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# Factors Associated with Pre-Exposure Prophylaxis (PrEP) Adherence Self-Efficacy among High-risk Drug Users in Treatment

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**Factors Associated with Pre-Exposure Prophylaxis (PrEP)**  
**Adherence Self-Efficacy among High-risk Drug Users in Treatment**

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Bachelor of Science in Nursing  
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A Thesis  
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Requirements for the Degree of  
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University of Connecticut  
2017

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Chanchala Tiwari

2017

# APPROVAL PAGE

Masters of Science Thesis

Factors Associated with Pre-Exposure Prophylaxis (PrEP) Adherence  
Self-Efficacy among High-risk Drug Users in Treatment

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## ABBREVIATIONS

ACASI	Audio Computer Assisted Self-Interview
AIDS	Acquired Immunodeficiency Syndrome
ART	Anti-Retroviral Therapy
BINI	Brief Inventory of Neurocognitive Impairment
CDC	Center for Disease Control and Prevention
CES-D	Center for Epidemiological Studies Depression Scale
CFA	Confirmatory factor analysis
CFI:	Comparative Fit Index
EFA	Exploratory Factor Analysis
FDA	Food and Drug Administration
HIV	Human Immunodeficiency Virus
IDU	Injection drug use
IRB	Institutional Review Board
IMB	Information-Motivation-Behavioral Skills
MMT	Methadone Maintenance Therapy
MSM	Men Who Have Sex with Man
NCI	Neurocognitive Impairment.
NIDA	National Institute on Drug Abuse
NIS	Neuropsychological Impairment Scale
OUDS	Opioid Use Disorders
PLWH	People Living With HIV
PrEP	Pre-Exposure Prophylaxis
PWUD	People Who Inject Drug
PCA	Principal Component Analysis
STD	Sexually Transmitted Disease
RMSEA	Root Mean Square Error of Approximation

UNAIDS	United Nations Program on HIV and AIDS
VIF	Variance Inflation Factor
WHO	World Health Organization

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## ABSTRACT

**Background:** Recent studies on Pre-exposure prophylaxis treatment (PrEP) has received significant recognition as a promising preventive strategy among high risk individuals. Likewise, rapid growth of research on information and communication technology regarding HIV prevention has also demonstrated a strong influence on health behaviors. Although a significant amount of research has been conducted on willingness, perceived risk of PrEP use, and NCI as predictors of HIV risk behavior, no study to date, has explored the impact of various motivation factors along with the use of internet & communication technology devices and psychological aspects on PrEP adherence self-efficacy. So, the objectives of these analyses were to examine whether various motivation factors, psychological factors, and communication technology predicts PrEP adherence self-efficacy.

**Method:** The study was conducted among 400 HIV-negative high risk PWUD enrolled in a community based methadone maintenance treatment program and reporting drug and /or sex related HIV risk behavior in the past 6-months. Participants completed an audio-computer-assisted self-interview (ACASI) which measured motivation, Neurocognitive impairment (NCI), depression, use of internet and technology devices and adherence self-efficacy. A factor analysis was conducted to determine different motivation factors. In order to examine significant association, we conducted linear regression analyses of different factors on PrEP adherence self-efficacy.

**Result:** The analysis showed the social motivation ( $\beta=.32$ ,  $p=.00$ ) and attitudes about PrEP use ( $\beta=.139$ ,  $p=.004$ ) predicted PrEP adherence self-efficacy. However, intention motivation for PrEP

( $\beta = -0.241$ ,  $p > 0.05$ ) showed a reciprocal relationship with adherence self-efficacy. Finding highlights that use of internet ( $\beta = 0.09$ ,  $p = 0.017$ ) has a positive impact on adherence self-efficacy along with the use of technology devices ( $\beta = 0.213$ ,  $p < 0.05$ ). On the other hand, psychological factor which involves depression ( $\beta = 0.145$ ,  $p = 0.04$ ) marginally predicts PrEP adherence self-efficacy, but NCI was not associated with PrEP adherence self-efficacy.

**Conclusion:** The results suggest that the accessibility of internet use among high risk drug users along with motivation for PrEP use can significantly contribute to PrEP adherence. The significant association with motivation and use of technology benefits strengthens our knowledge about important factors affecting PrEP use among high risk individuals that may be valuable to incorporate into future interventions.

# CHAPTER 1: INTRODUCTION

HIV continues to be a significant global health issue and a matter of concern among high risk drug users. Although the number of new HIV infections has declined by over 30% in the past decade, the number of people who contract new HIV infection each year is still unacceptably high (World health organization, 2016);(CDC, 2015b). People who uses drugs (PWUD) continue to account for HIV transmission related to the injection drug use. (“HIV Surveillance Report, CDC,” 2016) (World health organization, 2016) Despite HIV transmission being fueled through injection drug use, there remains inadequate attention and resources devoted to evidence based HIV prevention among high risk population. (Marshall & Wood, 2010);(UNAIDS, 2014);(“Opioids | National Institute on Drug Abuse (NIDA),” 2016). Furthermore, understanding the various important aspects of HIV transmission dynamics is an essential component in order to facilitate the containment of its epidemic.(UNAIDS, 2016)(Marshall & Wood, 2010) .

Reports on the global AIDS epidemic confirms that the decline in new HIV infections over the past 10 years is clearly linked with changes in behavior and social norms together with increased knowledge of HIV (UNAIDS, 2016);(World health organization, 2016). Due to prevailing barriers for HIV prevention strategies, it has now become a public health challenge.

In the current period, the concept of health, behavior and the continuum of care among the various vulnerable groups are directly shaped by the communication and health information technology (Hightow-Weidman, Muessig, Bauermeister, Zhang, & LeGrand, 2015)(Beck et al., 2014). In the core context to health care, the perspective of high risk population, ways for public search and use of health information significantly impact their behaviors and decisions. In addition, health literacy and motivation are the factors that may contribute to the willingness to adhere to

HIV prevention and treatment among the various high-risk populations. However, inequalities in internet access for the health related knowledge and motivation may be a limiting factor in that this is linked with the health disparities and awareness regarding the HIV prevention. (S. C. Kalichman et al., 2006);(Erik P. Bucy, 2008)(Hightow-Weidman et al., 2015).

Among the promising intervention for HIV prevention Pre-exposure prophylaxis (PrEP) is one of the preventive strategies for use before potential exposure to the HIV virus. The rising recognition of pre-exposure prophylaxis treatment has made a significant impact as a biomedical preventive strategy for HIV transmission. However, there is concern about the risk perception or sexual risk behavior and corresponding stereotypes of promiscuity and that the use of PrEP may undermine its preventive potential.

In terms of determining the underlying potential benefits of PrEP to high risk populations, the World Health Organization (WHO) has recommended that PrEP should be offered as a choice to people who are at substantial risk of HIV infection. New insights into the infection mechanism and the importance of the route of transmission may eventually lead to future preventive efforts. (UNAIDS, 2014). Breakthroughs in HIV prevention are important to the public including a variety of intervention such as antiretroviral therapy to the people living with HIV and PrEP for high risk HIV negative individuals.(Pre-exposure prophylaxis practice, 2014). Antiretroviral treatment (ART) medications markedly increase the survival of HIV infected persons and have long been the cornerstone of strategies to prevent vertical HIV transmission. PrEP is an HIV prevention strategy that involves the daily use of ART by HIV-negative persons to prevent infection and also have the potential for the wide range impact to overcome HIV acquisition.

Although studies have been conducted on the efficacy of PrEP and individual's adherence to it, to date there is limited evidence of motivation-related factors and adherence self-efficacy

(Liu et al., 2016);(Brooks et al., 2011). Available studies and reports support the efficacy of pre-exposure prophylaxis treatment in reducing the incidence of HIV infection as a new biomedical primary prevention approach among high risk HIV populations. However there is lack of data examining the possible role of internet use , information and technology to enhance motivation for PrEP adherence self-efficacy as an innovative and effective preventive approach for HIV (Laugesen, Hassanein, & Yuan, 2015). The health resources available through the use of internet and communication technology could improve behavior modification potential and boost participants' confidence in adhering to the appropriate treatment and intervention process to manage various health problem. (Curioso et al., 2007); (Jayakumaran, Aaron, Gracely, Schriver, & Szep, 2016).

The IMB theoretical model (Fisher, Fisher, & Harman, 2003) that is directly relevant to the performance of health behavior asserts that health-related information, personal or social motivation and behavioral skills are the critical determinants of health behavior performance. Based on the IMB model, understanding the adherence self-efficacy related to PrEP may be a key to identifying the potential predictors within the IMB constructs among this high-risk population (Sun Ju Chang, 2014). Similarly, prior studies based on the IMB model framework (Shrestha, Altice, Huedo-Medina, Karki, & Copenhaver, 2017) have shown significant associations in terms of willingness to use PrEP and IMB constructs. Another study also supports the potential adaptation of the IMB model for treatment adherence among a younger population (Rongkavilit et al., 2010). The study also suggests that consideration should be given to broadening the motivation construct to include other relational factors. While the IMB model have been utilized as a theoretical framework in examining a wide range of health behavior changes, it is yet to

explore the different forms of information and motivation constructs and examine the potential impact in terms of PrEP use and its adherence self-efficacy.

Evidence from prior studies and systematic reviews has shown the reciprocal relationship on neurocognitive impairment on medication adherence (Anand, Springer, Copenhaver, & Altice, 2010). In contrast study results demonstrates that participants with higher neurocognitive impairment and drug users have shown poor medication adherence and self- efficacy (Arentsen et al., 2016). Despite the success of ART in HIV prevention and treatment, NCI and other factors related to cognitive impairment has highly affected medication adherence and risk behaviors (Pineiro et al., 2016). Therefore, it is also important to look at the relationship between different cognitive factors and PrEP adherence self- efficacy which would be a contribution in developing potential effective intervention for medication adherence.

## **Specific Aims and objectives**

The aim of this study is to identify and investigate the factors influencing PrEP adherence self-efficacy among a sample of high risk drug users. Underlying the assessment and finding in prior studies in high risk populations this has become as a crucial priority. The objectives of this thesis are to investigate different aspects of motivation and attitude for the use of PrEP affecting the adherence self-efficacy (Chariyalertsak et al., 2011);(Brooks et al., 2011); (Turan, Fazeli, Raper, Mugavero, & Johnson, 2016). Secondary objectives of this study are to determine the potential role of internet, communication and technology alongside to identify the influence of NCI and depression as psychological factors on PrEP adherence self- efficacy. (Laugesen et al., 2015)(Meade, Conn, Skalski, & Safren, 2011).

## **CHAPTER 2: REVIEW OF LITERATURE**

### **2.1 Global Epidemiology of HIV/AIDS**

Along with the tuberculosis and Malaria, HIV is still one of the leading cause of death worldwide.(“WHO | Data and statistics,” 2016)(Fettig, Swaminathan, Murrill, & Kaplan, 2014).The HIV/AIDS epidemics has not left untouched any corner of the world and continues to exceeds the pessimistic projections made years ago. The human immune deficiency virus was believed to have originated from the historic trade routes of Congo basin in the 1920s. Researchers discovered that chimpanzee were the source of the HIV-1 virus and over the course of time it was found that those viruses have crossed species to humans (Worobey et al., 2010). The global HIV burden has claimed, approximately 36.7 million people worldwide living with HIV/AIDS as of the end of 2015 (World health organization, 2016). An estimated 2.1 million individuals worldwide became newly infected with HIV in 2015 and 60% of those people living with HIV know their status whereas remaining 40% are still unaware of their status(CDC, 2015a).

The prevalence of HIV is increasing in some geographical regions which is attributed to death averted from the antiretroviral treatment (Fettig et al., 2014);(UNAIDS, 2014). Unlike the HIV epidemics in the Asian and sub Saharan African countries, new infections and HIV related mortality has been steadily accelerating in the North Africa and Middle Eastern region. HIV/AIDS related deaths in sub Saharan Africa fell from 2005 to 2013 by 39% but with a very high original base rate, the region still accounted for 74% of the total HIV/AIDS related deaths. In comparison,



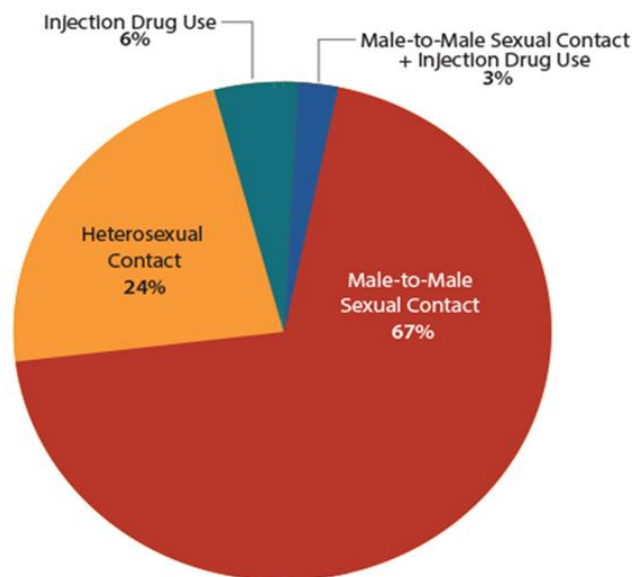
modest declines occurred (~ 27%) in Asia and the Pacific regions. In the Caribbean, it declined by 54%, in Latin America by 31% and by 19% in Oceania with lowest mortality rate of 2% in central Europe and North America. (Fettig et al., 2014); (UNAIDS, 2014)(GAP). Analyzing HIV diagnosis into various categories, the various reports presented in 2015, and the African American population appears to be most affected by HIV, with 45% of all new diagnosis. Similarly, Hispanics and Latinos populations are also strongly affected accounting for 24% of all HIV diagnoses (CDC, 2015a).

The worldwide response to HIV largely neglects young populations, which includes people trading sex, men who have sex with men (MSM), transgender population as well as people who injects drugs. These are key population especially vulnerable to HIV because they may engage willingly or not in behaviors involving frequent unprotected sex and the sharing of needles and syringes to inject drugs(“WHO | Data and statistics,” 2016). Furthermore, exploring those transmission categories, gay, bisexual and men who have sex with men are considered most at risk.(Merchant et al., 2016). People identifying as homosexual and bisexual accounted for 70% whereas, individuals infected through heterosexual sex made up 23% of all new HIV acquisitions. Global reports of 2014 also indicated that about 3.2 million children were living with HIV which comprises 9.1% of all people living with HIV (“HIV Surveillance Report, CDC,” 2016).

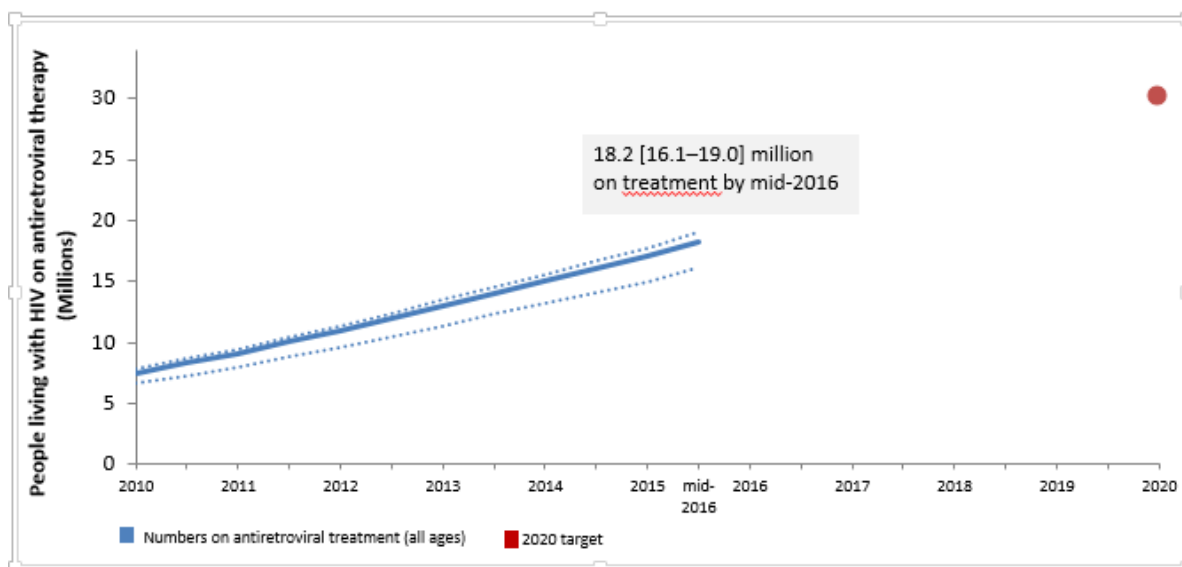
In the United States more than 1.2 million people are living with HIV and, of those 1 in 8 of the population are not aware of their HIV status. Six percent (2,392) of HIV diagnoses in the United States were attributed to injection drug use (IDU) and another 3% (1,202) to both male-to-male sexual contact and IDU(CDC, 2015b) (Figure 1). Annual national survey on drug use and health conducted in 2013 has estimated 24.6 million Americans aged 12 or older used illicit drugs in past month, which consists 9.4 percent of the population (“Opioids | National Institute on Drug

Abuse (NIDA),” 2016). About 18.2 million population people from all over the world living with HIV have access to antiretroviral therapy (ART) (Figure 2) as of June 2016 which is up from 15.8 million in 2015, 7.5 million in 2010, and less than one million in 2000 (“WHO | Data and statistics,” 2016). Untreated, HIV reduces the number of CD4 cells (T cells) in the body and continue to damage the immune system which makes it tougher to protect the body against infections. Reviews has shown the current gap in addressing some of the influential aspect including social stigma, social support and motivation to be impactful for HIV prevention. Reducing the incidence of HIV requires rapid and expansive primary HIV prevention strategies.(CDC, 2015) (“HIV Surveillance Report, CDC,” 2016)(“WHO | Data and statistics,” 2016).

**New HIV Diagnoses by Transmission Category  
(2015, n=39,513)**



**Figure 1- New HIV Diagnosis by transmission category 2015 [CDC Facts 2015]**



**Figure 2 - Number of people on antiretroviral treatment (ART) [UNAIDS/WHO] estimates**

## 2.2 Substance abuse, HIV risk, and Pre-exposure prophylaxis treatment

Substance abuse refers to a set of related conditions associated with consumption of mind and behavior altering substances that have negative behavioral and health outcomes. Social attitudes, political and legal responses to the consumption of alcohol and illicit drugs make substance abuse one of the most complex public health issues (“Healthy people 2020,” 2014). Although progress has been made in substantially lowering rates of substance abuse in the United States, use of substances continues to take a major toll on the health of individuals, families, and communities nationwide. (“Healthy people 2020,” 2014); (“Opioids | National Institute on Drug Abuse (NIDA),” 2016). Substance use can also contribute to these risks indirectly by lowering people’s inhibitions and making them less likely to use condoms.

Behaviors associated with drug abuse are also among the contributing factors in the spread of HIV in the US where injection drug use is responsible for approximately 10% of HIV cases annually (“National Institute on Drug Abuse (NIDA),” 2016). Effectively addressing high-risk populations requires supplemental efforts including providing them with tools such as condoms, PrEP care, and clean needles and syringes. In one study researchers found that 13.5% of participants reported currently injecting drugs and 82.3% had a history of injecting drugs with a higher prevalence of risk behavior among heroin injectors vs non-injectors (Tan, Kapiga, Khoshnood, & Bruce, 2015). In terms of gender differences in HIV risk behavior studies have shown an increased risk of HIV among the female participants, which was explained by injection partner being the same as the sexual partner (Evans et al., 2003). This shows the increase concerns regarding PWUD population as a high-risk group for HIV acquisition.

Prior studies have shown that interventions providing information, enhancing risk-reduction skills, and motivation the behavior change can reduce injection risk behavior. (M. M. Copenhaver, Lee, Margolin, Bruce, & Altice, 2011); (Kamarulzaman & Altice, 2015); (Wingood et al., 2004). PrEP represents a new biomedical approach to HIV prevention with the potential to become a powerful tool within the HIV prevention arsenal (HIV/AIDS, 2014) (Grant et al., 2010).

Truvada is currently the only drug approved for use as PrEP consists of a single pill that is a combination of two ARVs, (tenofovir and emtricitabine). This prophylaxis drug was approved by the U.S. Food and Drug Administration (FDA) to treat HIV in 2004, and it was approved by FDA for use as PrEP in July 2012 (HIV/AIDS, 2014). Study trials have shown that when taken consistently and correctly, PrEP is very effective among high risk individuals. Recent study trials have also shown that, among gay and bisexual men, those who were given PrEP were 44% less

likely overall to contract HIV than those who were given a placebo, and it reduced the risk of contracting HIV by 62 % among heterosexually active men and women.(Grant et al., 2010).

PrEP is a HIV prevention strategy that involves the daily use of ART by HIV-negative persons to prevent infection, but it also requires a multimodal, targeted approach including individual directed behavioral risk reduction approach to optimally prevent sexual transmission. In prior studies among injection drug users, the overall reduction of HIV infection was 49% and protection is increased to 75% among those who were on direct observation therapy during clinic visits (Choopanya et al., 2013); (Chariyalertsak et al., 2011). Antiretroviral medications markedly increase the survival of HIV infected persons and have long been the cornerstone of strategies to prevent vertical HIV transmission (Grant et al., 2010);(Chariyalertsak et al., 2011), and PrEP is now a significant step in the field of primary HIV prevention.

A recent study representing national retail pharmacy shows that the individuals who started “Truvada” has a gradually increased in first year of availability with an estimated 150 unique individuals in 2011 to the 1057 in first 3 quarters in 2013(Flash et al., 2014). The data indicates that the female comprises 42% of PrEP users and tend to be significantly younger ( $36.4 \pm 12.3$ ) than males ( $39.3 \pm 11.6$ ). PrEP users dropped to 22.9% later in 2013 (Flash et al., 2014). According to the new guideline by CDC, health care provider should consider advise patients to use the HIV prevention drugs only if they are at substantial risk of the HIV infection (CDC, 2015a).

PrEP is a new primary HIV prevention approach that requires continuous collaboration between the high-risk individuals and providers in order to boost the effectiveness because near perfect adherence to PrEP is essential. The population-level effectiveness of PrEP will depend on its acceptability, accessibility, adoption, and sustainability as part of a comprehensive HIV

prevention strategy. Appropriate PrEP uptake among those high-risk populations, coupled with high medication adherence, will help maximize PrEP public health impact.

## **2.2: Use of internet and Communication technology, PrEP and adherence self-efficacy.**

Health information in the current society is one of the most rapidly sought topics on the internet so that people can seek health information and manage their own healthcare more independently (Curioso et al., 2007). Recent findings show that more than 70, 000 websites disseminate health information which has led to patients shifting their role from passive recipient to active consumer of health information. In relation to being a health information consumer, 50 million people seek health information online, and this likely has consequences for the health care system (Beck et al., 2014);(Cline & Haynes, 2001). The internet offers widespread access to health information, and the advantages of interactivity, information tailoring, and anonymity. The majority of consumers (77%) seek health information for themselves and want disease information to use consultation with their physicians. Studies have shown that three quarters of online health seekers have made internet searches in conjunction with medical consultation. (S. C. Kalichman et al., 2006).

The rate of internet use has been increasing and many people relied on the web information and aware of different diseases, prevention and its treatment. Information and communication technology such as internet and mobile phones can deliver behavioral components for STD/HIV prevention and care to more people at less cost (Curioso et al., 2007). High-quality health information can be provided through websites, forums, blogs, and social networks, which have

been some of the most popular channels for health promotion among young people in the past 10 years (Beck et al., 2014). Prior studies have also shown that people who use internet for general purpose but also for health related purposes have demonstrated significant increase in self-confidence about the information related to medication adherence (S. C. Kalichman et al., 2006). Among those people, skills and knowledge regarding HIV has also increased significantly.

Furthermore, prior studies have reported those who use the internet for health care information have indicated that they experience improved knowledge about the illness, increased skills in coping, and greater support from others. (Van der Elst et al., 2013); (Kalichman SC, Cherry C, Cain D, et al.2006). Persons who used the internet for HIV related information were more likely to have an undetectable viral load compared to persons who had not used the internet. The disparities in internet use identified in this study suggest that individuals who access the internet, particularly for health information, are among the better resourced and healthier persons living with HIV/AIDS(Cline & Haynes, 2001). Analysis of internet and technologies users have shown that 26.6% (126/474) of participants reported utilizing online health information without seeking medical consultation. Further, 33.1%(157/474) reported they modified their healthcare based on the information they found on the internet(Beck et al., 2014).

Although increasing number of people accessing internet reported from prior studies (Cline & Haynes, 2001), but lack of awareness among high risk populations have appeared as barriers for the accessibility and adoption of such powerful approach for HIV prevention. On the other hand, increasing trends of access of internet and its effective use had shown potential benefits to high risk people in terms of their self-awareness of health-related information. Improved information access through use of the internet and technology enhance the patients confidence in understanding of health condition making better health choices that leads to improved health outcomes and

adherence to the preferred treatment.(Erik P. Bucy, 2008);(Murray et al., 2003); (Laugesen et al., 2015).

A cross sectional study on immediate PrEP uptake had shown that awareness on such a biomedical approach increased the ratio of participant's interest in using PrEP, and that those on PrEP reported peer, internet, and their partners as their primary sources for treatment motivation. (Krakower et al., 2012). With respect to internet access, perceived health information from the internet has shown to be significantly linked with users adherence to the treatment (Laugesen et al., 2015). On the other hand, access to health information have positive effects on improving individual's' treatment decision making, development of sense of control over their health, and being connected to a broader community coping with similar illnesses (S. Kalichman, 2002). Therefore population-level effectiveness of PrEP will depend on its acceptability, accessibility (including via technology), adoption, and sustainability as part of a comprehensive HIV prevention strategy.

## **2.4: Motivations, Pre-exposure prophylaxis and adherence self- efficacy**

### **2.4.1: Social support and motivation**

Antiretroviral medications markedly increase survival of HIV infected persons and have been the cornerstone of strategies to prevent vertical HIV transmission (Grant et al., 2010); (Chariyalertsak et al., 2011).Studies have shown that, despite the low utilization of PrEP, low self-perceived knowledge of PrEP, and a high prevalence of condom less anal intercourse, fewer than half of those same participants were interested in learning more about PrEP. (Merchant et al., 2016). Furthermore, recent studies have shown that, motivations were highest among men who



reported condom-less sex with both their primary and outside partners whereas, and lowest among men who had sex only with their primary partner (Gamarel & Golub, 2015). A prior intervention study among young MSMs demonstrated an increase in skills and knowledge regarding HIV, although the intention to use PrEP was associated with lower condom use among the study population (Bauermeister, Meanley, Pingel, Soler, & Harper, 2013).

In addition, descriptive studies have revealed that their past experience on taking medication was linked with adherence self-efficacy. Some participants of these studies have indicated their worries about the effectiveness and difficult in adhering to PrEP (Van der Elst et al., 2013); (Bil, van der Veldt, Prins, Stolte, & Davidovich, 2016).

Reductions in high-risk sexual behaviors to date have been based on theoretical models such as the Social Cognitive Theory (Bandura, 2004), addressing personal self-efficacy, assessing ability and willingness to modify behavior in injection drug users (IDUs) with HIV. Likewise, the Information-Motivation-Behavioral Skills Theory (Fisher, Fisher, Williams, & Malloy, 1994) which conceptualizes determinants of behavior that have the capacity to impair or improve health status. Findings reported on adherence self-efficacy and healthy behavior modification involves various components which influence its change through educational, motivational, peer-guided, and skill-building techniques (Coates, Richter, & Caceres, 2008).

Lack of awareness and feasibility of HIV treatment serves as a barrier to PrEP and also illustrates that behavior counselling and motivation are essential to increase in the adherence for PrEP use (Bauermeister et al., 2013). Prior studies on PrEP had shown lower adherence self-efficacy as an outcome of increased perceived medication side effects, whereas significantly positive outcomes have been associated with social stigma. (Zhang et al., 2016). Recent study results had indicate that social support is one of the predictor of higher medication adherence and

self-efficacy (Turan et al., 2016). Intention to use PrEP, however has been shown a negative effect on risk reduction self-efficacy.

Likewise, predictors of ART adherence among minority population shows that that lower self-efficacy was related to lower social support and motivational readiness was predicted by higher adherence self-efficacy (Kolmodin MacDonell, J. Jacques-Tiura, Naar, & Isabella Fernandez, 2016). Thus it is essential to explore the effects of motivation factors for PrEP use on individual's adherence self-efficacy as well as the impact of social and personal motivations on new biomedical approaches for HIV prevention.

#### **2.4.2: Attitude towards pre-exposure prophylaxis treatment and intention motivation**

Due to the socially marginalization of the people who injects drugs it is also unpalatable to provide adequate health services to those population.(UNAIDS, 2014). Such stigmatized and discrimination were considered as a major barrier in their willingness or intention to adopt biomedical intervention and treatment. So, peer network and their motivation had a great impact on improving knowledge, positive attitude regarding HIV prevention and accessing to health care services. Study reports had shown that high intention to use PrEP is associated with the low perceived self -efficacy(Cohen et al., 2015).Adherence to PrEP use is critical aspect and strongly associated with efficacy of the medication. Researchers have found that PrEP adoption intention is also associated with the risk perception. Therefore, in order to facilitate the PrEP adoption, community awareness and information have shown its significant role which address the perception among high risk individuals.(Brooks et al., 2012). Assessment on the Pre exposure

Prophylaxis and their association with PrEP adoption demonstrated that only 33% of total participants were aware of PrEP (Brooks, Landovitz, Regan, Lee, & Allen, 2015). Further, lower PrEP adoption were associated with negative perceptions regarding PrEP which may limit its uptake among those high-risk population.

One study(Copeland et al., 2017) illustrated that less than half of the participants were “very” or “extremely” familiar with the biomedical interventions such as microbicides, PrEP and other experimental vaccines. Further questions related to familiarity with those treatments, knowledge and attitudes were answered correctly less often (73%, 54%, and 45%, respectively. Moreover, higher overall knowledge scores were related to more positive attitudes regarding PrEP than those with less positive attitudes. Additional assessment from the randomized control trials, demonstrated the acceptability of PrEP but PrEP adherence were not up to the expectations.(Grant et al., 2010) ;(Hoff et al., 2015) (grant M , Hoff).

Researchers have found that, among HIV negative couples, partner support can increase the positive attitude about PrEP and potentially help with the PrEP use intention and adherence (Hoff et al., 2015). Although the results of the trials were in a the promising directions, a better understanding of variables that impact which attitude, intention and adoption of PrEP is a priority in present situation (Jayakumaran et al., 2016);(Zhang et al., 2016);(Arnold et al., 2017). Positive intention and appropriate risk perception regarding HIV transmission and prevention may play a key role in PrEP adherence and the development of PrEP treatment and adherence self-efficacy (Mey et al., 2017a); (Jayakumaran et al., 2016);(McCormack et al., 2016).

### **2.4.3: Neurocognitive impairment, depression, and adherence self- efficacy**

The adherence to the medication is crucial self-care behavior for people living with HIV as well as for optimal benefits of high risk individuals. In relation to self-efficacy, it is associated with health related behavior along with medication adherence like ART, and PrEP treatment in the context of HIV (McCormack et al., 2016). The prevalence of human immune deficiency virus has given rise to a new spectrum of neurocognitive and psychological impairment which hinders those individuals for the utilization of the available treatment and prophylaxis measures for prevention of the HIV (Meade et al., 2011); (Cross, Combrinck, & Joska, 2013). The core construct of the social cognitive theory applies to confidence in engaging in behaviors leading to the desired outcomes.

In the context of ART adherence self-efficacy and an individual's psychosocial aspect, studies among HIV infected individuals with higher adherence self-efficacy consistently demonstrate lower depression status. Likewise, analysis findings also reported low adherence self-efficacy resulting in poor health outcomes (Johnson et al., 2007); (Bandura, 2004). In regards to neurocognitive complication, a retrospective study among HIV infected people with ART treatment has shown deterioration of the neurocognitive abilities and depressive mood compared to HIV-sero-negatives individuals (Mey et al., 2017b).

In addition, studies have also shown that further impairment in verbal, auditory and learning abilities which have been observed among drug and alcohol users interferes with health management, high order thinking and medication adherence. ("Opioids | National Institute on Drug Abuse (NIDA)," 2016); (Carroll et al., 2016). Another study examining the relationship between

neurocognitive functioning and medication adherence has reported that drug dependence acts as mediator of cognitive function leading toward poor adherence (Meade et al., 2011).

A cluster randomized control trial has shown that the alleviation of the depression is improved with high adherence self-efficacy and also mediated by higher adherence motivation for the treatment (Wagner et al., 2017). Limited studies have gone in depth to examine the impact of depression and cognitive functioning on ART and other types of HIV treatment adherence, such as PrEP. However, there is reason to predict that of the improvements in motivation and self-efficacy that may translate to enhanced of adherence self -efficacy and self-care health behaviors for HIV prevention.

## **CHAPTER 3: RESEARCH QUESTION AND HYPOTHESES**

### **Research Questions**

1. Does motivation for PrEP predict PrEP adherence self-efficacy among high risk drug users?
2. Does technology & internet use and psychological factors (NCI and Depression) have a potential influence on PrEP adherence self-efficacy?

### **Research Hypotheses**

The following hypotheses will be tested in this study to see the potential influence of motivation, internet & technology use along with psychological factor on confidence in developing PrEP adherence among high risk drug users.

**Hypothesis 1:** Motivation for PrEP use predicts PrEP adherence self-efficacy.

**Hypothesis 2:** There will be a significant relationship between the use of technology and internet and PrEP adherence self-efficacy.

**Hypothesis 3:** There will be a significant impact of NCI and depression on PrEP adherence self-efficacy.

## **CHAPTER4: METHODS**

### **4.1 Design**

This is a secondary data analysis of a pilot study of PrEP treatment approach conducted among sample of high risk drug users enrolled in Methadone Maintenance Treatment (MMT). The pilot study design was cross-sectional survey method using a convenience sampling approach. The sample data were collected by trained graduate research assistants and clinical research facilitators.

### **4.2 Participants**

A total of 400 participants were recruited using convenience sampling between June and July 2016 at the APT Foundation, Inc., in New Haven, CT. The eligible criteria for the study were, a) 18 years or older, b) HIV-negative, c) reported drug- or sex-related HIV risk behaviors in the past 6 months, d) met DSM-V criteria for opioid use disorders (OUDs), e) enrolled in MMP, f) able to understand, speak, and read English, and g) able to provide informed consent. A total of 438 participants completed the initial screening form, twenty-eight were screened out because they did not meet eligibility criteria. Of those who were eligible to participate (n=410), one participant did not complete the survey and nine did not agree to participate in the study. Therefore, the final sample size included 400 participants in this study.

### **4.3 Study setting and procedures**

This cross-sectional study was conducted among high-risk drugs users within APT Foundation, which is a community-based facility in New Haven, Connecticut that provides drug treatment and clinical care to opioid- dependent adults. Participants were recruited via flyers, peers, word-of-mouth, and direct referral from counselors at APT Foundation. Individuals who met inclusion criteria, and who were willing to participate, were provided a description of the study and invited to provide informed consent, followed by the study survey. Participants were assessed using audio computer assisted self-interview (ACASI) which has demonstrated sound psychometric properties in prior studies(M. M. Copenhaver et al., 2011) and controlled trials(M. M. Copenhaver, Lee, & Margolin, 2007). All participants were reimbursed for the time and effort needed to participate in the survey.

### **4.4 Measures**

Participant's demographics were collected including age, gender, sexual orientation, ethnicity, marital status and educational status. Other variables of interest were motivations for PrEP, use of internet and technology, NCI, depression and PrEP adherence self- efficacy.

#### **4.4.1 Motivations for PrEP**

Motivations for PrEP use was assessed a 16-item questionnaire. For the validation of the questionnaire exploratory and confirmatory factor analyses were conducted and their model fit estimates and significance were examined (see Appendix Table8, Table 9). Participants were



assessed for their social motivation (e.g., “I have family members or friends to encourage me to take PrEP properly.”), intention motivation (e.g., “If I were on PrEP, taking it properly as prescribed would be hard”) and attitude towards PrEP (e.g., When on PrEP, I don’t need to use new or clean needles) all on a 5-point Likert scale (ranging from 1 = ‘strongly disagree’ to 5 = ‘strongly agree’). The reliability of the three domains of motivation that resulted from the EFA and CFA were within acceptable range (by factor social motivation  $\alpha=0.72$ , intention motivation  $\alpha=0.82$ , attitude toward PrEP  $\alpha=0.72$ ). Higher scores indicated greater motivations.

#### **4.4.2 Use of the internet**

Participants were assessed for their use of internet for health information which was measured with 7 items on a 5-point Likert scale (ranging from 1 = ‘never’ to 5 = ‘all the time’) (S. Kalichman, 2002). In order to measure internet use, the following items were included. Do you: 1) Access the internet across all your devices? 2) Search the web for general information? 3) Search the web for health-related information? 4) Search the web for HIV-related information? 5) Search the web for HIV experiences, treatment? 6) Search HIV-related news articles? 7) Search online for sexual partners? Scores ranged from 1 to 35 with higher score indicating higher use of internet. The mean score on these questions was computed and the reliability of the items were tested (Cronbach alpha =0.759) which indicated the reliability of these questions used.

#### **4.4.3 Use of communication technology device**

Participants were also assessed for their use communication technology device for health information. An adapted version of a questionnaire (Krishnan et al., 2015); was used to measure participants’ access to and frequency of using various types of communication devices (e.g.,

landline telephone, cell phone, tablet, laptop, personal computer, etc.). Participants were asked how often they use various types of communication technologies on a 5-point Likert scale (ranging from 1 = ‘never’ to 5 = ‘all the time’) (Shrestha, Huedo-Medina, Altice, Krishnan, & Copenhaver, 2016). The mean score on these questions was computed and the reliability of the items were tested (Cronbach alpha =0.853) which indicated the reliability of these questions. Higher scores indicated greater use of technology device for health information.

#### **4.4.4 Neurocognitive impairment (NCI)**

Neurocognitive impairment status of the participants was evaluated using the Brief Inventory of Neurocognitive Impairment (BINI). The BINI is a brief, self-report measure of 57-items and 9 factors which have demonstrated excellent overall reliability ( $\alpha=0.97$ ) (M. Copenhaver, Shrestha, Wickersham, Weikum, & Altice, 2016). It is a convenient tool developed as a rapid way to elicit diagnostically relevant information about generalized NCI which is categorized as “Global Impairment” as well as specific symptom areas (e.g., attention, memory, linguistic functioning, etc.). The Global Impairment factor is measured by 22 items (e.g., “I have difficulty paying attention” and “I get lost easily”), A Language-related factors included 5 items (e.g., “My words get mixed up”), Memory-related factor includes 4 items (e.g., “I have trouble remembering people’s names”), Academic-related factors consists of 8 items (e.g., “I count with my fingers” and “I have trouble learning new things”), while the psychomotor/physical question contained 5 items (e.g., “I am very”) clumsy and the Psychomotor/perceptual related factors comprised of 5 items (e.g., “I have trouble with the left side of my body”). The anger-related had 3 items (e.g., “I have urges to break and smash things”), the Pain-associated included 3 items (e.g., “I have severe headaches”), and the Traumatic Head Injury-related had 2 items (e.g., “I have been

knocked unconscious”). The overall BINI score was obtained by summing responses to all items. The nine factors ranged from good to excellent reliability (by factor: F1  $\alpha=0.97$ ; F2  $\alpha=0.89$ ; F3  $\alpha=0.82$ ; F4  $\alpha=0.76$ ; F5  $\alpha=0.79$ ; F6  $\alpha=0.75$ ; F7  $\alpha=0.75$ ; F8  $\alpha=0.74$ ; F9  $\alpha=0.73$ ).

#### **4.4.5 Depression**

Patients’ depressive symptoms over the previous week were assessed using the Center for Epidemiological Studies Depression Scale (CES-D). The (CES-D) is a 20-items self-report screening measure for depressive symptoms that has demonstrated excellent reliability and validity (Shrestha, Weikum, Copenhaver, & Altice, 2017). The items were rated on a 4-point Likert scale with 0 = *rarely or none of the time (less than 1 day)*; 1 = *some or little of the time (1–2 days)*; 2 = *occasionally or a moderate amount of the time (3–4 days)*; 3 = *most or all of the time (5–7 days)*. Total sum scores range from 0 to 60, with higher scores indicating increased levels of depression. Examples of questionnaire items used to measure depression were: 1) During the past week, you were bothered by things that usually don’t bother you. 2) During the past week, you did not feel like eating; your appetite was poor. 3) During the past week, you felt that you could not shake off the blues even with help from family or friends. 4) During the past week, you felt that you were just as good as other people. 5) During the past week, you had trouble keeping your mind on what you were doing. The overall internal consistency (Cronbach’s  $\alpha=0.864$ ) for the entire 20-item scale questionnaire.

#### **4.4.6 PrEP adherence Self- efficacy**

Participants were assessed with a set of 11 questions regarding PrEP adherence self-efficacy on 5-point Likert scale (ranging from 1 = *‘not at all confident*, 5 = *‘very confident’*)

(Shrestha, Altice, et al., 2017). Examples of the items used to measure PrEP adherence self-efficacy were: 1) How confident are you that you would remember to take PrEP every day? 2) How confident are you that you would stick to your PrEP medication even if you have some side-effects? 3) How confident are you that you could make PrEP part of your daily routine? 4) How confident are you that you could get PrEP refills before you run out? 5) How confident are you that you could fill your PrEP prescription no matter what it costs? 6) How confident are you that you could continue with your PrEP regimen even when people close to you say it isn't good? Scores ranged from 1 to 55 with higher score indicating higher adherence self-efficacy. The mean score on these questions was computed. The overall internal consistency for the entire 11-item scale was high (Cronbach's  $\alpha = 0.887$ ).

## **4.5 Data Analysis**

Data were analyzed using the statistical software (SPSS) Statistical Package for the Social Sciences, version 23.0[64] and R lavaan version 3.3.1 (see Appendix). A test of normality along with its graphical representation of the dependent variables were conducted. Tests for normality was carried out with a one-sample Kolmogorov Smirnov normality test. Histogram and Q-Q plot were used to specify the normal distribution pattern. Assumptions of the regression (linearity and homoscedasticity) were examined for the analysis. In order to check this assumption, the scatterplot of standardized residuals against standardized predicted values were plotted. Likewise, normality of residuals was examined by histogram and normal probability.

Descriptive statistics of the demographics along with other variables of interest which includes frequency, mean and percentages among variables of interest were provided by using SPSS software. The principle component analysis with "varimax" rotation, exploratory factor

analysis with four factors followed by confirmatory factor analysis were conducted. The model fit was determined with “Comparative fit index” and RMSEA (root mean square error of approximation) using the Lavaan package. The goal of this analysis was to sort out the different component of motivation for PrEP for validation of the components question.

In order to test our hypotheses, we conducted general linear regression for psychological variables and use of internet and technology. In the regression model, PrEP adherence self-efficacy was regressed with internet use, use of technology device, NCI and depression independently. Whereas multiple regression analyses were conducted for motivation for PrEP adherence self-efficacy, in this model, PrEP adherence self-efficacy was regressed with three factors of motivation (social motivation, intention motivation and attitude towards PrEP) controlling for demographic variables (age, gender, sexual orientation, ethnicity, marital status and educational status) due to their non-significant associations with the outcome variables.

## **CHAPTER 5: RESULTS**

### **5.2: Descriptive Statistics**

A total of 400 participants were included in the data analysis which consisted of 234 males (58.5%) and 166 females (41.5%) with mean age of (40.9). (Table1). The majority of participants were identified as heterosexual or straight (86.3%) and obtained minimum of the high school education (4.3%). The recruited participants were White (63.2%), African American (17.5%), Hispanic or Latino (15.3%) and other race (4%) (Table1) which indicates that the majority of the sample consists of white high-risk drug users.

The summary statistics (Table2) exhibits the mean scores from the predictor and outcome variables. A one-sample Kolmogorov Smirnov normality test was carried out for the dependent variable PrEP adherence self-efficacy which shows a non-significant ( $p=0.06$ ) indicating the hypothesis of normality was not rejected. Along with the normality test, the histograms (Appendix Figure 3) of the dependent variable showed the distribution is approximately normal. Likewise Q-Q plots have also shown the variables fall on the a linear trend (Appendix Figure 4) which supports the assumption of normal distribution.

As regression models should be assumed to have constant variance of the residuals (homoscedasticity), this assumption was examined. The scatterplot of standardized residuals against standardized predicted values plotted for PrEP adherence self-efficacy (see Appendix figure 5) shown that they were randomly scattered which verifies the assumption of homoscedasticity. The histogram and normal probability plot also shows whether there are deviations from normality. The bell-shaped curve of the histogram (Figure 6, Figure 7) and the probability plot (Figure 8) indicate the assumption of normality of residuals is met.

**Table 1 Demographic characteristics of participants (n=400)**

<b>Variables</b>		<b>N</b>	<b>Percent (%)</b>
<b>Gender</b>	Male	234	58.5
	Female	166	41.5
<b>Ethnic group</b>	White	253	63.2
	African American or Black	70	17.5
	Hispanic or Latino	61	15.3
	Other	16	4
<b>Marital status</b>	Married	83	20.8
	Divorced	65	16.3
	Separated	46	11.5
	Widowed	14	3.5
	Never married	192	48.0
<b>Sexual orientation</b>	Heterosexual	345	86.3
	Homosexual	9	2.3
	Bisexual	39	9.8
	Other	7	1.8
<b>Education</b>	Middle School	17	4.3
	High School,	90	22.5
	Junior (2-year) College	20	5.0
	Technical School	25	6.3
	College	62	15.5
	College Graduate	14	3.5
<b>In last 3months</b>	IV Injection	160	40
<b>Primary Method of illicit opiate use.</b>	Smoke	115	28.7
	Snort	47	11.8
	Oral	10	2.5
	Non-IV injection	2	5
<b>Age</b>	Mean (40.9 $\pm$ 11.08)		
	Total	400	100.0

**Table 2 - Summary statistics of motivations, internet and technology use, NCI and depression**

<b>Variables</b>	<b>N=400</b>		<b>Mean <math>\pm</math> S.D<sup>a</sup></b>
	<b>Min</b>	<b>Max</b>	
<b>Social motivation</b>	0	04	2.26 $\pm$ 0.75
<b>Intention Motivation</b>	0	04	0.84 $\pm$ 0.75
<b>Attitude</b>	0	04	2.53 $\pm$ 0.83
<b>Use of technology device</b>	07	42	25.36 $\pm$ 10.08
<b>NCI</b>	57	258	133.09 $\pm$ 44.71
<b>Depression</b>	0	51	24.33 $\pm$ 10.88
<b>Use of Internet</b>	07	35	16.84 $\pm$ 4.65
<b>PrEP adherence self-efficacy</b>	0	44	23.88 $\pm$ 8.72

Note: <sup>a</sup> Standard deviation

### **5.3: Factor Analysis**

Motivation for PrEP was measured using a Likert scale with 16 questions which consisting of various motivational components such as social motivation, motivation intention and attitude towards PrEP. In fitting the initial constructs, primary component analysis (PCA) was conducted using proportion of variance greater than or equal to (0.1). The PCA analysis indicated four possible factors to improve the fit of the model. Likewise, the exploratory factor analysis (EFA) determined a reduced number of items derived from higher factor loadings (Factor loadings >0.5) (see Appendix Table 8). Modifications of the constructs from the EFA resulted in 10 items of motivation domains which then were included in the confirmatory factor analysis (CFA) for the validation of the model fit. The confirmatory factor analysis (CFA) model yielded a good model



fit with [ $p < 0.05$ , Comparative Fit Index (CFI) = 0.95, [RMSEA 0.06] which is within an acceptable model fit range (Appendix Table 9). Further, a 95% confidence interval [CI (0.05, 0.08)] shows the lower range ( $< 0.08$ ) suggesting the acceptable model fit for the motivation for PrEP components (Table 9). The factor loadings of the CFA of the motivation domains included, social motivation, intention motivation and attitudes towards PrEP. The reliability of the three domains of motivation that resulted from the EFA and CFA were within acceptable range.

## **5.4: Regression analysis**

### **5.4.1 Influence of motivation for PrEP use on adherence self -efficacy**

A multiple regression analysis was conducted (Table 3) with general linear model while controlling demographic variables. This involved three motivation factors with their mean scores. Following the factor analysis of the motivation question we examined the potential effect of those factors on PrEP adherence self-efficacy. The analysis showed that motivation predicts PrEP adherence self- efficacy as hypothesized. The collinearity test has shown that there was no multicollinearity among the variables [variance inflation factor  $VF < 3$  (1.19, 1.21, 1.04)] (Table 3). Higher social motivation or social support ( $\beta = 0.32$ ,  $p = 0.00$ ) (table 3), predicts adherence self-efficacy.

Participants who indicated that they were had been motivated by family members, peer values among high risk drug users to take PrEP were more confident about being in PrEP. Similarly, attitude about PrEP use was also statistically significant ( $\beta = 0.139$ ,  $p = 0.00$ ) (Table 3) which indicates that positive attitude towards use of PrEP, was related to higher adherence self-

efficacy. In terms of intention motivation for PrEP there was an inversely proportional relationship ( $\beta = -0.24$ ,  $p < 0.05$ ) (Table 5) with PrEP adherence self-efficacy.

These results suggest that social support and positive attitudes towards HIV prophylaxis treatment among high risk drug users were associated with participants 'confidence in adherence to treatment. On the other hand, increased in intention motivation was related to lower PrEP adherence self-efficacy which may refer to decreased risk perception about HIV transmission and engaging in high risk behavior. The model summary of the regression analysis shows the motivation factors (social, intention and attitudes) as the potential predictors of PrEP adherence self-efficacy ( $R^2 = 0.168$ ), which shows that 16% of the adherence self-efficacy variance is explained by motivation factors.

**Table 3 - Regression analysis of social motivation, intention motivation and attitudes for PrEP on adherence self-efficacy**

<b>Variables</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>P&lt;0.05</b>	<b>VIF&lt;3<sup>a</sup></b>
<b>Social motivation</b>	0.30	0.05	0.00*	1.19
<b>Attitude towards PrEP</b>	0.14	0.05	0.00*	1.20
<b>Intention motivation</b>	-0.24	0.05	0.00*	1.04
<b>Age</b>	0.00	0.00	0.43	1.09
<b>Gender</b>	0.08	0.07	0.25	1.08
<b>Sexual orientation</b>	0.02	0.05	0.73	1.07
<b>Ethnic</b>	0.05	0.04	0.15	1.04
<b>Education</b>	-0.01	0.02	0.75	1.05
<b>Employment</b>	0.01	0.02	0.64	1.07

**Note:**

<sup>a</sup> VIF = variance inflation factor < 3

\* $p < 0.05$

### 5.4.2 Influence of internet use for health-related information and use of technology devices on PrEP adherence self-efficacy

Table 2 shows that participants reported significant use of the internet use (mean =2.6) and it was frequently used to search for health-related information, sexual partner and information related to HIV related prevention and treatment. The reliability of the questionnaire was tested (Cronbach alpha =0.76,  $\alpha > 0.7$ ) which implies acceptable reliability among the items used. In order to detect the influence of internet use and use of technology devices on PrEP adherence self-efficacy, a linear regression model was used to fit the data. This showed that participants who reported more use of the internet for HIV and health related information were more likely to have higher PrEP adherence self-efficacy ( $\beta=0.09$ ,  $p=0.02$ ) (table 4). Analyses also showed that participants who reported use of technology devices for the mode of communication and information reported higher adherence self-efficacy ( $\beta=0.21$ ,  $p<0.05$ ) (Table 4). These findings suggest that use of communication technology and internet may potentially have significant impact on high risk individuals being aware of HIV prevention and treatment along with enhancement of self confidence in utilizing biomedical approaches to reduce the possibility of HIV acquisition.

**Table 4 - Regression analysis on use of internet and technology device on PrEP adherence self -efficacy**

Variable	Coefficient	Std. Error	t	P<0.05
Use of Internet	0.09	0.04	2.40	0.02*
Use of Technology device	0.21	0.05	4.03	0.00*

\* $p<0.05$

### 5.4.3 Influence of Psychological factor on PrEP adherence self- efficacy

We also examined two psychological variables NCI (Neurocognitive impairment) and Depression as a predictor variable of PrEP adherence self-efficacy. Regression analyses were conducted to determine the potential influence of these variables. The analysis revealed that NCI was not a significant predictor of PrEP adherence self-efficacy ( $\beta=.03$ ,  $p=0.52$ ) (Table 5), while controlling for demographic variables as covariates. Similarly, we also examined the effects of depression while controlling for demographics. In this case, depression was found to be marginally associated ( $\beta=0.15$ ,  $p=0.04$ ) (Table 6) with adherence self- efficacy. In the combined model of psychological factors for PrEP adherence, however NCI beta coefficients showed a higher score with NCI associated with lower adherence self-efficacy ( $\beta= -0.37$ ,  $p>.05$ ) (Table 7). A positive association was found with depression, but it was not statistically significant ( $\beta= 0.16$ ,  $p>0.05$ ).

**Table 5 - Regression Analysis on NCI and PrEP adherence self- efficacy**

<b>Variables</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>t</b>	<b>P&lt;0.05</b>
<b>NCI</b>	0.03	0.05	0.65	0.52
<b>Age</b>	0.00	0.00	0.63	0.53
<b>GENDER</b>	0.13	0.08	1.48	0.14
<b>Sexual orientation</b>	0.01	0.06	0.09	0.93
<b>Ethnicity</b>	0.03	0.04	0.70	0.48
<b>Education</b>	0.01	0.03	0.39	0.69
<b>Employment</b>	-0.01	0.02	-0.30	0.76

**Table 6 - Regression Analysis on depression and PrEP adherence self-efficacy**

<b>Variables</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>t</b>	<b>P&lt;0.05</b>
<b>Depression</b>	0.14	0.07	1.98	0.048*

\*p<0.05

**Table 7 Combined model of depression and Neurocognitive impairment on PrEP adherence self-efficacy**

<b>Variables</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>t</b>	<b>P&lt;0.05</b>
<b>NCI</b>	-0.04	0.07	-0.55	0.58
<b>Depression</b>	0.16	0.09	1.68	0.09

## Chapter 6: Discussion

The goal of this study was to examine the potential influence of motivation, internet use, communication technology and psychological factors on PrEP adherence self-efficacy among high risk drug users. When the socio demographics were examined it revealed that the population distribution among the included categories were not in equal proportion, therefore, no any significant associations were ruled out with the outcome variable. (Table1). The regression analyses, however, were conducted after controlling for the demographic variables. Recent studies have also found similar results with regard to the impact of motivation on PrEP adherence and risk behaviors (Bauermeister et al., 2013);(Mey et al., 2017b).

In this study, various constructs of motivation have been yield with a good model fit conducted using EFA and CFA. We found the derived constructs of motivation were significantly associated with PrEP use and predicted higher adherence self-efficacy, with the exception of intention motivation resulted in a negative relationship with PrEP adherence self-efficacy. Prior studies have predicted the positive effects of social motivation and attitude(Brooks et al., 2012); (Khumsaen & Stephenson, 2017), whereas higher perceived HIV risk or perceived severity of disease resulting in lower adherence self-efficacy. With regards to prior findings, intention to use PrEP is highly associated with increased risk behavior, there exists a intention and risk behavior relationship that concerns the need to explore intervention in future to bridge the gap. Our study findings support the hypotheses and expands upon the existing literature on factors of motivation including social support, intention motivation and attitude reported among high risk drug users.

When we examined the linear regression analyses, it indicated that decrease in intention motivation appears to be associated with to the personal motives of individual and their perceived

high risk for HIV predicted increase PrEP adherence. In relation to, low perceived side effects of medication, low perceived risk regarding PrEP treatment individuals were more likely to be on treatment. Our study extends another construct of motivation (social motivation and attitudes) as significant predictors of individual PrEP adherence self-efficacy. This PrEP survey supports the findings of prior studies by showing that the family and peer support can play a positive role in encouraging high risk people to develop greater adherence self-efficacy. Thus, these findings may be an important aspect of developing new intervention approaches among high risk drug users and other high-risk groups.

Because an increasing number of high risk groups, lack of awareness of HIV prevention related information, this has caused significant barriers related to their accessibility to and adoption of such powerful approaches that can prevent HIV among currently HIV negative people. Our study findings revealed that participants who reported being involved in use of internet and technology were more likely to obtain information relevant to HIV prevention and PrEP which may be useful in reducing barriers stemming from a lack of relevant information. In this study, we found that internet use focused on high risk individuals, gathering HIV prevention information and searching for health-related treatment including PrEP. Findings from our study also show that participants who use the internet as the source of such information tend to have higher PrEP adherence self-efficacy. Thus, internet search of informational content regarding HIV, prevention and current treatments has the potential to provide valuable knowledge to keep people informed about the effective interventions.

Some studies have assessed internet use among youths populations and found it to be effective at improving knowledge and skills (Hightow-Weidman et al., 2015). In terms of communication and technology, use of various communication devices works along with access

to the internet which aids in developing the knowledge and appropriate information to different group of people (Laugesen et al., 2015). We found participants were more likely to have smartphones with internet access other than laptops and PCs. In the study, we examined the use of technology device and found that the more likely the use of technology device the higher the predicted higher adherence self-efficacy. Thus, thesis findings highlight the importance of awareness on HIV transmission and its different preventive approach on developing skills that benefits the individual to promote self confidence in such HIV prevention approaches. It is important to note that lack of information about HIV prevention and adoption of PrEP can leads to high risk behavior and lowers the chances of PrEP adherence.

Analyzing the components of the Information-Motivation-Behavioral model with respect to the study findings, information and awareness regarding PrEP treatment tended to impact participants' adherence self-efficacy. The findings have revealed that individuals' use of internet information and communication through technological device is a source of primary information regarding HIV treatment, rather than participating in typical intervention program designed to target treatment adherence. On the other hand, the study also indicates the importance of various types of motivation in association with PrEP adherence self-efficacy. In comparison to other high-risk populations results shown a similar pattern of associations, but it is yet to be explored whether there are significant differences across risk groups in terms of PrEP adherence.

With respect to psychological factors, a non-significant statistical difference was evident in terms of the potential influence of NCI on PrEP adherence self-efficacy. However, the influence of depression in our sample of high risk drug users was found to be marginally associated with PrEP adherence self-efficacy. These findings suggest that there is may be an influence of some psychological factors on PrEP adherence self-efficacy but have not shown a statistically significant



relationship in our data. In the combined model, including both NCI and depression, psychological factors have shown a non-significant association. These study findings of non-significant as well as negative association of NCI with PrEP adherence suggest that the presence of different cognitive deficits might be a barrier to PrEP adherence to some degree. Although prior studies have demonstrated that higher NCI is related to lower self-efficacy (Shrestha, Weikum, et al., 2017); (Anand et al., 2010), no such pattern was found in this analysis, whereas, it supports other studies reporting similarly marginal significance levels (Wagner et al., 2011) of depression and its impact on PrEP adherence self-efficacy.

Overall, the findings from this study supported prior research finding but the majority of those studies were conducted among MSM populations. To the best of our knowledge, our study is the only one to find the potential predictors of PrEP adherence self-efficacy among people who use drugs. We have found that different domains of motivation play different role in developing self-efficacy in an individual. Results also showed that use of technology and internet access may be one of the component that is essential in promoting information exchange among different and facilitating their make awareness of current treatment approaches and their effectiveness. A better understanding of the emergent issues inherent in the provision of PREP will allow for the development of both individual-level interventions supporting PREP users and community-level interventions designed to increase awareness and acceptability of PREP.

## **6.1 Limitations**

This study had some limitations which deserve attention in terms of interpreting the findings presented here. First, the study methodology was cross sectional which greatly limits the potential to make cause and effect conclusions. Second, self-report assessments were used in this study and

this may have impacted our ability to correctly determine outcomes due to biases associated with self-report of socially undesirable behaviors. Another limitation might be the impact of demographic characteristics such as age, gender, income and education. The association of PrEP use intention with high HIV risk acquisition in this cross-sectional study might be a limitation among the participants with need of immediate intervention to eliminate the high-risk behavior. Finally, this study was specific to high risk drug users participating in a methadone treatment program and this may restrict our ability to generalize the findings to other populations and to different settings. Despite these limitations, and others the study findings provide important information pertaining to PrEP adoption/adherence self-efficacy as influenced by motivation and the use of internet.

## **Chapter 7: Conclusions**

People who use drugs have always been at risk for the HIV infection around the globe despite numerous promising HIV intervention approaches. Of particular note, however, the demand for PrEP treatment is rising among high risk populations, which has the potential for preventing a substantial amount of HIV acquisition and subsequent transmission. The lack of the motivation and current awareness hinders many high risk individuals from the benefits of such innovative preventive approach(Carroll et al., 2016). On the other hand, the increasing trends of access to the internet has shown the potential benefits to the high-risk people in terms of greater awareness about new HIV prevention approaches.

Prior studies have demonstrated the high adherence to PrEP treatment was associated with low perceived risk of HIV which are more likely to be socially determined. Although clinical trials for the HIV prevention among MSM are now underway, PrEP was unfamiliar to the high risk sample. On the other hand, the potential for the rapid uptake of the PrEP among various priority populations seems feasible. Findings collected from other studies (Krakower et al., 2012); (Bil et al., 2016); (Bauermeister et al., 2013) has raised concerns on that the evolving awareness and the utilization of the PrEP is associated with the behavior deterioration which could lead to the lower risk perception and might reduce the motivation to engage in risk reduction. Therefore this study analysis will provide considerable empirical evidence on potential impact of those motivation factors on adherence self-efficacy of Pre-exposure prophylaxis treatment.

Despite of widespread utilization of ART there are high prevalence of neurocognitive impairment, depression and other psychological factors among people who use drugs. With respect to, NCI and depression among our sample, there seems to have a very limited impact on the individual's confidence regarding treatment adherence which might be related to potential correlation of the similar items constructs used in the assessment. Thus, study findings could be helpful in future work in developing efficacious intervention considering the potential influences that might benefits high risk people with cognitive impairment.

Future direction includes exploring intervention strategies that involves greater use of the internet on the PrEP adherence and HIV risk reduction. The results suggest the importance of exploring the various intervention components in order to examine behavioral changes related to HIV and warrants further modeling using bidirectional approach to examine the impact among adherence self-efficacy-related variables. Based on our data, it seems that effective use of the internet or technological devices could be used to strengthen the patient and providers relationship

as well as enhancing HIV prevention outcomes. Likewise, future research should concentrate on how best to translate interest in PrEP information and motivation in the form of effective real-world PrEP related interventions for optimal individual and community health.

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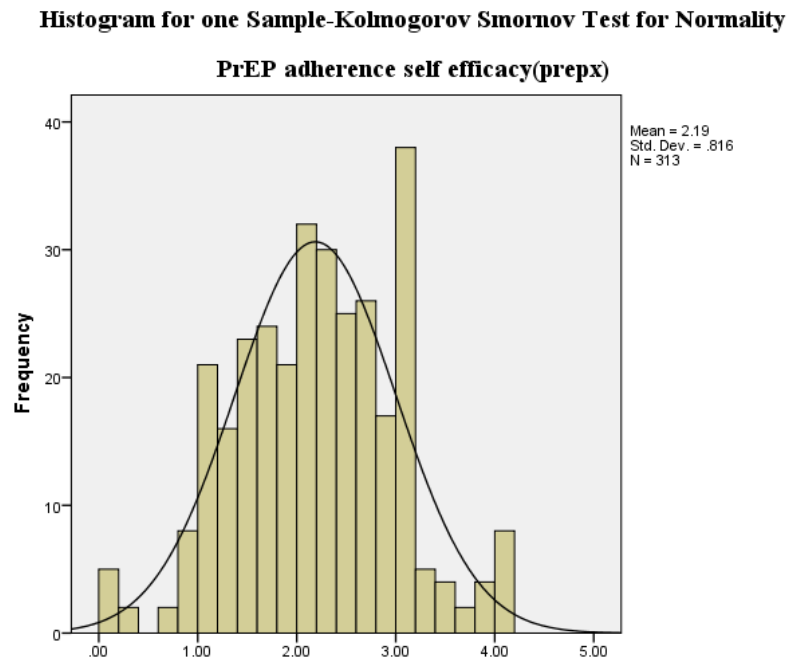
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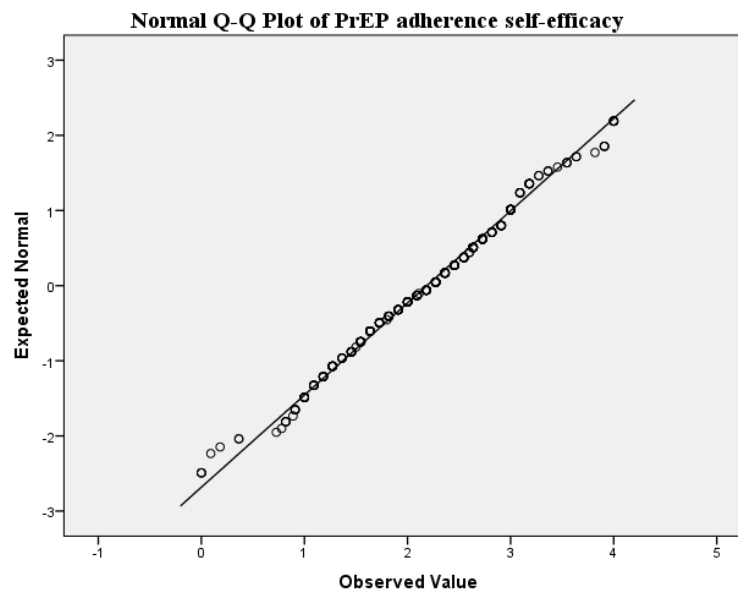


## APPENDIX

**Figure 3 - Histogram with normality plot of dependent variable**

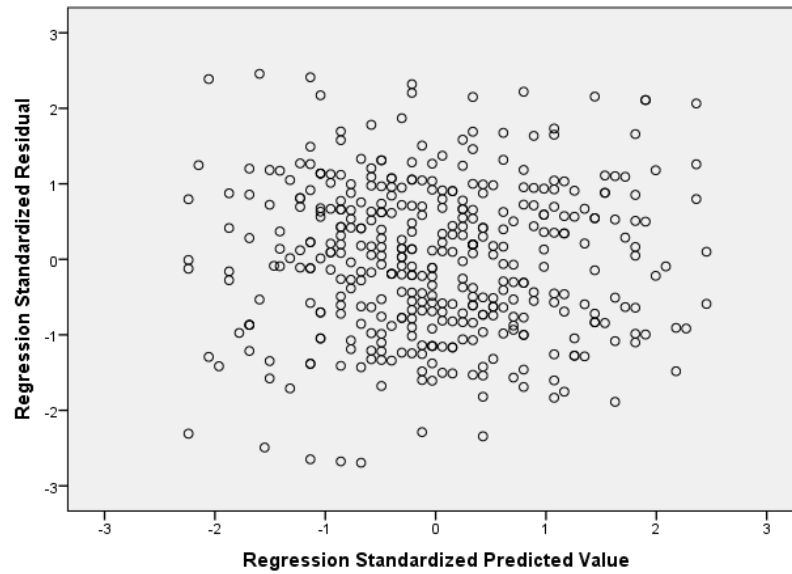


**Figure 4 - Q\_Q plot of dependent variable(PrEP adherence self-efficacy)**

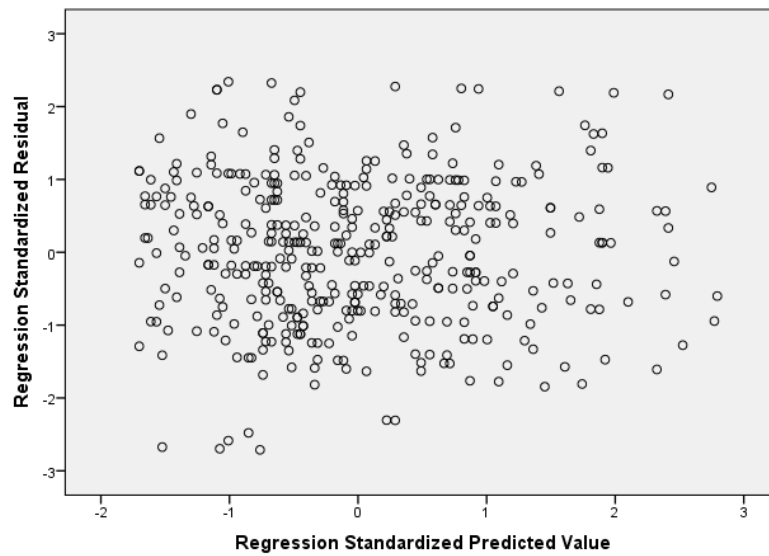


**Figure 5 - Scatterplot to test for Homoscedasticity**

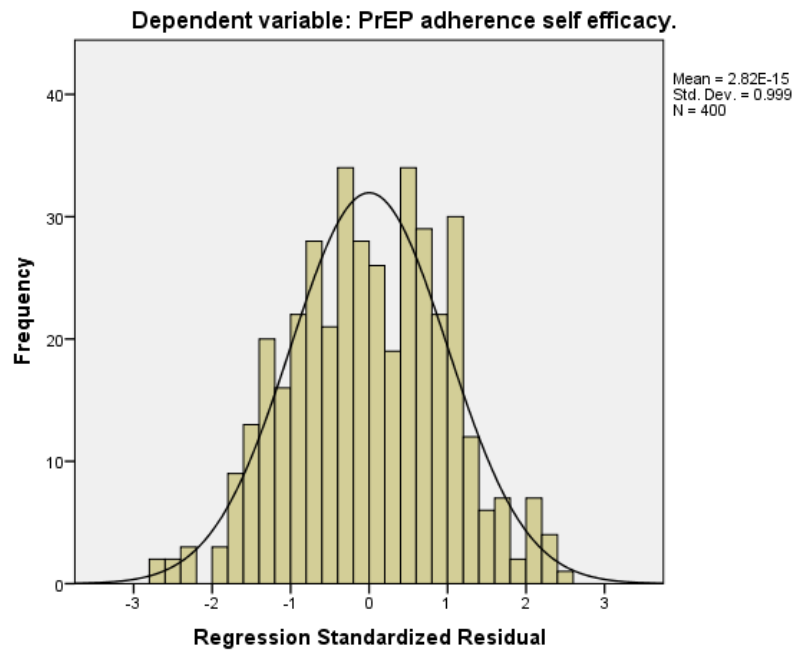
**Scatterplot on normality of residulas of PrEPa dherence self-efficacy**



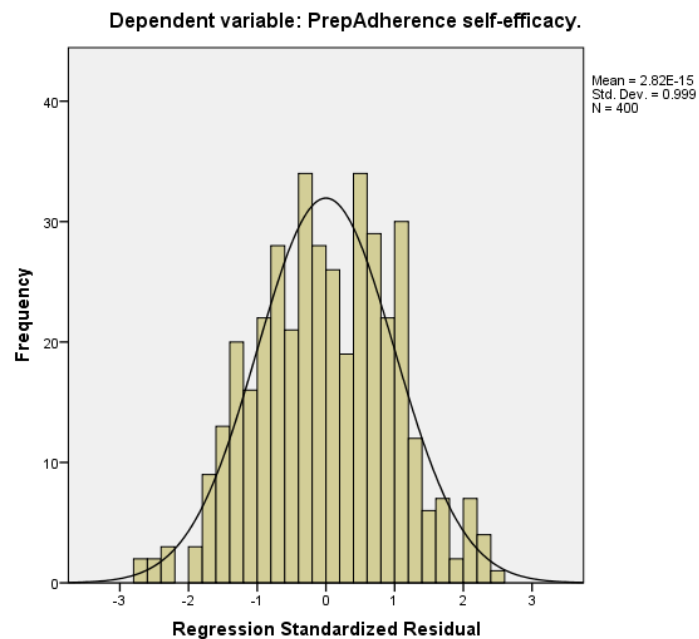
**Scatterplot of normality of residuals of PrEP adherence self efficacy**



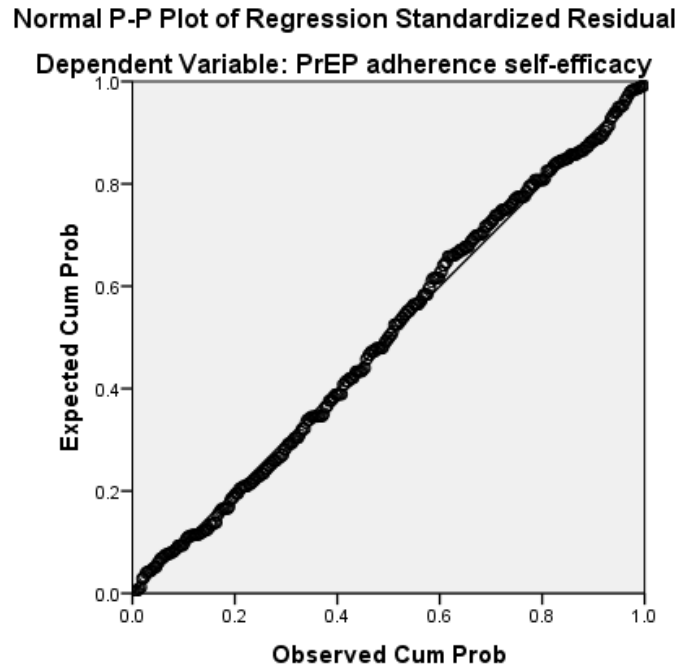
**Figure 6 - Histogram of residuals of motivation factor on dependent variable (PrEP adherence self-efficacy)**



**Figure 7 Histogram of residuals of Internet use on dependent variable (PrEP adherence self-efficacy)**



**Figure 8 P-P plot of the residuals**



**Table 8 Exploratory factor analysis of domains of Motivation related to PrEP**

Constructs	Items	Factor loadings
<b>Attitude towards PrEP</b>	If I were on PrEP, I'm sure that PrEP would be effective in protecting me from HIV-infection	<b>0.54</b>
	I think I would be less worried about HIV infection if I were on PrEP.	<b>0.63</b>
	If I were on PrEP, it would take the worry out of the sex.	<b>0.65</b>
<b>Intention motivation</b>	If I were on PrEP, I won't have to worry about using condoms.	<b>0.78</b>
	If I were on PrEP, I won't have to worry about sharing needles and works.	<b>0.88</b>
	If I were on PrEP, I won't have to worry about my partner's HIV status.	<b>0.77</b>

<b>Social motivation</b>	I would take PrEP if I know someone (for example, friend, and family member) who is currently taking it.	<b>0.53</b>
	I have a responsibility to contribute to HIV prevention efforts by using PrEP.	<b>0.65</b>
	I have family members or friends to encourage me to take PrEP properly.	<b>0.55</b>
	If I disclose that I'm on PrEP to my sex partner, he or she will be comfortable with it.	<b>0.57</b>

**Table 9 Confirmatory factor analysis fit model of domains of motivation related to PrEP**

Number of observations	400
Estimator	ML
Minimum Function Test Statistic	105.81
Degrees of freedom	38
P-value (Chi-square)	0.00
<b>Model test baseline model:</b>	
Minimum Function Test Statistic	1223.27
Degrees of freedom	55
P-value	0.00
User model versus baseline model:	
Comparative Fit Index (CFI)	0.94
Tucker-Lewis Index (TLI)	0.91
<b>Root Mean Square Error of Approximation:</b>	
RMSEA	0.067
90 Percent Confidence Interval	0.05 0.08
P-value RMSEA <= 0.05	0.033

## **R code Exploratory and confirmatory factor analysis on R lavaan.**

Dataset “**abc**” is used to conduct factor analysis

### **Primary component analysis:**

To obtain the data in r software from the data set.

```
>home <- read.csv("~/Fall mediation project/home.csv")
```

To install the R lavaan package from library.

```
>library(lavaan)
```

For primary/ Principal component Analyses.

```
>surveya.pca<-princomp(abc)
```

```
>summary(surveya.pca)
```

### **R code for exploratory factor analysis.**

```
> surveybt<-factanal(abc, factor=4, rotation= "varimax")
```

```
>library(lavaan)
```

```
> surveybt
```

### **R code for Confirmatory factor analysis:**

```
cfa.mod<-'intd=~prepm9+prepm10+prepm11
```

```
+ somt=~prepm13+prepm14+prepm15
```

```
+ values=~prepm3+prepm4+prepm5
```

```
+ barriers=~prepm7+prepm8'
```

```
> fitcf<-cfa(cfa.mod, data=abc)
```

```
> summary(fitcf,fit.measures=TRUE)
```