading Patterns for Reported Service Gaps

	Factor1	Factor2	Factor3	Factor4
Medical Specialty	0.3375	0.2357	0.2359	0.3098
Oral Health Care	0.4082	0.0009	0.5597	0.1782
Mental Health, Psychiatry	0.4530	0.5130	0.1779	0.2737
Local Pharmacy Program	0.5598	0.3939	-0.1639	-0.1672
AIDS Drug Assistance Program (ADAP)	0.2783	0.5965	0.2690	-0.1655
Medical Nutrition Therapy	0.5099	0.1468	0.0032	0.3129
Rehabilitation	0.5652	0.1227	-0.3094	0.0636
Counseling and Testing in Care Settings	0.3315	0.5897	-0.3093	-0.1374
Health Education/Risk Reduction	0.5871	0.4059	-0.4827	0.1844
Treatment Education	0.5845	-0.0741	-0.3493	0.3245
Psychosocial Case Management	0.4685	-0.0535	0.5970	-0.0904
Skilled Nursing	0.5755	-0.2138	0.2327	0.1098
Housing Case Management	0.6948	-0.2509	0.0507	-0.4843
Medical Transportation – Taxi Voucher	0.7101	-0.1541	0.0684	-0.3140
Medical Transportation – Bus Tokens	0.5936	-0.1650	0.3299	-0.1831
Medical Transportation – Bus Passes	0.5998	-0.5185	-0.0963	-0.0317
Short Term Rent, Mortgage, Utility	0.6210	-0.5010	0.0564	0.0071
Rental Assistance	0.5789	-0.1898	-0.1563	-0.0794
Emergency Shelter	0.7827	-0.2904	-0.0744	-0.0232
Permanent Supportive Housing	0.7688	-0.1014	-0.2548	-0.0316
Health Insurance Premiums Cost Sharing	0.5881	0.3292	0.0205	-0.3541
Benefits Specialty	0.7347	0.1048	0.1970	-0.3035
Outreach	0.7027	0.1650	-0.1875	-0.1227
Referrals	0.6312	0.0066	-0.2541	-0.2805
HIV LA Directory	0.6518	-0.0817	0.1508	0.4035
Mental Health, Psychotherapy	0.5085	0.0395	0.1939	0.4106
Peer Support	0.4690	0.2720	0.1732	0.1398
Nutrition Support – Food Bank	0.4770	0.0154	0.3625	0.1341
Nutrition Support – Home Delivered Meals	0.3953	0.2009	0.1379	-0.2483
Legal	0.5987	-0.3184	-0.3978	0.1959
Workforce Entry/Re-entry	0.5620	-0.0849	-0.1179	0.3822
Variance Explained by Factor	**10.1655**	**2.5754**	**2.2319**	**1.8401**

Below is the oblique rotation (Promax) of the four retained factors. Note that variables with loading patterns of less than 30% are not included as they show poor correlation to the factor of interest. As mentioned above, a cutoff value of 40% correlation is acceptable lower limit for determining factor loading. As you can see from table 6.4.3, while many variables achieve this cutoff value with respect to factor loading, there is quite a bit of cross-loading observed. For example, gaps in home based case management services loaded equally onto both factor 1 (0.40) and factor 2 (0.41).

If traditional factor analysis were to be applied to these results factor 1 would consist of six variables (Housing Case Management, Taxi Vouchers, Rental Assistance, Emergency Shelter, Benefits Specialty and referrals). Many of these services focus on obtaining financial support with respects to housing. An argument could be made that Taxi vouchers may also be connected to housing as a means of assistance with transportation to or from one's home, and referrals may be related in some ancillary way with respect to referrals for maintaining housing benefits (as referrals specifically was related to obtaining HIV services by using a telephone or non-electronic means).

Variables loading onto factor 2 included treatment education, legal assistance and workforce re-entry services. These variables demonstrate that persons in need of treatment education are also seeking other assistance related to legal and employment assistance. This could signify that these individuals are seeking educational/informational services that for a variety of both medical and interpersonal reasons.

Factor 3 saw four variables with successful loading; Oral Health, Psychosocial case management, skilled nursing and food bank services. Three of these variables are related to some form of ancillary medical/psychological support with the exception of food bank services. It can be speculated that persons experiencing difficulties obtaining these types of medical services may also be experiencing similar barriers with respect to

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nutritional support, specifically since clients may rely heavily on case managers in helping to obtain food bank services. Also, it is unclear if requirements for obtaining food bank services come from case managers exclusively; as many organizations that offer food bank services require a case manager evaluation prior to enrollment in their programs. It should be noted that medical Nutritional Therapy did also load onto this factor, but cross-loaded onto factor 2 as well.

Finally, factor 4 contains three variables, Pharmacy services, ADAP and counseling and testing services. It should be noted that only counseling and testing in medical setting was asked. While the first two variables are clearly related to access to pharmaceutical services (both HIV and non-HIV related), it is unclear how counseling and testing services fits into this scenario. It should be noted that health education/risk reduction services also strongly loaded onto this factor, but this variable also cross-loaded onto factor 2 equally as strong.

Of importance to note is almost half of the variable listed (n=15) either were too heavily cross-loaded be exclusive to one factor or were poorly correlated with any factor. This has the cumulative effect of decreasing the potential sample size to generate exclusive factors by half. Due to this reason factor scores were generated and were retained for analysis.

Table 6.4.3: Promax Orthogonally Rotated Factor Loading Patterns for Reported Service Gaps

	Factor1	Factor2	Factor3	Factor4
Medical Specialty	-0.1181	0.0662	0.38156	0.1814
Oral Health Care	0.0323	-0.0646	**0.56291**	0.0339
Mental Health, Psychiatry	-0.1661	0.0881	0.39970	0.40880
Local Pharmacy Program	0.2424	0.0569	0.0108	**0.50461**
AIDS Drug Assistance Program (ADAP)	0.0230	-0.1898	0.2318	**0.43614**
Medical Nutrition Therapy	-0.1780	0.3723	0.4005	0.4361
Rehabilitation	0.1399	0.2993	-0.0715	0.1495
Counseling and Testing in Care Settings	-0.0386	0.1218	-0.0187	**0.47913**
Health Education/Risk Reduction	-0.0813	0.50651	-0.0516	0.47897
Treatment Education	-0.0664	**0.60775**	0.0595	0.0744
Psychosocial Case Management	0.2039	-0.1640	**0.48823**	0.0127
Skilled Nursing	0.1163	0.2472	**0.42090**	-0.1478
Housing Case Management	**0.75816**	-0.0790	0.0249	0.0423
Medical Transportation – Taxi Voucher	**0.63001**	-0.0116	0.0984	0.0493
Medical Transportation – Bus Tokens	0.38548	-0.0552	0.3679	-0.0327
Medical Transportation – Bus Passes	0.36802	0.3622	0.1032	-0.2682
Short Term Rent, Mortgage, Utility	0.31562	0.3345	0.2558	-0.2905
Rental Assistance	**0.42873**	0.2057	-0.1603	0.0557
Emergency Shelter	**0.51740**	0.3326	-0.0533	0.0061
Permanent Supportive Housing	0.40049	0.4074	-0.0570	0.1265
Health Insurance Premiums Cost Sharing	0.33064	-0.0636	0.1215	0.4630
Benefits Specialty	**0.55262**	-0.1146	0.1728	0.3565
Outreach	0.36126	0.1897	-0.0989	0.3919
Referrals	**0.41252**	0.1158	-0.1498	0.2727
HIV LA Directory	-0.0220	0.4072	0.38358	0.0333
Mental Health, Psychotherapy	-0.0222	0.2094	0.34187	0.1286
Peer Support	0.0290	0.0354	0.30146	0.2888
Nutrition Support – Food Bank	0.0062	0.0901	**0.50806**	0.0301
Nutrition Support – Home Delivered Meals	0.1670	-0.0963	0.1890	0.2084
Legal	0.1479	**0.55673**	-0.0405	-0.1001
Workforce Entry/Re-entry	0.0480	**0.43689**	0.0904	0.0400

Table 6.4.4 presents the standardized individual level factor scores generated for each variable of interest by factor. Higher scores indicate greater factor loading for that particular variable, but unlike traditional factor analysis these scores allow for analysis of all variables of interest within a factor. As these scores are standardized based on the mean and standard deviation, negative values are expected. Below the factor scores are univariate statistics on the normality of these factors. Overall, scores are normally distributed with means of zero and standard deviations of one. Median scores indicate that each factor is slightly skewed.

Table 6.4.4: Standardized Scoring Coefficients for Promax Rotated Factors

	Factor1	Factor2	Factor3	Factor4
Medical Specialty	-0.0688	0.0082	0.1629	0.0686
Oral Health Care	0.0047	-0.0673	0.2667	-0.0303
Mental Health, Psychiatry	-0.1065	0.0118	0.1516	0.1879
Local Pharmacy Program	0.0446	-0.0113	-0.0450	0.2390
AIDS Drug Assistance Program (ADAP)	-0.0165	-0.1180	0.0839	0.2116
Medical Nutrition Therapy	-0.1105	0.1508	0.1567	0.0437
Rehabilitation	0.0141	0.1216	-0.0725	0.0943
Counseling and Testing in Care Settings	-0.0608	0.0409	-0.0563	0.2483
Health Education/Risk Reduction	-0.1036	0.2199	-0.0948	0.2400
Treatment Education	-0.0749	0.2729	-0.0144	0.0160
Psychosocial Case Management	0.0778	-0.1192	0.2366	-0.0449
Skilled Nursing	0.0301	0.0831	0.1945	-0.1308
Housing Case Management	0.2805	-0.0932	0.0008	-0.0378
Medical Transportation – Taxi Voucher	0.2269	-0.0583	0.0329	-0.0327
Medical Transportation – Bus Tokens	0.1423	-0.0739	0.1739	-0.0768
Medical Transportation – Bus Passes	0.1290	0.1410	0.0433	-0.1907
Short Term Rent, Mortgage, Utility	0.1111	0.1237	0.1199	-0.2099
Rental Assistance	0.1410	0.0700	-0.1001	0.0005
Emergency Shelter	0.1667	0.1162	-0.0545	-0.0461
Permanent Supportive Housing	0.1088	0.1541	-0.0692	0.0231
Health Insurance Premiums Cost Sharing	0.0872	-0.0773	0.0168	0.2056
Benefits Specialty	0.1801	-0.1154	0.0496	0.1303
Outreach	0.0895	0.0512	-0.0975	0.1755
Referrals	0.1240	0.0217	-0.1077	0.1167
HIV LA Directory	-0.0461	0.1608	0.1539	-0.0288
Mental Health, Psychotherapy	-0.0389	0.0704	0.1383	0.0315
Peer Support	-0.0198	-0.0155	0.1154	0.1204
Nutrition Support – Food Bank	-0.0148	0.0079	0.2320	-0.0314
Nutrition Support – Home Delivered Meals	0.0486	-0.0749	0.0749	0.0823
Legal	0.0231	0.2472	-0.0472	-0.0812
Workforce Entry/Re-entry	-0.0187	0.1867	0.0114	-0.0046
Mean	**0**	**0**	**0**	**0**
Median	**-0.40**	**-0.35**	**-0.28**	**-0.25**
Standard Deviation	**1**	**1**	**1**	**1**

Figure 6.3 displays the distribution of factor scores per factor. As described earlier, each factor is slightly left skewed, but otherwise normally distributed; indicating that simple t-test analysis to reveal differences between substance users and non-users by factor is warranted.

Figure 6.3: Distribution of Factor Scores by Individual Factor
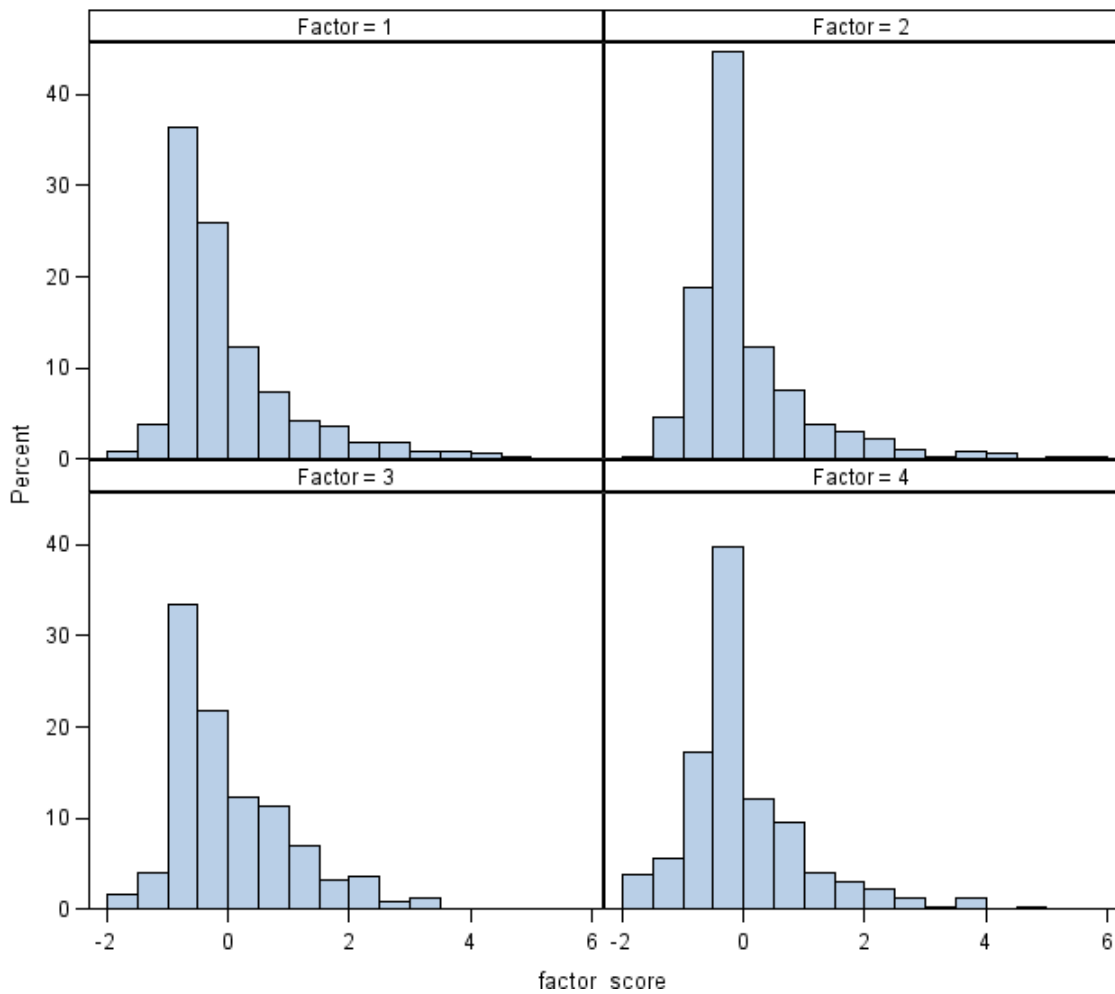
Descriptive statistics and paired t-test results per factor by substance use can be found in Table 6.4.5. In general substance users reported higher mean standardized factor scores than non-substance users. Factor 1 and 3 revealed statistically significant

results, indicating that substance users were much more likely to report gaps for services that loaded heavily on those factors.

With respect to factor one, if you ignore issues of cross loading, services that loaded onto this factor with values <0.40 (see table 6.4.4) included: Housing Case Management, Taxi Vouchers, Rental Assistance, Emergency Shelter, Permanent Supportive Housing, Benefits Specialty and Referrals. Many of these services are either directly or indirectly related to housing needs. Those that aren't directly related to needed housing (e.g., taxi vouchers and referrals) can be secondarily associated with safely related to one's home or seeking housing related resources.

Factor 3 showed the greatest difference in factor scores based on substance use. Ignoring issues related to cross-loading, this factor primarily comprised of services gaps for: Oral Health Care, Mental Health (Psychiatry), Medical Nutritional Therapy, Psychosocial Case Management, Skilled Nursing Care, Food Bank services. The majority of these services are directly related to medical care. Despite the high utilization of medical care services by participants, substance users were more likely to report gaps for these types of services as a group. This highlights that substance users are having difficulties receiving many types of these services, despite obtaining primary HIV medical care.

Table 6.4.5: Descriptive Statistics and Paired t-Test Results for Standardized Factor Scores by substance use

Factor	Substance Users (n=119)		Non-Substance Users (n=281)		p-value
	Mean (SD)	Median	Mean (SD)	Median	
Factor 1	0.16 (1.15)	-0.24	-0.07 (0.92)	-0.50	0.04
Factor 2	0.07 (1.17)	-0.23	-0.03 (0.92)	-0.37	0.37
Factor 3	0.21 (1.10)	-0.06	-0.09 (0.95)	-0.30	<0.01
Factor 4	0.13 (1.14)	-0.25	-0.06 (0.93)	-0.25	0.09

SECTION SUMMARY

The purpose of this section was to identify clusters of services respondents reported gaps for, and then investigate if the probability of reporting gaps for these clusters varied by substance use behavior. Based on EFA results several potential factors were identified. Upon rotation the same factors of services were revealed, but limited numbers of services successfully loaded onto distinct factors. Several variables were either poorly correlated to any given factor (<0.40 correlation) or were cross-loaded onto multiple factors making distinctions difficult to make. Due to this fact standardized factor scores were generated for each variable per factor. These scores were then used to compare substance users with non-users.

Analysis revealed that in on average substance users reported greater factor scores (higher probability of reporting service gaps) for all revealed factors. This fact is supported by the data, as substance users were more likely to report service gaps as described in aim 1 above. Additionally, data from aim 2 demonstrated that even when all variables from the theoretical model were controlled for (RR=3.13; CI=1.32-7.42). As stated previously, research has shown that substance users are more likely to report gaps in primary medical care (Gonzalez et al., 2012; Gonzalez et al., 2011; Wolf et al., 2010). Also, injection drug use specifically use has been shown to be a powerful barrier to obtaining ancillary services (Wolf et al., 2010). This is the first such investigation to show that among a generalized population of HIV-infected persons, any reported illicit substance use may pose a barrier to obtaining needed ancillary services.

Only two of the four factors (1 and 3) showed a significant difference in reporting gaps. Although all variables of interest are taken into account with factor scoring, variables with high loading (>0.40) can be considered the most influential. Many of the variables with high scores for Factor 1 included services that were either directly or indirectly related to housing needs. This finding is consistent with aim 3, which

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demonstrated that among substance users homeless individuals had almost twice the risk of reporting an additional service gap (RR=1.95; CL=1.29-2.96) compared to individuals with stable housing. Literature has shown that substance use is highly correlated with housing insecurity among HIV-infected persons, and that this connection has measurable health consequences (Leaver et al., 2007). Also, the National HIV/AIDS strategy specifically highlights housing disparities as an important barrier to obtaining adequate HIV services (White House, 2010). This is the first such research to highlight gaps among specific clusters of Ryan White funded housing services among substance using populations.

Variables associated with Factor 3 were all directly or indirectly related to some form of medical care and included services such as oral health care, psychiatric services, nutritional support/evaluation and case management. Many of these are services that are provided or easily referred to in a medical setting. Despite the high utilization of primary medical care by participants, it seems that a subset of respondents were unable to obtain these support services. This finding supports a criticism of past research on ancillary services, in that attainment of primary medical care as generally the outcome of interest. The clustering of these services suggests that even though individuals may be receiving primary medical care, disparities with respect to medical supportive services still exist. While it is still unclear to why these gaps exists, aim 3 did reveal that among substance users, stimulant users who reported structural/ organizational barriers to care reported over a 60% increased risk for reporting an additional service gap than non-stimulant users (RR=1.62, CL=1.08-2.41). Additionally, when the number of substances used was taken into account, for each additional type of substance used in the previous six months, there was an additional 27% increased risk of reporting an additional service gap (RR=1.27; CL=1.02-1.60), an association that revealed to be driven largely by persons who reported structural/interpersonal barrier to

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obtaining services (RR=1.24, CL=1.14-1.35). All of this evidence supports the notion that substance users are at increased risk for reporting these types of service gaps despite obtaining primary medical care.

A separate analysis looking at predictors in gaps for Oral Health services alone yielded no significant correlations, but this analysis shows that when clustered together with other unmet needs, increased gaps for Oral Health was included along with other medical type services. Another finding to note is that this cluster included two nutritional services (Medical Nutritional Support and Food Bank), indicating that persons who reported gaps for medical ancillary services also expressed difficulty in obtaining nutritional support. This may be an indicator that persons needing additional medical support also are in need of these services as well. Research on the link between food services and access to HIV treatment services generally is limited, but is has been associated with factors such as virologic failure and premature death (Anema, Vogenthaler, Frongillo, Kadiyala, Weiser, 2009). All of these results reinforce the hypothesis presented here, that substance user are not only more likely to report an increased number of service gaps overall, but also are reporting unique patterns of gaps. A broader look at how service gaps are clustering for vulnerable populations may aid policy makers and planning bodies in how to streamlining and or bundle services to reduce these disparities.

CHAPTER 7: DISCUSSION AND CONCLUSIONS

7.1: Study Summary

The purpose of this investigation was to gain a better understanding of the role that substance use has in predicting ancillary service gaps among a sample of HIV infected Ryan White recipients living in Los Angeles County, California. While the role of ancillary services as a mechanism for promoting proper linkage and retention in primary HIV care is well established (Aday, 2002; Ashman et al., 2002; Chan et al., 2002; Conover et al., 2002; Messeri et al., 2002; Sherer et al., 2002; Shapiro et al., 1999a), little research has focused on factors affecting use of ancillary services independent of primary medical care. Additionally, substance use among HIV infected populations has been associated with increased HIV morbidity and mortality (Altice et al., 2010; Wolfe et al., 2010). Reasons for this are complex, but it is generally understood that substance use creates unique risk environments that disrupt both the treatment of HIV disease and increases exposures to secondary conditions (e.g., hepatitis C, tuberculosis) affecting overall health (Des Jarlais et al., 1988). In order to understand these issues more closely data from the 2011 Los Angeles Coordinated Needs Assessment Care (LACHNA-Care) study was analyzed.

To explore different dimensions of this overall research question four specific aims were proposed. Additionally, several theoretical models and frameworks were used to both add context to the analysis and support relevant findings. Aim 1 described the socio-demographic and service utilization characteristics of the population. Aim 2 described the role substance use plays in predicting service gaps. Aim 3 looked specifically at the role both stimulant use, and the number of substances used, play at predicting service gaps among substance users. Finally, aim 4 investigated if newly identified service gap clusters differed by substance use behavior. As chapter

summaries discussed individual findings within each aim, the following section will explore relevant findings across the project and their implications for future research.

7.2 Discussion of Major Findings

<u>Dataset: AIM 1</u>

The goal of AIM 1 was to demonstrate that this sample appropriately represented the population of interest (RW recipients in LAC). This was to ensure that the applied weighting would accurately estimate true population risks. Based on comparisons with local surveillance data and socio-demographic characteristics of Ryan White recipients, LACHNA-Care survey participants were fairly consistent with clients enrolled in the LAC RW system. When weighted, the sample size was consistent with that of the RW population during the surveillance period. Thus, the outcomes of the 2011 LACHNA-Care survey can be considered a good approximation (and therefore generalizeable) of all patients in the LAC RW system.

Comparisons of service utilization characteristics (awareness, need, receipt and gaps) and socio-demographics between substance users and non-users from the sample revealed important differences in not only the number of service gaps reported, but also by variables such as age, gender and employment status. These results indicated that substance users are a unique group within this sample in need of further study.

<u>Service Gaps: AIMs 2 and 3</u>

Results from aims 2 and 3 explored the primary topics of this investigation, the central role of substance use as a predictor of ancillary service gaps. Aim 2 focused on the entire sample, while aim 3 investigated the role of both stimulant use and the number of substances used among a subsample of substance users. Results from aim 2 indicated a strong correlation between the presence of service gaps and reported

substance use, a relationship that was upheld when competing variables were added to the model. Aim 3 showed a less robust correlation between stimulant use, as well as the number of substances used, and an increased number of gaps among substance users. Additionally, stratification by barrier type had no effect on this outcome. So while substance use itself predicts the occurrence of any service gaps, it is less predictive in understanding how many gaps are actually reported among this population.

Results from aim 3 demonstrated that, among substance users, both stimulant use and an increasing number of substances use were positively associated with increased risk for reporting additional service gaps. Interestingly, both groups reported similar levels of increased risk, with RR ranging between 1.54 to 1.75 for stimulant users and 1.32 to 1.56 for individuals reporting more intense use. Although the risks were slightly higher for stimulant users, the overall strength of the association was less for stimulant users (overall 95% CI: 0.99-2.88) when compared to persons with more intense use (overall 95% CI: 1.05-1.87). Additionally, when stratified by barrier type, systems barriers (as compared to information barriers) were identified as the major reason for reported gaps.

Together these results reveal that substance users are not a monolithic group with respect to risk of service gaps. Even among substance users, persons reporting higher levels of use and stimulant use reported more service gaps. These poor outcomes do not stem from a lack of information about available services, but may be due to other systemic factors related to drug seeking behaviors, clinic wait times or systemic regulations. Both intensity of use and stimulant use have been positively associated with poor utilization of HIV medical care (Altice et al., 2010). Additionally, HIV case managers have identified substance use as a major problem in clients accessing support services (Reif, Golin, Smith, 2005). It should be noted that the majority of

research in this field compares substance users to non-users, rarely are different types of substance users compared.

This investigation offers the first evidence that substance use can profoundly disrupt access to RW funded ancillary services independent of primary medical care. This investigation is the first to show this relationship within the RW system, and it corroborates evidence from other fields such as child welfare about the disruptive nature of any substance use in accessing social services (Choi & Ryan, 2007; Smith & Marsh, 2002). Taken together, while any substance use may be linked to poor access to needed services, individuals reporting high levels of use, and stimulant use specifically may be the most at risk for reporting these gaps. Increased systemic roadblocks to accessing needed services may translate into falling out of the system altogether. Future research should investigate this possible connection.

In addition to these main findings other socio-demographic factors associated with service gaps were revealed. While many of these were discussed in individual section summaries, some that are consistent across models deserve further scrutiny. These include substance abusing women, those with current mental health conditions, younger individuals, and those reporting a past lapse in medical care. It should be noted that many of these factors have been independently linked to poor patterns of HIV medical care adherence. Therefore, findings suggest that some groups at risk for poor HIV care and treatment may also be at similar risk for deficiencies in support services.

Although females did not report an increased risk of reporting service gaps, female substance users were at much greater risk even when competing variables were taken into account (aim 2). Also, females reporting more (as opposed to less) intense use were at elevated risk of reporting additional services gaps (aim 3). Interestingly, when stratified by barrier type no elevated risk was detected, indicating that the reason for these gaps is not necessarily related to the types of barrier reported on this survey.

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Some of these findings are slightly contradictory to past research showing that female substance users tend to encounter unique structural and interpersonal barriers with respect to receiving both HIV and substance abuse treatment (Duffus et al., 2012; Andersen et al., 2005; Bertakis et al., 2000). Additionally, Andersen et al., (2005) demonstrated that HIV infected women with co-occurring substance abuse and mental health disorders have poor care without extra social support such as nursing case management. Finally, a recent article reported that among HIV-infected women who abuse drugs, those not in care reported transportation and insurance barriers to obtaining care (Blackstock, Blank, Fletcher, Verdecias, Cunningham, 2015). Perhaps future needs assessments should consider expanding choices related to barriers to care, or conduct focus groups on substance using women to identify reasons why they are not receiving necessary services. These findings may also reflect a systemic bias in substance abuse treatment by gender. Many women report that traditional substance abuse treatment programs are primarily geared towards men (Duffus et al., 2012; Andersen et al., 2005; Bertakis et al., 2000). Perhaps these findings are mirroring the same issue, indicating that service providers may not be targeting the unique needs of this population, thus leading to service deficiencies.

Findings consistently revealed an inverse relationship between age and reporting service gaps, with older persons reporting fewer gaps. This correlation remained in the presence of competing variables. This finding was not only true for the entire sample (aim 2), but among substance users as well (aim 3); although the correlations found in aim three were less robust. Interestingly, when the sample was stratified (aim 2), younger individuals reporting primarily information barriers were at the greatest risk of reporting service gaps compared to those reporting systems barriers. Conversely, among substance users (aim 3) younger individuals reporting systems barriers (as opposed to information barriers) were at the greatest risk. This indicates that substance

use moderates the types of barriers younger individuals report as the reason they are unable to received needed services.

According to an HIV cascade model developed for adolescents by Zanoni & Mayer (2014), youth 13-29 have poorer rates of HIV care engagement, retention, ART adherence and viral load suppression than adults. It is estimated that only 6-15% of HIV infected youth are virally suppressed, much lower than national estimates among all infected persons (25%), (Hall, Frazier, Rhodes, Holtgrave, Furlow-Parmley, Tang, 2013). Reasons for this deficiency are complex, as adolescents with pre-existing conditions often face multiple barriers (e.g., stigma, insurance difficulties, poor case management, health literacy) when transitioning to traditional adult medical environments (Gilliam, Ellen, Leonard, Kinsman, Jevitt, Straub, 2011). This is the first investigation to demonstrate that similar patterns of poor HIV care translate into poor access to ancillary services. Research has shown that younger individuals who also use drugs encounter multiple structural barriers to obtaining care (Rapp, Xu, Carr, Lane, Wang, Carlson, 2006). While such findings are important, no one has been able to identify which of these variables exerts the strongest effect (youth or substance use). Findings here demonstrate a rudimentary comparison of these competing factors. Results suggest that even among a group traditionally known for having poor health care utilization and health literacy (younger individuals), the effects of substance use behaviors may be more relevant in explaining why they are not receiving needed services than lack of knowledge.

This investigation found that reporting an inconsistent history of adherence to HIV medical care translates into reporting current service gaps. This finding was predictive of both having any service gaps as well as an increased number of service gaps (aim 2). Additionally, inconsistent care histories were also a strong predictor of

reporting additional service gaps among substance uses (aim 3). When stratified, neither barrier type moderated this risk.

As previously reported, research in this area has focused on understanding predictors of poor HIV medical care retention (Catz, McClure, Jones, Brantley, 1999; Catz, Kelly, Bogart, Benotsch, McAuliffe, 2000). Catz et al., (2000) demonstrated that among HIV infected populations factors such as social support, self-efficacy and mental health affect patterns of both ART adherence and retention in HIV care. Among HIV-infected substance uses similar patterns of poor medication and primary care adherence have been demonstrated (Gozalez et al., 2011). This investigation is the first to report a correlation between past lapses in HIV medical care and current ancillary service utilization independent of a respondents current care status (as the majority of respondents are currently receiving medical treatment for HIV).

Understanding the mechanisms through which past poor care retention affects future behavior is limited. Some have theorized that health beliefs and self-efficacy play a substantial role in why some HIV infected patients have poor patterns of care (Catz et al., 2000; Uphold et al., 2005). Still others have noted that more structurally based interventions (such as increased insurance coverage) alone have substantial positive effects on preventative care utilization (Jerant, Fiscella, Tancredi, Franks, 2013). Among substance users both of these structural and interpersonal factors have been noted as predictors of poor care adherence (Gonzalez et al, 2011). While all these investigations offer important insights into predictors of poor care adherence among different populations, none have looked at the effects of past behaviors on current ancillary service utilization.

In this sample factors such as insurance status and income (as measured by the Federal Poverty Guidelines-FPG) had little effect on patters of ancillary service utilization. This investigation did find that longer travel time to doctors' appointments was

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positively associated with service gaps for some groups. Perhaps this result could be a proxy indicator for difficulties some respondents may have in navigate the Ryan White systems, as many services are not co-located and may be geographically dispersed throughout the county. This highlights the need for future work to better understand this relationship. It also highlights the need for service providers to understand clients' patterns of care utilization to more effectively target populations at risk of reporting service deficiencies.

Many findings applicable for one population did not necessarily translate to another, creating some inconsistencies across aims. Many times this translated into findings from the entire sample (aim 2) not translating to substance users specifically (aim 3). Additionally, some findings reported in past research to be strongly correlated with deficiencies in medical care access among HIV infected populations did not predict gaps in ancillary services in this analysis. For example, individuals reporting current mental health conditions reported an increased risk for gaps (aim 2), a finding not replicated among substance users (aim 3).

Mental health has been identified as important structural barrier to obtaining HIV care (White House, 2010a,b; Walkup et al., 2008) so its role as a disruptor of ancillary services for this RW population is not surprising. This finding is contrary to Conover et al. (2002), who demonstrated that RW recipients on public assistance had no additional risk of reporting ancillary service gaps, but this sample was not generalizeable of RW recipients.

What is surprising is that among substance users who also reported a current mental health condition no risk of reporting additional gaps was found, even in the presence of moderator. Past research has shown that HIV-infected substance users with co-occurring mental health conditions reported difficulties with primary care adherence (Tobias, et al. 2007). These findings indicate that among substance users the effects of

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mental health may not lead to increased risk for service gaps, and perhaps substance use alone is a more powerful predictor of service deficiencies even in the presence of a co-occurring mental health condition.

Another inconsistent finding of note is education level. No increased risk for service gaps based on educational attainment was reported (aim 2), but among substance users lower levels of education were correlated with decreased risk of reporting additional service gaps (aim 3). No conclusive findings linking education level to health care utilization have been reported (Peltzer et al., 2013; Gari et al., 2013). In the absence of an explanatory mechanism, these negative correlations are difficult to interpret. It should be noted that no differences based on FPG were reported, and the correlation between FPG and educational attainment was low (r=-0.19). This indicates that in this sample, education level is not a good indicator of income status. Still, this relationship is surprising. One possible explanation is that education level could be a proxy measure of familiarity with public assistance systems of this type. Persons of low education tend to rely on multiple types of public assistance to obtain needed services, so these individuals may be more aware of how to navigate bureaucracies of this type.

These findings may be helpful in better understanding the mechanisms for predicting service gaps among RW recipients generally, and among substance users specifically. An important insight into answering this question can be found in the types of barriers reported. The overall intent of applying this moderator was to determine if reported gaps were more related to agency (information) or structural (systems) barriers. This distinction between information and systems barriers emphasize two differing perspectives on how health disparities are explained (Cockerham, 2005).

When the sample was stratified by the moderator (aim 2), the majority of factors strongly associated with increased risk of service gaps were among those reporting information barriers. This supports previously work from this dataset, which identified

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individual barriers (which included all information barriers) as the main reason respondents were reporting service gaps (DHSP, 2011). When the sample was limited to substance users (aim 3), the majority of increased risks were among those reporting systems barriers. This distinction highlights that even though the majority of respondents reporting gaps noted lack of proper information about services, substance users (as a group) are aware of available services but noted systems barriers to obtaining services.

Interpersonal barriers, like the ones described by information barriers, are consistent with an agency perspective supported by both the Social Learning Theory (SLC) and Information Motivation Behavior (IMB) skills theory (Bandura, 1963; Fisher et al., 2000). Conversely, systems barriers support a more systemic approach to explaining health disparities supported by the ecological theoretical frameworks of Andersen and Gelberg (Andersen, 1995; Gelberg et al., 2000). It should be noted that SLC and IMB are cognitively based models focused on individualized effects of differential reinforcement and social acceptance on behavior patterns.

Put within the context of this study, it may be difficult to conceptualize how a cognitive approach can be useful in explaining services gaps. This approach assumes that reduced access to needed social services was somehow positively reinforced by individual choices. Realistically, many of the findings found here suggest a more systemic problem and suggest that Ryan White providers lack appropriate knowledge as to what the system can actually fund. Findings from this investigation suggest that individuals are not choosing to forgo services. Rather they lack the appropriate resources to receive them. It should be noted that only a few variables measuring cognitive factors were available in this dataset, so this could not be tested in these analyses. Future iterations of these types of assessments should take more time to understand the mechanisms and social determinants that may be preventing certain groups from accessing the full range of services that are available to them.

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According to the World Health Organization's Commission on Social Determinants of Health (CSDH, 2008), structural inequalities related to access based on gender, living conditions and education are often highlighted as reasons why the systemic imbalances like those presented here exist. Many of these issues may not affect access to Ryan White services locally, but are still suggestive that observed barriers may be based on systemic deficiencies when it come to providers and consumers understanding the system as a whole. Inequalities based on substance use, patterns of care history, and mental health status are strong indicators that these social determinants may be affecting unequal access among RW recipients. This suggests that strategies for identifying and supporting these populations are beneficial for policy makers when determining resource allocations.

Cluster Analysis: AIM 4

AIM 4 used factor analysis to: 1) determine if naturally occurring clusters of service gaps exist and 2) understand if substance users (as a group) tended to report gaps for these services clusters more than their non-substance abusing counterparts. Research in this area is limited. What has been reported often groups services by type (e.g., all case management or housing services) and doesn't inductively explore how services correlation independently (DHSP, 2011; Wohl et al., 2011b).

Though four factors were extracted, a high level of crossover between variables (n=15) means that they did not correlate well into any discernable clusters. Despite this limitation, many interesting patterns were revealed. First, persons reporting gaps for medical care also reported gaps for nutritional support, case management and oral health care. Substance users were much more likely to report service gaps for this cluster than their non-substance abusing counterparts. Second, many housing type services did naturally cluster together (i.e., Section 8 rental assistance, emergency shelter and supportive housing), but one transportation service (taxi vouchers) also

correlated with this group. These findings all point to the need for increased diversity of services from providers across the system. Co-location of services has long been shown in the literature to be a cost effective way of ensuring that patients receive adequate services in an efficient way. This is especially true when the conditions being tested or treated are highly stigmatized like HIV and or substance use (Sylla, Bruce, Kamarulzaman, Altice, 2007). These findings suggest that the RW system needs to not only improve co-location of services, but also use methods reported here to better understand which services should be clustered to ensure system efficiencies.

7.3 Limitations

Several important limitations that could potentially bias results should be discussed. The first sets of biases are those related to the sampling scheme used. As the sampling frame was limited to individuals receiving at least one RW funded service in the last 12 months, it does not attempt to capture information among HIV-positive persons not receiving any RW support. As this investigation is attempting to characterize service gaps among a generalized sample of HIV infected persons, those completely outside of the RW system may potentially have greater needs. This could have the effect of underestimating the true number of service gaps reported by eligible residents. Additionally, persons who received services at more than one agency, or who visited the same agency several times during the study period, may have been over-represented in the sample; however, adjustments to the weighting scheme compensated for these types of duplicate responses.

Potential biases related to the questionnaire also exist. This includes the fact that while attempts were made to capture information on RW-funded services only, several service categories have multiple funding streams, making it difficult to provide estimates on gaps exclusive to RW-funded services. Additionally, persons may report gaps for

which they are not eligible. This is because certain services (e.g., residential care and housing) have strict eligibility requirements. Both of these factors may result in a slightly overestimated of some services gaps.

Analyses comparing substance users and non-users revealed important differences between groups. It should be noted that although the sample can be thought of as an effective approximation of the RW population, it is unclear if the sub-sample of substance users is equally representative. Since no stable baseline measures of substance use within the RW population exists, we must assume that its representativeness may be less accurate than that of the larger population.

Some of the variables and measures used in this analysis do not have known efficacy. Measures for mental health status and severity of use were limited to recently self-reported behaviors only, and were not based on any standardized methods. For mental health only a self-reported current diagnosis of either depression, schizophrenia, bipolar disorder or anxiety were counted, so no standardized diagnostic measures of these conditions were conducted. Additionally, using the number of classes of substances (hallucinogens, depressants, opiates or stimulants) used in the past six months as a proxy for intensity of use is untested. More standardized measures based on frequency of route of administration of a single substance are generally used, neither of which were collected. While this project offers a unique perspective on measuring this construct, the efficacy of this measure should be considered while interpreting results.

An important potential confounding issue related to co-location of services also exists. Participants who report gaps in primarily medical care may also have a greater likelihood of reporting other types of social service gaps as these are many times co-located. Potential examples of this may be that persons reporting service gaps for case management and transportation were more likely to be out of medical care. It is unknown how substantial this issue may be, as so few persons sampled were truly out of

care (n=24) according to the HRSA definition of two medical visits within a 12-month period, at least three months apart, where standard disease indicators (viral load and CD4 counts) are performed (HRSA, 2011).

Finally, respondents with limited computer literacy or disabilities such as blindness required assistance completing the laptop-administered survey resulting in possible response bias. However responses for persons requiring limited assistance (n=83) were no different from persons who were not assisted. Also, even though standard sample size calculations determined 400 respondents could estimate the population, this limited certain types of subgroup analysis performed because of small sample sizes. Lastly, as this was a one-time cross sectional survey causality cannot be established as temporality cannot be established.

7.4 Policy Implications and Recommendations

Results from this analysis can provide several contributions to the field of public health, as well as to Ryan White service care delivery. Overall, results can inform local policy makers and providers about service deficiencies system wide. Specific recommendations include: increasing dissemination of program services, targeting high risk groups to improve utilization, increasing co-location of services and augmenting future surveys to include variables related to actual mechanisms that could explain why these service gaps exist. These recommendations will give provider's necessary information about who are more likely to report service deficiencies and how to reduce them.

Recommendation 1: Increased Dissemination

Improving how information about available services is delivered to consumers would help reduce service gaps systemically. Findings here support an increased need for

more extensive dissemination activities. The Commission on HIV currently offers information about services on a website. This resource is limited, with only 53% of the sample reporting they are aware of its existence (see table 6.1.3). Currently consumers rely on providers or case managers to inform them about available services, but data suggests that this is not effective. Perhaps more formalized trainings for providers, or informational pamphlets distributed at Ryan White funded facilities explaining how to obtain needed services may be more beneficial to consumers who may be intimidated or unfamiliar with such a large system.

Recommendation 2: Targeted Case Management

Targeted programming to certain sub-groups to identify and avert service gaps is necessary. Data suggests that certain groups (e.g., substance users, persons with mental health conditions, substance abusing women, youth) face increased challenges when trying to access available services. Effectively targeting populations at risk of reporting gaps may reduce this systemic burden and improve the lives of consumers. A system for: 1) effectively identifying these groups, 2) disseminating information to the correct provider/case manager and 3) implementing service plans to ensure consumer follow through would be necessary. This may involve a specialized strengths-based case management intervention intended to reduce gaps. Currently a medical care coordination program exists at publically funded HIV clinics in Los Angeles County. This program screens HIV-infected persons and enrolls persons at high risk of falling out of care into expanded services program. Perhaps a parallel program for ensuring effective coordination of RW funded services can be implemented to reduce service gaps among consumers.

Recommendation 3: Co-location of Services

Systemic co-location of services can reduce service gaps for all RW recipients. As was stated previously, co-location of services has shown to effectively increase the use of health services overall. Information from this analysis can inform providers and policy makers as to which services should be co-located. Additionally, procedures for determining which services are likely to be co-utilized can be repeated when necessary to assist in determining which services to bundle.

Recommendation 4: Identifying Social Determinants

Gathering information related to social determinants in future surveys could assist in understanding the mechanisms of why these gaps exist. These types of needs assessments are requirements of Ryan White funding, but far too often their utility is limited to identifying gaps but offering no insights into why the gaps exist. Future iterations of this survey should incorporate multiple methods to identify social determinants of service gaps. This includes both increasing the diversity of survey questions to capture other constructs (e.g., stigma, discrimination, poverty, homophobia), exploring qualitative methods (e.g. focus groups) and implementing population-specific surveys in an effort to better understand not only the needs of consumers, but the context in which service deficiencies happen. This approach will better inform providers and policy makers as to where resources should be allocated to increase access for all consumers.

7.5 Final Thoughts

This project provided the first systematic analysis of ancillary services gap in an existing Ryan White system focused on substance users. As this analysis is a snapshot of this system during a specific time, proposed federal changes to Ryan White by the

Affordable Care Act will change how this system will be administered and funded

(HRSA, 2014). This analysis serves as baseline data, which can be used to measure the

effectiveness of Ryan White as health care delivery nationally is overhauled for persons

relying on public assistance.

Appendix A: List of Available Ryan White Services

Table A: Available Ryan White Service Categories Accompanied by Exact Survey Language (N=47)

Service Category	Survey Language
AIDS Drug Assistance Program (ADAP)	ADAP: Access to FDA-approved HIV medications through the state
Counseling and Testing in Care Settings	HIV testing and counseling in a doctor's office or medical clinic
Health Education/Risk Reduction	Services that teach persons with HIV how to reduce the risk of giving it to others
Home Health Care	Home health care from a nurse or certified nurses aide
Hospice	End-of-life care
Local Pharmacy Program /Drug Reimbursement	Access to medications not covered under ADAP
Medical Nutrition Therapy	Nutrition evaluation and nutritional supplements
Medical Outpatient	Ongoing medical care for HIV disease
Medical Specialty	Medical care by a specialist (OB/GYN, cardiology, endocrinology, neurology, etc...)
Mental Health, Psychiatry	Psychiatric or mental health services
Oral Health Care	Dental care for people living with HIV
Rehabilitation	Physical recovery services (physical therapy or speech pathology)
Skilled Nursing	24-hour nursing care in a non-institutional, home-like environment
Substance Abuse, Treatment – Methadone	Methadone maintenance or detoxification services
Substance Abuse, Treatment – Outpatient	Outpatient substance abuse treatment or counseling
Treatment Education	Services that help people remember to take their medication on time and correctly
Home-based Case Management	Case management for individuals who are physically impaired and can't leave home
Housing Case Management	Case management to assist people with locating and getting appropriate housing
Medical Case Management	Case management services provided by a nurse
Psychosocial Case Management	Case management provided by a case worker or social worker
Transitional Case Management	Case management for people who are being released from prison/jail
Transitional Case Management – Youth	Case management for runaway, homeless, and emancipating/emancipated youth
Emergency Shelter	Emergency shelter for persons who are homeless
Medical Transportation – Bus Passes	Bus passes to access HIV medical care
Medical Transportation – Bus Tokens	Bus tokens to access HIV medical care
Medical Transportation – Taxi Voucher	Taxi vouchers to access HIV medical care
Permanent Supportive Housing	Rental housing with linkages to case management and other services
Rental Assistance	Section 8 and other rental assistance that help pay rent throughout the year
Residential Care Facility for the	Housing, supervision and nursing care

Appendix A: List of Available Ryan White Services

Chronically Ill	
Short Term Rent, Mortgage, Utility	Programs that help pay for rent when an emergency occurs because of HIV
Substance Abuse, Residential	Residential substance abuse programs
Transitional Housing	Transitional housing for persons who are homeless
Transitional Residential Care Facility	Housing, supervision, and non-medical care in a home-like setting
Benefits Specialty	Assistance with accessing public and private benefits
Child Care	Child care to allow a parent/guardian to attend medical and service appointments
Health Insurance Premiums and Cost Sharing	Financial assistance to help pay for health insurance
HIV LA Directory	The HIV LA Directory (booklet or Internet) to learn about HIV services
Language/Interpretation	Interpreter services (including sign language)
Legal	Legal assistance to fight discrimination and access public benefits
Mental Health, Psychotherapy	Counseling services that help to improve your quality of life
Nutrition Support – Food Bank	Groceries or food bank services
Nutrition Support – Home Delivered Meals	Home-delivered meals
Outreach	Outreach workers to assist people in finding medical care
Peer Support	Peer-led support and educational group services
Referrals	Assistance with accessing HIV services (using telephone/written communication)
Respite Care	Services to relieve a caregiver
Workforce Entry/Re-entry	Services to help people start or return to work

Appendix B: Sampling Probabilities by Facility

Table B: Sampling Frame and Accompanying Probabilities and Sampling for 2010-11 LACHNA Care Survey

Sampling Strata	Universe of Sampling Unit	Sampling Probability	Sampled	Patients Sampled
HIV Clinical Care	L.A. Gay and Lesbian Center	Certainty	Yes	30
	AHF Hollywood	Certainty		
	AHF L.A. Westside	Certainty	Yes	20
	St. Mary Medical Center CARE Program & Clinics	Certainty	Yes	19
	Rand Schrader Clinic	Certainty	Yes	19
	AHF Downtown L.A.	Certainty	Yes	16
	Martin Luther King Jr./Drew Medical Center-OASIS	Certainty	Yes	13
	ALTAMED (Whittier Blvd)	Certainty	Yes	13
	Northeast Valley Health Corporation	Certainty	Yes	10
	Tarzana Treatment Center	Non-Certainty	Yes	10
	Harbor/UCLA Medical Center	Non-Certainty	Yes	9
	AHF San Fernando Valley	Non-Certainty	Yes	9
	Maternal and Child Adolescent Clinic	Non-Certainty	Yes	7
	Olive View Medical Center	Non-Certainty	Yes	7
	LAC Hubert H. Humphrey Comprehensive Health Care	Non-Certainty	Yes	6
	City of Long Beach - AIDS Program	Non-Certainty	Yes	6
	T.H.E. Clinic, Inc. (To Help Everyone)	Non-Certainty		
	East Valley CHC - Pomona	Non-Certainty	Yes	6
	City of Pasadena	Non-Certainty	Yes	9
	ALTAMED - Pico Rivera	Non-Certainty		
	AHF Whittier	Non-Certainty	Yes	7
	East Valley CHC - West Covina	Non-Certainty		
	Long Beach CHC	Non-Certainty		
	Valley Community Clinic	Non-Certainty		
	ALTAMED Health Service Corp - El Monte Clinic	Non-Certainty		
	High Desert Health System	Non-Certainty		
	Memorial Miller Children's Hospital	Non-Certainty		
	Watts HealthCare Corporation	Linked		
	AHF Redondo Beach	Linked		
	RS Weingart EIC	Linked	Yes	4
	AHF El Monte	Linked		
	Adolescent Medicine - Children's Hospital LA	Linked		
	AHF Lancaster Healthcare Center	Linked	Yes	3
	Catalyst	Linked		
	AHF Carl Bean HCC	Linked		
Residential Services	PATH - People Assisting the Homeless	Certainty	Yes	1
	Salvation Army Alegria	Linked	Yes	1
	Project New Hope - Our House	Linked		

	Project New Hope - Padua House	Linked		
	Project New Hope - Benton/Dallas House	Linked	Yes	2
	Serra Ancillary - Casa Madona Y Nino	Linked		
	Serra Ancillary - Casa Portiuncula	Linked		
	Serra Ancillary - Casa De Corazon	Linked		
	Serra Ancillary - Casa De Nuestra Senora	Linked	Yes	2
	Salvation Army Alegria Emergency Shelter	Linked		
	Project New Hope - Frank Cala House	Linked	Yes	1
	Project New Hope - Pioneer Home	Linked		
	L.A. Family Housing Corp.	Linked		
	Wells House Hospice Foundation, Inc.	Linked		
Social Services	AIDS Project Los Angeles-Nutritional Support	Certainty	Yes	32
	AIDS Project Los Angeles-Social services	Certainty	Yes	15
	AIDS Service Center	Certainty	Yes	7
	Project Angel Food	Non-Certainty		
	Minority AIDS Project	Non-Certainty	Yes	7
	Bienestar - Hollywood	Non-Certainty		
	Spectrum	Non-Certainty	Yes	7
	HALSA	Non-Certainty		
	Bienestar - East LA	Non-Certainty	Yes	6
	JWCH Institute, Inc.	Non-Certainty		
	El Proyecto del Barrio	Non-Certainty		
	South Bay Family Healthcare Center	Non-Certainty	Yes	6
	Common Ground	Non-Certainty	Yes	6
	Bienestar-Long Beach	Non-Certainty		
	Special Services for Groups (API Foundation)	Non-Certainty	Yes	6
	Rainbow Bridge	Linked		
	Antelope Valley Hope Foundation	Linked		
	Whittier Rio Hondo AIDS Project	Linked	Yes	5
	Foothill AIDS Project	Linked		
	Women Alive	Linked	Yes	6
	Being Alive- PWA Action Coalition	Linked	Yes	6
	Bienestar Pomona	Linked		
	Center for Health Justice	Linked		
	Greater Los Angeles Council on Deafness	Linked		
	Bienestar Long Beach	Linked		
Substance Abuse Services	CRI-HELP	Certainty	Yes	1
	Substance Abuse Foundation - Transitional	Certainty	Yes	5
	Van Ness Recovery House	Linked	Yes	4
	Palms Residential Care	Linked		
	Substance Abuse Foundation - Sobriety House	Linked		

	Behavioral Health Services-American	Linked	
	Substance Abuse Foundation - Day Treatment	Linked	
	LACADA (L.A. Center for Alcohol & Drug Abuse)	Linked	Yes	2
	Tarzana Treatment Center - Long Beach	Linked	
	Behavioral Health Services-Redgate	Linked	Yes	1
	Prototypes/Warn Women's Center-Rehab	Linked	
	Watts HealthCare Corporation - House of Uhuru	Linked	Yes	1
	Palms II Residential Care	Linked	
	Tarzana Treatment Center - Lancaster	Linked	
Oral Health Services	AIDS Project Los Angeles-Dtown Oral Health Clinic	Certainty	Yes	25
	St. Mary Medical Center CARE Program-Oral Health	Non-Certainty	Yes	9
	Northeast Valley Health Corporation-oral health	Non-Certainty	Yes	7
	USC School of Dentistry	Non-Certainty	
	AIDS Project Los Angeles-S Mark Tapper Foundation	Non-Certainty	Yes	6

Certainty selection sampling units have a sampling probability of 1

Non-certainty selection sampling units have a sampling probability of <1

Linked sampling units have a sampling probability <1 and EPL<80 patients

Appendix C: Identifying Service Gaps

Exact Survey language for used to Identify Service Gaps

Assessment of Service Needs

1. Please check all the Health-Related services you're **AWARE** HIV-positive individuals could receive:
    a. *[List of all 47 available services]*

2. Please check all the Health-Related services that you **NEEDED** in the past 12 months.
    a. *[List of all 47 available services]*

3. Please check all the Health-Related services that you **RECEIVED** in the past 12 months.
    a. *[List of all 47 available services]*

Identifying Service Gaps

4. Earlier you stated that you **NEEDED** but did not **RECEIVE** *[service]*. What is the main reason why you had trouble getting this service?
    1 = Too much paperwork or red tape
    2 = Too many rules and regulations
    3 = The service provider or persons providing services was/were insensitive to my issues and concerns
    4 = The amount of time that I had to wait to get an appointment was too long
    5 = The amount of time that I had to wait in a waiting room before I received the service(s) was too long
    6 = The organization did not provide the right referrals to the services I needed
    7 = I was not aware that a service or treatment was available to me
    8 = I was not aware of a location of the service(s)
    9 = I was not aware of whom to ask for help
    10 = Other reason

Appendix D: Map of Los Angeles County Service Planning Area*

Antelope Valley
654 (1%)
169

San Fernando
6,609 (14%)
308

San Gabriel
3,263 (7%)
186

Metro
17,905 (38%)
1,594

West
2,587 (5%)
405

South
4,970 (11%)
488

East
3,067 (7%)
236

South Bay
7,857 (17%)
512

Legend
Number of Persons (%)
Rate per 100,000 population

N

0   5   10   15
Miles
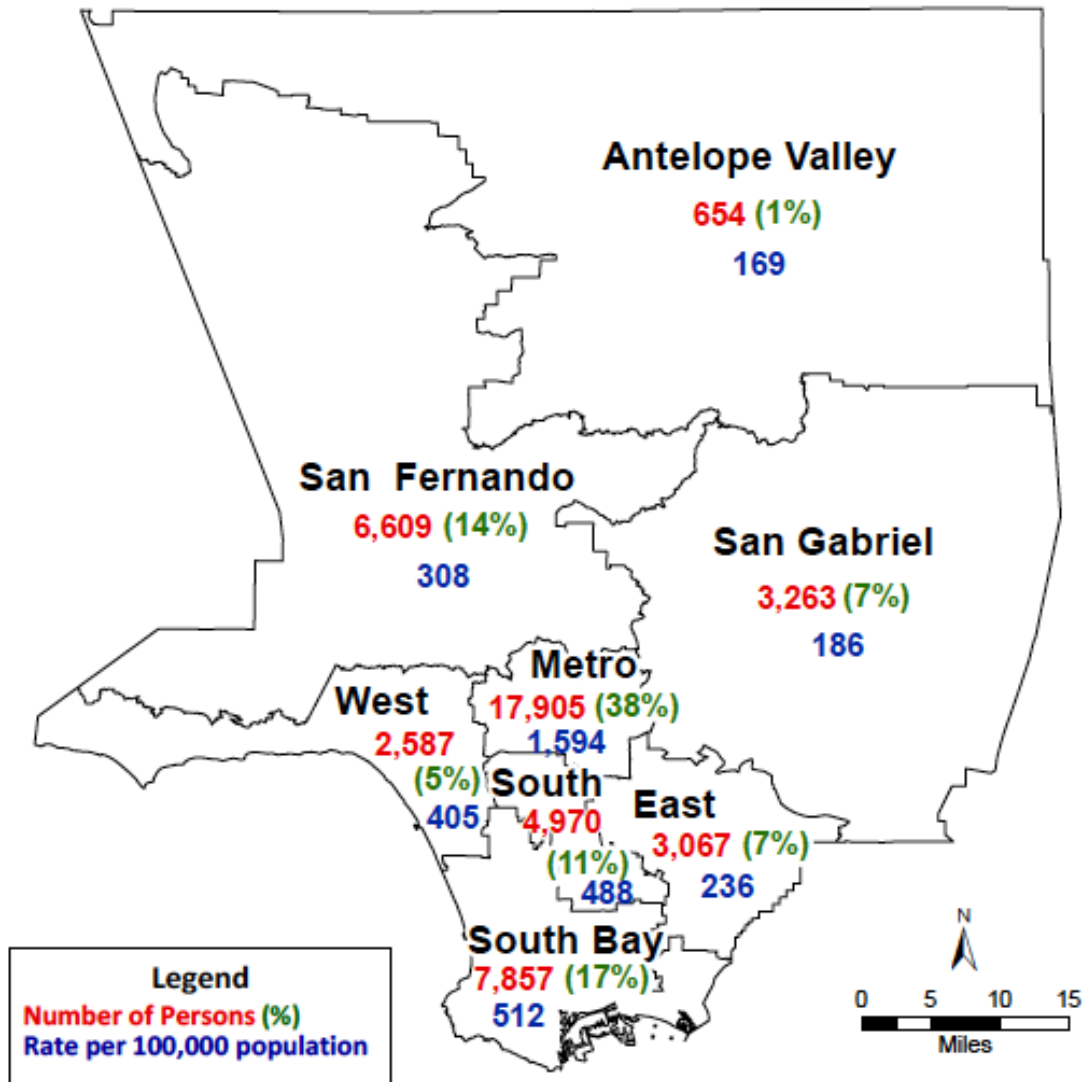
* Rates are based on population estimates (PEPS) for 2012.
** Does not include 236 Persons (<1%) whose information on
   SPA at time of diagnosis was unknown.

*** DHSP, 2014

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