

**Ending HIV: Improving Providers Perceptions and Implementation Practices of Preexposure
Prophylaxis in Females at Risk of HIV Infection**

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There is no conflict of interest to report.

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Dedication

I would like to dedicate this project to my family and friends who supported me on this life changing journey. To my life partner and the reason I began this program, Matthew, thank you for always encouraging me and reminding me that this was a learning process. To my dad and my Nonnie, thank you for shaping me into the person that I am today. To my girls, Louisa and Margot, I hope that I have shown you that as a woman you have the strength and ability to change the world.

A special thank you to all the women in my life who supported me through this journey, with words of encouragement, care packages on my doorstep, caring for my children, and never letting me give up; and to all the women who paved this path for me, my deepest and utmost respect is yours.

Abstract

Introduction: Pre-exposure prophylaxis (PrEP) is a critical development in HIV prevention, yet females at risk of contracting HIV have lower rates of PrEP use compared to their male counterparts. Insufficient knowledge on PrEP indications for women has been a key barrier in health care providers (HCP) utilization of PrEP in this population. Prior research has revealed educational interventions improved providers' use of PrEP in at risk populations.

Methods: A 1-hour, educational session was developed for eleven HCPs at a university-based clinic. The educational session was guided by the Cognitive Learning Theory and included information on clinical practice guidelines for PrEP implementation in women. The effects of the intervention were analyzed using a pre/post-survey design, with post surveys delivered at two and eight weeks. The 16-item survey evaluated outcomes including provider discussion and prescription rates of PrEP with female patients and perceived knowledge and perceptions of PrEP in women, utilizing a Likert scale. All procedures were given exempt status by the university IRB.

Results: Paired sample *t* tests were used to analyze provider reported conversations and prescription rates, while matched ordinal data were analyzed utilizing Wilcoxon signed rank tests and descriptive statistics. At two-weeks post intervention there was a significant increase in provider's reported likelihood of prescribing to at risk cis gender females in the next six months (*Mdn* = 2 [pre-survey], *Mdn* = 3 [post-survey], $\alpha = 0.05$, $V = 0.00$, $z = -2.53$, $p = .011$). At eight weeks postintervention, there was a statistically significant decrease in provider's beliefs that HIV risk assessment was an essential component of a primary care visit for female patients (*Mdn* = 3.00 [pre], *Mdn* = 2.00 [eight-week], $\alpha = 0.05$, $V = 10.00$, $z = -2$, $p = .046$). The results of the data analysis have been shared with the leadership team of the health clinic and used to inform future practice on provider educational sessions on PrEP.

Conclusion: Women at risk of contracting HIV are a key demographic missed for the utilization of PrEP. Limited statistically significant findings from the intervention have prompted further research to focus

on interventions that promote long-term behavior change and improve providers implementation practices of the preventive measure in at-risk female identifying patients.

Keywords: preexposure prophylaxis, human immunodeficiency virus, females, health care providers, educational intervention

Ending HIV: Increasing Use of Preexposure Prophylaxis in Females at Risk of HIV Infection

Human Immunodeficiency Virus (HIV) has gone from a death sentence to a manageable chronic condition through the use of antiretroviral therapy (Ntim & Kransdorf, 2017). These same medications are now being used for the prevention of HIV. Preexposure prophylaxis (PrEP) is a once daily antiretroviral medication taken to prevent HIV infection. PrEP is indicated for those at high risk of contracting HIV and is essential in the goal of the international community to end HIV/AIDS (Sales & Sheth, 2019). Despite the proven efficacy of PrEP in the prevention of HIV, there is minimal use of the medication among those who would benefit, specifically in females who are considered high risk of HIV infection (Sales & Sheth, 2019).

Problem Statement

According to the Centers for Disease Control and Prevention ([CDC], 2017a), at the end of 2016 there were a total of 991,447 persons living with a diagnosis of HIV in the United States. By the end of 2018, this number had increased to 1,040,352 (CDC, 2018). Among those newly infected in 2018, 24 percent of them were female (CDC, 2018). Additionally, the largest increase in HIV rates from 2014 to 2018 occurred in transgender male to female (MTF) individuals (CDC, 2018). One in nine women are unaware of their HIV status, and many women are unaware of high-risk behaviors that put them at risk of contracting HIV, including their male partners risk factors (CDC, 2018). In Arizona in 2018, the number of new HIV infections was 774, and increased to 776 in 2019, 117 of the cases being female (Arizona Department of Health Services [AzDHS], 2019; AzDHS, 2020). In 2018, among females that were newly infected with HIV, 27 percent were infected through high-risk heterosexual activity (AzDHS, 2019).

PrEP utilization data shows a disparity in the use of PrEP among women. In 2015, the CDC estimated that there were 1.2 million individuals in the United States that would benefit from PrEP, 176,670 being women (2015, as cited in Smith, Handle, & Grey, 2018). In 2018, it was estimated that among current PrEP users, only 6.3 percent were female (AIDSvu, 2021a). In Arizona, there was

estimated to be 3,009 PrEP users in Arizona, only 4.8 percent of which were female (AIDSVu, 2021a).

The “PrEP- to-Need” (PNR) ratio is used to assess whether an area has an adequate number of PrEP users to stop the spread of HIV and it is calculated by dividing the number of PrEP users by the number of individuals newly diagnosed with HIV (Siegler et al., 2016; AIDSVu, 2021b). A lower number indicates a more unmet need. In the United States in 2016, the PNR for women was 0.8, while it was 2.9 for men (AIDSVu, 2021b). In Arizona, this unmet need is just as clear as the PNR for women was 1.33 for women versus 4.37 for men in 2018 (AIDSVu, 2021a).

Purpose and Rationale

The purpose of this project is to highlight the significant gap in the use of PrEP among at risk female identifying individuals and to assess the effectiveness of an educational intervention on improving primary care provider’s perceptions and comfortability with prescribing PrEP to all at risk parties, specifically those identifying as women.

Background and Significance

Females and Effectiveness of PrEP

Since 2012, PrEP has been approved for use in individuals at high risk of contracting HIV (US Public Health Service, 2017). Women are considered as high risk of contracting HIV if they have a partner who is HIV positive, have a history of inconsistent or no condom use, have had a bacterial sexually transmitted infection (STI) in the last six months, have had multiple sex partners, or if they are engaging in commercial sex work (US Public Health Service, 2017).

Early studies on the use of PrEP in heterosexual females, most notably the FEM-PrEP trial, were not shown to significantly prevent HIV infection in women (Damme et al, 2012). Other trials conducted with women were prematurely ended because of low retention and poor medication adherence among participants, and thus insignificant protection against HIV (Peterson et al., 2007). However, these early

studies have been contradicted by more recent research proving the effectiveness of the drug against the transmission of HIV through sexual contact in both males and females.

Baeten et al. (2012) determined in their study of serodiscordant heterosexual couples that the combination tenofovir– emtricitabine (TDF-FTC), was 75 percent effective in reducing the incidence of HIV-1 infection. A meta-analysis conducted by Fonner et al. (2016) found that in comparison to a placebo, PrEP was 51 percent more effective at reducing the risk of HIV. When comparing gender in these studies, there was no significant difference in the effectiveness of PrEP between males and females during heterosexual contact (Fonner et al., 2016). The iPrEx drug trial with PrEP showed a 42 percent risk reduction of HIV acquisition in transgender women who have sex with men, and 92 percent risk reduction with those who have detectable drug levels (Grant et al., 2010). Despite the proven effectiveness of the medication, rates of PrEP use are still low among females, indicating a gap in the understanding of the risk of females contracting HIV and the benefit of prevention through PrEP.

The United States Preventative Services Task Force ([USPSTF], 2019) has given a grade A recommendation for providers offering PrEP to persons at high risk of contracting HIV. Additionally, PrEP allows for a user-controlled method of HIV prevention, without women needing approval or compliance of their partner to utilize this preventative measure (Bradley et al., 2019).

Standard of Care

The current standard of care related to PrEP education for healthcare providers (HCPs) is the United State Public Health Service's (2017) clinical practice guidelines related to PrEP use and implementation. This is at the discretion of a provider to review and determine if they will provide PrEP to a patient or refer them to another specialist. In a qualitative study performed by Hoffman et al. (2016), providers were asked who should be prescribing PrEP. While most providers stated that primary care providers should be the prescriber, there were concerns related to the need for specialty knowledge on anti-retroviral medications. Blackstock et al. (2016) found in their qualitative study that

HIV providers were shown to have more knowledge related to PrEP and were more comfortable prescribing the medication to at-risk patients. The detrimental effect of this current standard of practice is that those who would benefit from PrEP are not offered the medication due to lack of provider confidence in managing a patient on PrEP. Those who are at high risk of contracting HIV are likely not going to engage with a HIV specialist or infectious disease provider for their preventive care services and routine HIV testing. By the time these patients reach providers confident in prescribing PrEP, they are usually already infected.

Educating Providers to Prepare at Risk Patients

In a web-based town hall discussion, the Centers for Disease Control and Prevention ([CDC],2017b) asked a panel of clinicians and other stakeholders what challenges and barriers were present in relation to the implementation of PrEP among women. The most common theme was low or no PrEP knowledge. Blackstock et. al (2016) gave surveys to an array of providers to assess their self-rated knowledge of PrEP, prescribing behaviors, and willingness to prescribe. Providers working with 50 or more HIV positive patients were more likely to adopt PrEP into their practice (Blackstock et. al, 2016). Compared with non-adopters, adopters of PrEP were more likely to rate their knowledge of PrEP as good, very good, or excellent. In addition, they were more confident in their understanding of PrEP side effects, perceived the medication as moderately safe, and rated that they were extremely likely to prescribe PrEP in the next six months (Blackstock et al., 2016).

Primary care providers are in the unique and optimal position to combat this gap in care. Their focus on health promotion, prevention, and continuum of care puts them in the trusted position to evaluate and offer PrEP to their patients (Blackstock et al., 2016). Educational interventions have shown to increase provider's understanding and willingness to prescribe PrEP. Clement et. al (2018) conducted an educational intervention on PrEP at 14 primary care clinics. The effect of the intervention was tested through a pre/post-test analysis. On the initial survey, before the intervention, providers were asked

about barriers to prescribing PrEP and 60 percent of respondents cited lack of knowledge as the primary barrier (Clement et al., 2018). Post intervention, there was a significant increase in the number of providers that prescribed PrEP to their patients and in the number of providers stating they had no barriers in prescribing PrEP (Clement et al., 2018).

The limited use of PrEP among high risk females is a combination of a lack of knowledge and understanding about the existence of PrEP among high risk females, and low rates of providers implementing the preventative measure. An educational intervention has shown to improve not only providers understanding of the medication but also their willingness to prescribe to at risk parties. This type of intervention could assist in increasing prevention of HIV.

Internal Data

In a university-based clinic in the southwestern United States there is a growing need for awareness and implementation of PrEP among female students. The clinic predominately serves young adults between the ages of 18-30, and providers often come in contact with females engaged in high risk sexual behaviors (D. Labban, Nurse Practitioner at the clinic, personal communication, October 21, 2019). Lab services within the clinic will talk with patient's about PrEP who have frequently come in for HIV testing, but these conversations often occur with the men having sex with men (MSM) population (F. Avila, Lab manager at the clinic, personal communication October 23, 2019). There appears to be a gap in education, both for providers and female students of the university, on the benefits of PrEP for females who may be, or have partners who are engaged in high risk sexual behavior (D.Labban, Nurse Practitioner at the clinic, personal communication, October 21, 2019). Many providers are aware of the medication, but do not feel comfortable prescribing or offering the medication to at risk students (D.Labban, Nurse Practitioner at the clinic, personal communication, October 21, 2019).

While specific data on HIV incidence and prevalence could not be gathered from the clinic, the Arizona Department of Health Services has data on the prevalence of HIV in the county where the

university lies. In 2018, there were 551 new cases of HIV infection, up from 526 in 2017 (AzDHS, 2018; AzDHS, 2019). Among these new cases of HIV, 60 of the individuals were female, which is an increase from 55 in 2017 (AzDHS, 2018; AzDHS, 2019).

PICO Question

This inquiry has led to the clinically relevant PICO question, “In primary care providers treating females at risk of contracting HIV, how does provider education on PrEP, compared to standard provider knowledge, affect attitudes, perceptions and rates of prescribing PrEP?”.

Search Strategy

An exhaustive search of the literature was performed to abstract the current evidence to answer the PICO question. Three databases were extensively searched including, PubMed, CINAHL, and Medline. These databases have a history of providing relevant and up to date research and literature related to health care.

Each aspect of the PICO question was searched using the advanced search strategy provided by the databases. Key terms included: *primary care, preexposure prophylaxis, education, perceptions, females, and prescribe*. Mesh and Boolean phrases, described below, were used to further broaden the search and obtain more relevant articles. Titles and abstracts with the selected key words were included in the search. Filters were applied to provide the most relevant research including studies done between 2015-2020, English language studies, and those that had been peer reviewed. The time restriction was relaxed to 2010 to broaden the yield and allow for inclusion of landmark studies.

Database Search and Study Yield

The terms initially used included: *primary care OR physicians OR primary care providers AND pre-exposure prophylaxis OR PrEP OR preexposure prophylaxis OR Truvada OR antiretroviral AND education OR training AND perceptions OR attitudes OR beliefs*. This initial search yielded 91 relevant articles and 18 were extracted for further review. Keyword terms including *females* and *prescribe* were

left out of the original search to yield the most studies. Subsequent search strategies included key terms *female OR females OR women* which yielded 52 results, and four articles were extracted for appraisal. The removal of the search term *females* and related Mesh terms, and addition of *prescribe OR prescription*, as well as adding Mesh terms *knowledge OR educational* yielded 113 results, and three new studies were extracted. The final search strategy of PubMed included all keywords, as well as added Mesh terms, *HIV prevention OR anti-HIV agents*, which yielded 93 studies with no new studies for extraction.

To provide consistency and a systematic approach to the database search CINAHL and Medline databases were searched in the same fashion. Additional Mesh terms were used for keywords in CINAHL, as the phrases used in PubMed did not yield as many results. Additional terms used included: *primary healthcare OR family practice OR community care, HIV OR AIDs OR acquired immunodeficiency syndrome OR human immunodeficiency syndrome and opinion OR experience OR view OR reflection*. CINAHL yielded a total of 125 results, 11 of which were extracted and critically appraised. The Medline search yielded a robust 3,197 studies in the initial search. The search was further refined using the above-mentioned strategies and yielding 273 studies, five of which were extracted for critical appraisal. Government and State funded websites were searched for grey literature including current epidemiological data on HIV, landmark studies on PrEP, and clinical practice guidelines for the implementation of PrEP. The final yield of 10 studies were further analyzed and placed in evaluation and synthesis tables (see Appendix A).

Critical Appraisal and Synthesis of Evidence

The ten studies extracted from the search of the literature were further scrutinized using Fineout-Overholt and Melynck's (2015) rapid critical appraisal checklists. Eight of the studies were predominately lower levels of evidence, and two were systematic reviews (See Appendix A, Table A1).

While limited bias and neutral funding parties were noted in a majority of the studies, three received their funding from Gilead, the pharmaceutical manufacturer of PrEP (see Appendix A, Table A1).

Demographics of the participants of the studies that collected demographic data were homogenous. A majority of the study participants were middle aged (40-50), female, and Caucasian (see Appendix A, Table A2). While this aids in reducing confounding variables that could affect study outcomes, it does reduce the generalizability of the results. In studies employing a survey model there was a mix of HCPs with limited, to no HIV training, and those with experience working with patients with HIV (typically Infectious Disease providers or HIV providers) (see Appendix A, Table A2).

The study designs were surveys assessing providers perceptions of PrEP and educational interventions. For the studies employing a survey method, sample sizes tended to be large, but attrition rates were high. Studies that implemented an educational intervention showed smaller sample sizes but lower attrition rates (see Appendix A, Table A1). There was an abundance of literature on the perceptions and beliefs about PrEP, and the reasons for lack of implementation, but more recent studies were focused on interventions to increase provider implementation of PrEP.

There was significant heterogeneity across studies, including study design and method of implementation. Despite the differences, common variables assessed included knowledge of PrEP, willingness to adopt, and rates of PrEP prescription. There was homogeneity across many of the surveys used in both types of studies to assess provider knowledge and perceptions of PrEP. Blumenthal et al.'s (2015) survey was adapted and used for the studies done by Blackstock et al., (2016), Newman (2019), and Sales et al. (2019). The original survey used by Blumenthal et al. (2015) was created by the Fenway Institute and adapted from an instrument created by the CDC. Surveys and pre/post-tests utilized by the remaining studies varied in length, but the information assessed was similar. While no validity or reliability data was available on the measurement tools, they were developed by experts in the field of HIV, informed by current literature, and peer-reviewed or pilot tested (see Appendix A, Table A1).

Limited studies were available on PrEP implementation with women, although two were found in the literature review. One systematic review gathered studies that assessed barriers and facilitators affecting PrEP implementation in women from both the perspectives of providers and women (See Appendix A, Table A1). The largest barrier identified across studies was lack of education on PrEP (Bradley et al., 2019). Sales et al. (2019) utilized an educational intervention at a family planning clinic and assessed PrEP knowledge gained by providers. Patient interviews were also conducted post intervention to assess PrEP implementation practices of providers. After the one and half hour training, providers had significantly higher PrEP knowledge, confidence in identifying at risk patients, and were more likely to believe that HIV prevention was an essential topic to cover as part of a family planning visit (see Appendix A, Table A1). To assess changes in PrEP implementation, female patients of the HCPs were interviewed for approximately four months post intervention. Through the post intervention interviews, it was found that among women who reported conversations of HIV prevention, 74 percent reported discussions of PrEP (Sales et al., 2019). Among the women who were identified as high risk of contracting HIV, 66 percent reported that the provider discussed PrEP with them (Sales et al., 2019).

Four of the selected studies reviewed the effectiveness of an educational intervention. The educational interventions had significant heterogeneity, ranging from single, one-hour sessions, to a telehealth mentor intervention that gathered data for three and half years. The interventions covered similar topics related to HIV and PrEP, including epidemiology of HIV, HIV transmission, identification of at-risk individuals, PrEP indications and pharmacology, and implementation guidelines for PrEP. Despite the heterogeneity among interventions, all models showed statistically significant increases in knowledge scores and intent to prescribe PrEP (see Appendix A, Table A2).

Heterogeneity existed in the statistical analysis methods across the studies. For studies determining differences in PrEP knowledge among providers and the effects of an educational intervention, two-sample *t* tests and chi square tests were utilized (see Appendix A, Table A1). The

statistical tests were used to evaluate if there was a significant difference in perceptions and implementation practices of PrEP between providers based on their knowledge of HIV and PrEP. A majority of the studies set $p < .01$ to identify significance, but a few did set significance at a $p < .05$ (See Appendix A, Table A1). Despite these differences, all studies employing these methods showed statistically significant associations in PrEP knowledge and increased implementation of PrEP (See Appendix A, Table A2). In studies where several provider characteristics were analyzed to determine which affected perceptions, willingness to adopt, and implementation of PrEP, Kruskal Wallis tests and multivariate analysis of variance, were used (See Appendix A, Table A1). Studies utilizing these methods consistently showed a statistically significant correlation between PrEP and HIV knowledge and positive perceptions of PrEP, in addition to higher rates of PrEP implementation (See Appendix A). To further determine the link between PrEP knowledge, and adoption and implementation of PrEP, several studies utilized multivariable logistic regression and multivariate linear regression statistical analysis tests (See Appendix A, Table A1). Again, these studies further validated that increased PrEP knowledge was linked to a willingness to adopt PrEP into practice (See Appendix A). Although there was heterogeneity of statistical analysis methods across studies, the methods employed were appropriate for the type of data collected and isolated the link between increased PrEP knowledge and improved implementation practices.

In conclusion, the 10 studies were lower levels of evidence and there was significant heterogeneity in the study designs and educational interventions. Despite these findings, the studies used sound methodology, had limited bias, and utilized evidence-based instruments of measurement. Across the studies, increased PrEP knowledge correlated with positive attitudes towards and increased implementation of PrEP (see Appendix A, Table A2).

Conclusion of the Evidence

Although women are among the minority of those infected by HIV, they are a pivotal group to engage in order to reach the international goal of ending HIV. Literature has shown that many women are not aware of PrEP, or its benefit to them. Primary care providers are in a fundamental position to identify and educate women on their PrEP eligibility, but do not feel adequately prepared to do so. Several studies of HCPs have shown that those with higher knowledge scores related to PrEP were significantly more likely to have positive perceptions of PrEP and adopt it into their practice. Various methods of educational interventions have shown statistically significant increases in PrEP knowledge, adoption, and rate of prescription (see Appendix A, Table A2). The heterogeneity of studies evaluated with statistically significant outcomes allows for flexibility in the development of an educational intervention.

Theory Application

Before creating the educational intervention, a theoretical model was selected to support and guide the development through studied phenomena. The cognitive learning theory (CLT) is a theory grounded in the behavioral sciences and has been used since the 1920s to guide education and learning (Ku, Phillipson, & Phillipson, 2015). The basis of CLT is that humans employ several cognitive methods to gain, integrate, and apply new knowledge. The theory is made up of three central concepts explaining the learning process: input, cognitive processing, and behavior (see Appendix B, Figure 1). The concept of cognitive processing is individualized to each person and influenced by their perceptions of the world (Ku, Phillipson, & Phillipson, 2015). Included in cognitive processing are the elements of attention, observing, perception, interpreting, organizing, memory, categorizing, and forming generalizations (see Appendix B, Figure 1). CLT emphasizes the importance of not just giving information, but presenting it through multiple channels, in a way that is of interest to the learner. This promotes not only the

retention of knowledge, but knowledge construction, which is the process of integrating old and new knowledge to critically think and solve new problems (Ku, Phillipson, & Phillipson, 2015).

This theory was chosen due to the evidence showing statistically significant improvement of knowledge scores and implementation of PrEP into practice through increased knowledge and educational interventions. It is the intent of the writer to employ an educational intervention that will have lasting change in the practice of the providers attending the educational sessions. CLT will guide the creation of an educational intervention utilizing case studies, group discussion, and resource guides to aid in cognitive processing and knowledge construction.

Implementation Framework

An implementation framework is useful as a guide to track and conceptualize the change process. The implementation framework selected to address the identified gap is Rosswurm and Larrabee's (1999) evidenced-based model. The model was created to integrate evidence-based research into practice. The framework is a step by step guide for evaluating the available evidence and navigating the change process that ensues. While the model is set up in a linear fashion, it is expected that you may move back and forth as the process unfolds (see Appendix B, Figure 2).

The framework begins with assessing the need for a change in practice through the collection of internal and external evidence (Rosswurm & Larrabee, 1999). Following the identification of a gap, the team involved links the problem to interventions and outcomes available in the literature. The available evidence is then analyzed and synthesized, and practice change is designed. After the design and resources are in place, the implementation and evaluation phases can occur. Based on the evaluation of the implemented change, adjustments are made to the design and the goal is then to integrate and maintain the intervention (Rosswurm & Larrabee, 1999).

Stakeholders were met with to determine the presence of a gap related to PrEP. Key stakeholders included HCPs and lab personnel in the clinic, student organizations related to sexual

health and wellness, community agencies and non-profits focused on HIV prevention, clinics engaged in HIV prevention, and staff at the State Department of Health. Internal soft data was collected related to provider perceptions of patient's HIV risks and HIV infection rates within the health clinic. The literature was then reviewed on HIV infections among women in the United States and locally, along with perceptions of PrEP among women and HCPs. The most current and highest-level evidence in the literature related to PrEP knowledge, perceptions, and implementation by HCPs was analyzed and synthesized. It was determined that increased knowledge on PrEP and various methods of educational interventions significantly increased HCPs understanding of PrEP and increased the adoption of PrEP into their practice. An educational intervention was designed and delivered over the online platform Zoom. The impact of the educational session was evaluated utilizing a pre/posttest design with questions focused on providers implementation of PrEP and their beliefs about PrEP use in female identifying patients. The surveys were compared and analyzed using paired sample *t* tests and Wilcoxon signed rank tests. Findings from the data analysis were reported to the site champion and clinic leadership team to inform future educational endeavors and PrEP practices in the clinic with the female identifying population.

Methods

Based on the analysis and critical appraisal of the evidence, a one-hour interactive educational session was developed for HCPs at the student health clinic. The educational intervention included a PowerPoint presentation with information on the epidemiology of HIV in women, infection rates both nationally and locally, guidance on identifying women at risk of HIV infection, PrEP implications, PrEP drug information and side effects, clinical practice guidelines for PrEP implementation, and tips for discussing PrEP with female patients. Due to the recent COVID-19 pandemic, the educational session was held via the online video conferencing platform, Zoom. To best implement the theoretical framework and promote an interactive learning environment, features in the video conferencing

platform were utilized. The polling feature was used to assess knowledge mid-intervention and the whiteboard feature allowed providers to simultaneously brainstorm how the new information they received would affect their practice. Two case studies were also used to immediately apply the information received in the educational session. Among all of the interactive portions of the educational session, the case studies yielded the most participation. A survey was administered pre-intervention, two weeks post-intervention, and eight weeks post-intervention to evaluate the effectiveness of the educational session on provider's perceptions of PrEP utilization in females, perceived knowledge of PrEP use in females, and integration into practice.

The population targeted for the intervention were HCPs at the clinic that provide primary and acute care services to female students at the student health clinic. There is a total of 16 providers at the Tempe location of the clinic, but due to the online nature of the intervention, providers from other student clinic sites of the university in the greater Phoenix area were invited to attend the session. A total of eleven providers attended the educational session. The session took place during an established "Lunch and Learn", which is a monthly event offering educational opportunities for providers. Providers who completed both the pre and post intervention surveys and attended the educational session received a \$10 Starbucks gift card. The gift is minimal and does not represent a significant amount to illicit coercion to participate in the educational session or complete the surveys. The amount was determined to offer gratitude for the participants' time and participation.

Project plans and supporting documents were submitted and received exemption status by the Institutional Review Board (IRB). The proposed educational session was implemented in September 2020. Evaluation of the intervention occurred through data analysis of the survey results from February to March 2021. Results of the applied project were disseminated to site champion, Medical Director, Section chief of the university-based clinic, and faculty of the College of Nursing and Health Innovation.

Participants will potentially have increased knowledge of PrEP and improved screening of patients that would benefit from PrEP. Providers will potentially gain positive perceptions of harm reduction for patients engaging in high risk sexual behaviors, particularly females. Providers may have improved holistic care and relationships with their patients. Potential risks to participants include engaging in uncomfortable conversations about topics related to sexual practices and sexual health. Participants who are uncomfortable discussing certain topics may remain silent during that discussion. If any of this discussion causes any emotional distress, a participant may request to not participate in the discussion or excuse themselves and leave during those uncomfortable discussions. Since the clinic usually holds a monthly lunch hour educational activity, this educational session is built into the participants regular routine, so it will not take more time than usual. Economically, this educational session will not interfere with the workflow or work hours of providers, hence posing no economic risk to participant or clinic. All intervention materials and processes were approved by the IRB to ensure human subject protection.

The proposed budget for the project is estimated at \$1200, which includes both direct and indirect costs. The largest indirect cost is related to provider time, but as stated before, this event is already built into the providers schedule, so limited economic loss should be expected. Costs related to recruitment materials (flyers, emails), security of data (encryption software), and participant gift will be supplied by the writer. No outside funding or grants were applied for or received for the endeavor.

Outcome Measurement

The evaluation of the intervention is that of a pre/post-survey design. Providers participating in the educational session were asked to complete a baseline survey as well as a two-week and eight-week, post-intervention survey to assess the effectiveness of the intervention. The 16-item survey was adapted with permissions from Blackstock et al. (2016), Blumenthal et al. (2015), and Sales et al.'s (2019) surveys on PrEP knowledge, attitudes, beliefs, and implementation practices among health care

providers. These surveys were selected due to their utilization in similar populations and study design. Sales et al.'s (2019) survey was selected in particular due to its assessment of provider perceptions of PrEP utilization in women, as it was implemented in a family planning clinic. While there is no published validity or reliability studies on the individualized tools, they were created by experts in the field of HIV.

The format of the survey is divided into sections to comprehensively assess providers implementation practices related to PrEP in high risk female patients, as well as their perceived knowledge, attitudes, and beliefs of PrEP utilization in this population. Four items assess implementation practices. These items include yes or no questions on whether the provider has initiated conversations about PrEP and if they have prescribed PrEP to at risk female patients. To assess to what degree the provider is implementing the preventative practice, the provider is then asked to give a numerical estimation of how many female patients they have initiated conversations about PrEP with and how many females they have prescribed PrEP. Three items assess future implementation practices in specific female populations, as well as male populations for comparison, utilizing a three-point Likert scale, a smaller number indicating less likely. Five items related to attitudes and perceptions of PrEP utilization in high risk females, the importance of HIV risk assessment, and PrEP education in female patients are assessed using a five-point Likert scale. Two items assess confidence of the provider in identifying at risk females and educating female patients on PrEP utilizing a 5-point Likert scale. The provider is also asked to self-rate their knowledge of PrEP utilizing a 5-point Likert scale, with answers ranging from poor (one) to excellent (five).

Demographic data was collected in the beginning of the survey but only appeared on the baseline survey. Demographic questions included age, gender, race, and ethnicity. Provider demographic questions included health care provider role, years in practice, percentage of patients that identify as female, and if the provider cares for individuals at risk of developing HIV. Refer to Appendix C for the survey in its entirety.

Evaluation Questions

The survey was distributed via the online platform, Qualtrics. All data collected from the survey was kept secure on a password protected computer, utilized only by the writer. Participants created a unique identifier to ensure that their data remained anonymous. The outcomes that were assessed by the proposed outcome measurement tool utilizing descriptive and correlational statistics included:

1. How does an educational intervention on PrEP utilization in high risk females impact implementation practices of the preventative measure by providers?
2. How does an educational intervention of PrEP use in high risk females impact perceived knowledge of PrEP in providers?
3. How does an educational intervention of PrEP in high-risk females impact provider's attitudes and beliefs of PrEP utilization in females?

Data Analysis

Eleven providers attended the educational session, nine completed the presurvey and two-week post survey (n=9), and five completed the presurvey, two-week, and eight-week post surveys (n=5). Survey data was directly entered into the statistical software Intellectus. Paired sample *t* tests were used to analyze scale format data, and due to the small sample size, nonparametric and descriptive statistics were used to analyze outcomes and statistical significance of ordinal data.

Results

The providers who participated in the educational session were predominately female identifying (82 percent), white (63.6 percent), and non-Hispanic (90.1 percent). Providers were most frequently nurse practitioners (72.7 percent), in practice for an average of 11-15 years, and on average identified 26-50 percent of their patient population as female. See Appendix D, Figure 1 for more detailed descriptive analysis of study participants.

Knowledge of PrEP. Providers were asked to rate their knowledge on PrEP utilization in females on a Likert scale from 1 (*terrible*) to 5 (*excellent*). In providers who completed the pre-survey and two-week post-survey, there was no significant change in perceived knowledge of PrEP after the intervention ($Mdn = 3.00$ [pre], $Mdn = 3.00$ [post], $\alpha = 0.05$, $V = 6.00$, $z = -1$, $p = .317$). In providers who completed all surveys, there was no significant change in perceived knowledge of PrEP utilization in female patients ($Mdn = 2.00$ [pre], $Mdn = 2.00$ [two-week post], $\alpha = 0.05$, $V = 4.00$, $z = -0.58$, $p = .564$, $Mdn = 2.00$ [eight-week post], $\alpha = 0.05$, $V = 1.50$, $z = 0$, $p = 1.000$).

Conversations About PrEP. Utilizing paired sample t tests, provider's discussions of PrEP were analyzed. Providers were asked to give an estimate of how many times they had discussed PrEP with their female identifying patients. The average number of conversations on the pre-survey was 6.44, and at two weeks it was 6.56, but the result of the two-tailed paired samples t test was not significant ($\alpha = 0.05$, $t(8) = -0.04$, $p = .972$). Comparing surveys of providers who completed all aspects of the intervention, on the presurvey the mean number of conversations was 8.60, at two weeks post intervention the mean number of conversations was 4.80 ($\alpha = 0.05$, $t(4) = 0.87$, $p = .432$), and at eight weeks postintervention the mean number of conversations was 4.00 ($\alpha = 0.05$, $t(4) = 1.15$, $p = .315$). These finding suggests the difference in the mean of how many conversations providers had with their female identifying patients before the intervention and post intervention was not significantly different.

Provider Reported Prescription Rates and Future Practices. Providers were asked to self-report their estimated number of female identifying patients in which they prescribed PrEP. Paired sample t tests were run to determine significance between pre and post surveys. In providers who completed the presurvey and two weeks post intervention survey, the presurvey mean number of PrEP prescriptions was 0.56, and at two weeks post intervention the mean was 1.44, although the result was not significant ($\alpha = 0.05$, $t(8) = -1.58$, $p = .154$). In providers who completed all aspects of the study, the mean was 0.4 on the presurvey, and 0.6 on the two-week post survey, but the results of the two-tailed paired samples

t test was not significant ($\alpha = 0.05$, $t(4) = -1.00$, $p = .374$). Due to the small sample size, and duplicate variables, descriptive statistics were run on the 8-week post survey results on PrEP prescription rates, and the mean rate of conversations was 0.4.

Providers were also asked how likely they were to prescribe PrEP to cis-gender and transgender females in the next six months. Pre and post survey data were analyzed utilizing the Wilcoxon signed rank test. Providers were asked to rank their likelihood of prescribing from not likely (one) to very likely (three). At two weeks post intervention in providers who completed the presurvey and two-week post-survey, there was a significant increase in provider's reported likelihood of prescribing to at risk cis gender females ($mdn = 2$ [pre-survey], $mdn = 3$ [post-survey], $\alpha = 0.05$, $V = 0.00$, $z = -2.53$, $p = .011$) (See Appendix D, Figure 2). For transgender females there was no significant change between the pre and post survey ($Mdn = 2$ [pre], $Mdn = 2$ [post], $\alpha = 0.05$, $V = 4.00$, $z = -0.58$, $p = .564$). At eight weeks post intervention there was no significant difference in perceived future prescription practices in cis-gender female patients ($Mdn = 2$ [pre], $Mdn = 1$ [post], $\alpha = 0.05$, $V = 6.00$, $z = -1.73$, $p = .083$) or in transgender female patients ($Mdn = 2$ [pre], $Mdn = 1$ [post], $\alpha = 0.05$, $V = 6.00$, $z = -1.73$, $p = .083$).

Attitudes and Beliefs about PrEP Utilization and HIV Risk in Female Identifying Populations.

Additionally, providers were asked how effective they believe PrEP to be in preventing HIV infection in female identifying patients on a Likert scale from one (*not effective at all*) to five (*extremely effective*). Due to the small sample size, descriptive statistics were used to analyze the results. For providers who completed the presurvey and two-week postsurvey, the most frequently observed category on the presurvey was four ($n = 5$, 56%) and at two-weeks was five ($n = 5$, 56%). In providers who completed all surveys, at the two-week post survey, the most frequently observed category was five ($n = 3$, 60%) on the pre-survey, and five ($n = 3$, 60%) on the two-week post survey. At the eight-week post survey the most frequently observed category was five ($n = 3$, 60%). Since only descriptive statistics could be performed, no statistically significant data could be concluded.

To further assess beliefs providers were asked how essential they believe evaluating and educating their female patients on PrEP is on a Likert scale from one (*not essential*) to five (*always essential*). For providers who completed the presurvey and two-week post survey the rates were improved, but not statistically significant ($Mdn = 2.00$ [pre], $Mdn = 3.00$ [two-week post], $\alpha = 0.05$, $V = 3.00$, $z = -1.34$, $p = .180$). For providers who completed all three surveys, descriptive statistics were run due to small sample size. On the presurvey the most frequently observed category was four ($n = 3$, 60%), five ($n = 4$, 80%) at two weeks and five ($n = 3$, 60%) at eight weeks. Between the presurvey, two-week, and eight-week postsurvey there was a statistically significant decrease in provider's beliefs that HIV risk assessment was an essential component of a primary care visit for female patients ($Mdn = 3.00$ [pre], $Mdn = 2.00$ [two-week], $Mdn = 2.00$ [eight-week], $\alpha = 0.05$, $V = 10.00$, $z = -2$, $p = .046$).

Confidence in evaluating and educating on PrEP. To assess confidence in their implementation of PrEP, providers were asked to rate if they agree that they are confident in educating and counseling female identifying patients on PrEP on a Likert scale from one (*strongly disagree*) to five (*strongly agree*). In providers who completed the presurvey and two-week post survey, there was an increase in provider agreeability with the statement, but not statistically significant ($Mdn = 3.00$ [pre], $Mdn = 4.00$ [post], $\alpha = 0.05$, $V = 6.00$, $z = -1$, $p = .317$). In providers who completed all three surveys, there was no statistically significant change in providers' confidence ($Mdn = 3.00$ [pre], $Mdn = 3.00$ [two-week post], $\alpha = 0.05$, $V = 3.50$, $z = -0.27$, $p = .785$, $Mdn = 2.00$ [eight-week post], $\alpha = 0.05$, $V = 13.00$, $z = -1.52$, $p = .129$).

Impact of the Intervention

The intervention showed to have a significant impact on provider reported intent to prescribe PrEP to cis gender females at risk of contracting HIV at two-weeks post intervention. The intervention also showed, although not statistically significant, increases in provider conversations, and prescription rates of PrEP to female identifying patients in the short-term. On the contrary, providers were shown to have a statistically significant decrease in their perception that HIV risk assessment was a necessary part

of a primary care visit. Long term outcomes of the intervention were less favorable to its effectiveness. The intervention is a low-cost mechanism that with future evaluations and research could be a feasible and sustainable intervention to improve provider implementation and comfortability with PrEP in female identifying patients.

Sustainability

Based off the results of the surveys, it is important to have continuing and ongoing education of PrEP use in female identifying patients with providers. There is currently a provider with the student health organization that is a representative for Gilead, the pharmaceutical company that manufactures PrEP. She provides a yearly educational update on the guidelines and implementation practices of PrEP to providers. To improve upon provider perceptions and implementation practices it would be imperative to integrate an emphasis on the use of PrEP in female identifying patients. It would also be beneficial to have designated providers to manage patients on PrEP within the clinic. Those providers could be a continuous resource to other providers as well as be committed to stay up to date on the guidelines with PrEP implementation.

Discussion

While the results of this applied project may be small there are implications for future practice. Several agencies under the United States Health and Human Services Department have formed the coalition Ending the HIV Epidemic: A Plan for America, which has the goal of ending the HIV epidemic by 2030 through the reduction of new infections by 90 percent (Office of Infectious Disease and HIV/AIDS Policy, 2021). For this goal to be met it is essential for providers to have the tools to adequately assess for HIV risk and implement preventative measures for HIV acquisition in all at risk patients. Although minimal statistical significance was attained by this intervention, evaluating barriers can inform future research.

Barriers

Due to the COVID-19 pandemic, the full scope of the intervention could not be implemented as guided by the CLT. The intent of designing an educational intervention using the CLT was to provide hands on and interactive elements of the educational intervention, to promote learning through many avenues and stimulate knowledge construction. The results obtained from the data analysis were consistent with current literature, showing that educational interventions that simply provide information are not as effective as those that provide various modes of learning (Ku, Phillipson, & Phillipson, 2015; Doblecki-Lewis, et al., 2018). Additionally, when the intervention was implemented, the University campus was not operating at full capacity due to the pandemic. In person appointments were limited and census at the clinic was reduced. Providers were also very overwhelmed with the current pandemic, and “zoom fatigue” may have had an impact on the outcome of the intervention (D.Labban, Nurse Practitioner at the clinic, personal communication, October 15, 2020).

Outside of the barriers caused by the global pandemic, design of the survey tool may have had an impact on the collection of data. The survey tool utilized was not validated or reliable, but rather a composite of surveys from previous research on PrEP educational interventions. Due to limited studies on improving implementation practices in female identifying patients, survey questions were adapted to evaluate the outcomes of the intervention in female patients. Small sample size and high attrition rate may have also impacted the outcomes of the intervention and effected generalizability of the results. The homogeneity of the participants, being predominantly white, female, and nurse practitioners also affect the ability of these results to be inferred with different populations. In addition, response bias may have played a role in providers perceived future implementation practices.

Future Research

The female identifying population has a severe need for PrEP. The data shows that there is a gap in the number of women that would benefit PrEP and those who are currently prescribed the preventative medication (AIDSVu, 2021a; AIDSVu, 2021b). Future research should focus on educational interventions

that have the most impact on providers implementing PrEP with high risk, female identifying patients. In addition, research should concentrate on interventions that promote long term behavior change, as providers reporting they feel comfortable prescribing PrEP to at risk female patients, and them actually doing so are important distinctions to make. Future educational interventions should look at utilizing a point person at a clinic to be a resource for providers with ongoing questions about PrEP, such as a PrEP navigator. The most successful interventions have shown that long term support promotes more effective outcomes and implementation practices of PrEP (Doblecki-Lewis, et al., 2018). This type of intervention may also support a more sustainable intervention. Qualitative research from the perspective of female identifying patients at risk of HIV infection and their perceptions of PrEP would also be beneficial in informing future practice.

PrEP has been a radical development in preventing HIV and has shown successful uptake in the MSM population. The goal of the international community is to end the HIV epidemic and to make this goal a reality, female identifying patients need to become part of the conversation when providers are discussing PrEP. A synthesis of the literature has clearly shown that HCPs agree that they should be spearheading this movement, but that a lack of knowledge on PrEP and how to medically manage a patient on PrEP is a key barrier. Increased education on PrEP and educational interventions have shown statistically significant improvements in provider knowledge and implementation practices of PrEP with at risk parties. The educational intervention in this study did show short-term improvements in providers perceived future practices of prescribing to at risk females. Unfortunately, long-term outcomes were shown to statistically decrease providers understanding that HIV risk assessment was an essential component of a primary care visit with female identifying patients. These outcomes show that while an educational intervention may be impactful on behavior change in the short-term, future research needs to focus on interventions that result in long-term behavior change. PrEP offers a user control method for HIV prevention, which is an additional area of empowerment to female identifying

patients and their sexual wellness. While this particular intervention did not show improvement in provider use of PrEP with their female identifying patients or a change in their perceptions of the importance of educating their female identifying patients on PrEP, it offered guidance on the development of future research.

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Appendix A

Evaluation and Synthesis Tables

Table A1

Evaluation Table of Quantitative Studies

Citation	Theory/ Conceptual Framework	Design/ Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis	Findings/ Results	Level/Quality of Evidence; Decision for practice
Blackstock, O. J., et al.(2016). A cross-sectional online survey of HIV pre-exposure prophylaxis adoption among primary care physicians. Country: US Funding: supported by	CLT (inferred)	Design: CSA online survey Purpose of study: Assess PrEP awareness, adoption, and factors associated with PrEP adoption and implementation Sampling: CS anonymous	N= 366 initiated surveys n= 246 eligible AR=32.8% Demographics: mean age (40.9), 79% attending physicians; sample was predominately white, female, and heterosexual	IV= Provider characteristics (age, race/ethnicity, age, gender, sexual orientation, current role, and medical education) DV1: PrEP adoption DV2: Knowledge,	PCP PrEP Survey The PCP PrEP Survey was a peer reviewed, existing survey instrument It was developed and pilot-tested.	Provider characteristics : Descriptive statistics Compare characteristic between AD and NAD: CSTs, & MANOVA Compare provider	DV1: being an attending physician (vs. trainee, OR = 2.16, 95 % CI 1.04–4.50) and providing care to more than 50 HIV-positive patients (vs. 0, OR = 7.63, 95 % CI 2.33–24.98) were associated	LOE: V Strengths: Large sample size. Detailed survey that was pilot tested and supported by peer reviewed evidence. Statistically significant results showing that adopters of

Key: 4PLS- 4 point Likert Scale; α – alpha; AD – adopters; APP – Advance practice providers; AR – attrition rate; ART – antiretroviral therapy; B&M – barriers and motivators; BREMRA - Bivariate random-effects meta-regression analyses; CDC – Centers for Disease Control and Prevention; CFI – comparative fit index; CFIR - consolidated framework of implementation research; CLT – Cognitive Learning Theory; CPT – Community of practice theory; CS – convenience sampling; CSA – cross sectional analysis; CST – Chi-square tests; DSLREM - DerSimonian–Laird random-effects model; DV – dependent variable; DS – descriptive statistics; FET – Fisher’s exact test; FP – family planning; HIV – Human Immunodeficiency Virus; IDP – infectious disease provider; IMB – information- motivation – behavioral skills; ISP – implementation science project; KEP – knowledge, experiences, preferences; KWT – Kruskal Wallis Test; KRF - Kuder and Richardson Formula LR – logistic regression; LS – longitudinal study; MA – meta analysis; MANOVA - multivariate analysis of variance; MLR – multivariate linear regression; MvLR - multivariable logistic regression HCP - health care provider; IV – independent variable; NAD – non adopters; NM – nurse midwife; PCP – primary care provider; PEP – post exposure prophylaxis; PGY – post graduate year; PIS – Pilot implementation study; PPS – pre/post test; PrEP – pre-exposure prophylaxis; PRISMA - Preferred Reporting Items for Systematic Reviews and Meta-Analyses ;PSiT- paired-sample t-tests; Pts- patients; QE – quasi experimental; RS χ^2 - Rao–Scott χ^2 tests RMSEA - root-mean-square error of approximation; RCT – randomized control trial; RN- registered nurse; Rx – prescription; SUDAAN - Statistical Software for Analyzing Correlated Data; SCT – Social cognitive theory; SLT – Situated learning theory; SR – systematic review; TLI – Tucker-Lewis Index; TSiT- two-sample t test; US – United States; USPHS – United States Preventative Health Services; WSRT – Wilcoxon Signed Rank Test; X- not reported; *-demographic data was given for individual studies, reader hand calculated demographic data from provider studies of SR

Citation	Theory/ Conceptual Framework	Design/ Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis	Findings/ Results	Level/Quality of Evidence; Decision for practice
the Yale Center for Clinical Investigation. One author was funded as a Yale Drug Abuse, Addiction and HIV Research Scholar. Bias: None determined		survey sent to members of Society of General Internal Medicine; providers who were involved in direct clinical care or provided oversight to those involved in direct clinical care		Attitudes and Beliefs of PrEP		clinical practice and PrEP adoption: LR	with higher odds of PrEP adoption DV2: Compared with non-adopters, adopters were more likely to report excellent, very good, or good self-rated knowledge of PrEP (p < 0.001; Fig. 1), knowledge of PrEP side effects (p < 0.001), and to report being extremely likely to prescribe PrEP in the	PrEP had more self-rated knowledge of PrEP and experience with HIV positive patients Weaknesses: Convenience sampling. Homogenous sample does not allow for generalizability . Self-report bias. Conclusion/ Feasibility: Statistically significant data consistent with literature on the correlation of knowledge and PrEP

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							next 6 months (p < 0.001)	implementatio n. Low risk of harm. Strong evidence to inform practice.
Blumenthal J., et. al (2015). Knowledge is power! Increased provider knowledge scores regarding pre- exposure prophylaxis (PrEP) are associated with higher rates of PrEP prescription and future intent to prescribe PrEP. Country: US	CLT (inferred)	Design: Cross- sectional analysis; Self- administered survey Purpose of study: Understand HCP knowledge and interest in prescribing PrEP, as well as perceived barriers to implementati on.	N= 233 75 percent response rate No information on how many HCP were asked to take the survey and how many responded Demographics: mean age – 40; Gender – 60% female; Race/ethnicity- 50% white, 19% Asian, 7% Black. 52% of participants were HIV	IV1: PrEP knowledge IV2: B&M to PrEP DV1: rate of PrEP prescriptions DV2: Attitudes towards future PrEP Rx	Survey: 35 question, survey. Content of the survey was developed at the Fenway Institute, and adapted from a survey developed by the CDC PrEP knowledge score: 5 questions assessed PrEP knowledge. KRF had an α of 0.22 showing poor	PrEP knowledge scores: Scores were compared between HIV specialists and non-HIV specialists using the TS&T. MLR used to study factors associated with higher knowledge scores Participant characteristic: summarized overall and	IV1: higher among HIV providers (2.8 vs. 2.2; P<.001), those who had previously prescribed PEP (3.1 vs 2.2, p<.0001) and those who felt comfortable determining who was a good candidate for PrEP (2.8 vs 2.0, p=0.005)	LOE: V Strengths: Detailed description of survey and data collection methods, and statistical analysis of results. Assess varying aspects of HCP attitudes, perceptions, and knowledge of PrEP. Statistically significant outcomes. Little to no risk

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<p>Funding: Several authors supported through grants from Gilead and other pharmaceutical companies. The study was supported by an award from USCD Center for AIDs Research Bioinformatics and Information Technology Core</p> <p>Bias: funding from pharmaceutical manufacturer of PrEP</p>		<p>Sampling: CS Participants were recruited from an International AIDS Society meeting, AIDS rounds, Medical Grand Rounds, formal didactic lectures</p>	<p>providers, 60% physicians, 13% nurse practitioners; Specialty – 34% internal medicine, 13% family medicine, 15% infectious disease</p>		<p>internal consistency</p>	<p>stratified by HIV provider status</p> <p>PrEP Rx: FET and MLR</p> <p>B&M: summarized by HIV provider status.</p>	<p>DV1: occurred more often among HIV providers (p<.001), those with higher knowledge scores (p<.001), those who asked about sex practices (p=0.004), and those most comfortable determining PrEP candidacy (p=0.027)</p> <p>IV2: 40% cited drug toxicities, development of resistance, and patient</p>	<p>to participants, and easy to implement.</p> <p>Weaknesses: Not a RCT. Convenience sampling. Physicians recruited were attending AIDs conferences, Long survey. Low validity of PrEP knowledge questions of survey.</p> <p>Conclusion/ Feasibility: Addressing these areas and HCP’s major concerns about prescribing</p>

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							adherence to follow-up as barriers to prescribing PrEP. >80% stated new studies showing efficacy, patient request, ease of obtaining PrEP, and recommendations from the CDC would facilitate PrEP prescribing	PrEP could lead to successful PrEP implementation. Strong study for practice change.
Bradley et al. (2019). Factors effecting pre-exposure prophylaxis implementation for women	CLT (inferred)	Design: SR Purpose of study: Explore issues surrounding PrEP	N = 39 n = 26 (women studies) n= 13 (provider studies)	(1) awareness or knowledge of PrEP, (2) willingness to use or prescribe PrEP,	PRISMA guidelines	One reviewer performed data abstraction including study design,	Awareness and knowledge: PrEP knowledge among women ranged from 0-33%; few studies on	LOE: I Strengths: SR, several databases and reference lists of articles searched to

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in the United States: A systematic review Country: US Funding: The study funding was not disclosed, all authors were employees of the CDC. No conflict of interests was declared . Bias: none determined		implementation for women and identify research gaps in the current evidence. Sampling: Systematic search of the literature for relevant articles published from January 2000 to April 2018. Databases searched included MEDLINE, EMBASE, CINAHL (EBSCOhost), and PsycINFO.	Studies included were largely cross-sectional and mainly used surveys and focus groups	(3) attitudes toward PrEP, (4) barriers or facilitators of PrEP use or prescription.		dates, location, and size; participant demographic s, major findings of study, and conflict of interest. Second reviewer confirmed abstraction and at each review level, the process and forms were piloted before full implementation. Outcomes were	provider knowledge, one study showed 38% awareness of PrEP from providers Willingness to use of prescribe: 51-79% of women were willing to take PrEP; 60-92% of providers reported willingness to prescribe PrEP to women. Attitudes toward PrEP: High rates of acceptance of PrEP among women and providers	provide an exhaustive search of the literature. Literature consistently shows lack of knowledge as barrier to PrEP implementation. Weaknesses: Predominately includes studies that are cross-sectional analysis with small sample sizes and convenience sampling. Conclusion/ Feasibility: Well performed SR

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						categorized by topic area and whether they were a study focused on women or providers. Under each category data was summarized.	Barriers and facilitators: barriers: largest barrier was lack of education on PrEP, additional barriers included discrepancies between guidelines and clinical practice; provider studies largely did not report on facilitators	that shows consistency among peer reviewed articles on knowledge of PrEP among providers. Identifies lack of provider education as a key indicator for lack of PrEP prescribing specifically in women. Strong evidence to inform practice.
Henny et al. (2019). HIV - related training and correlates of knowledge, HIV screening	CLT (inferred)	Design: Survey, cross-sectional Purpose of Study: To examine the overall	N= 4595 n = 820 AR=82.1% Demographics: 49.7% ≥ 50 years of age, 59.4% female, and	IV: HIV related training DV1: PrEP Rx DV2: Familiarity with PrEP	56-item survey instrument included measures of knowledge, attitude, screening	RS χ^2 tests, Factors that were statistically associated ($p \leq 0.05$) a MvLR	PCPs with HIV-related training were more likely to prescribe DV1: PrEP Rx (PR = 2.00,	LOE: V Strengths: Large sample size compared to similar studies; Statistically

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and prescribing of nPEP and prEP among primary care providers in southeast United States, 2017. Country: US Funding: CDC Bias: None identified		readiness of PCPs to provide nPEP and PrEP services and the impact of HIV-related training on their ability to do so Sampling: sampling frame of study was derived from the IQVIA® provider database, which contains a census of all currently active health care providers in the U.S. This	60.2% white. Weighted sample comprised 75.6% physicians, 20.7% nurse practitioners and 3.6% physician assistants.			model was used SUDAAN (Version 11) procedures, which are appropriate to analyze complex survey data.	95% CI 1.59, 2.56) DV2: familiar with PrEP (PR = 2.63, 95% CI 2.13, 3.23	significant results showing link to provider education and PrEP familiarity and prescription Weaknesses: Convenience sampling; lower quality of evidence; self-reported data related to HIV training; no survey reliability data available; sample predominately from the southeastern United States; High attrition rate

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		population was used to obtain a representative sample of six selected Southeast jurisdictions, stratified by region and provider type						Conclusion/ Feasibility: Statistically significant data from a large sample size showing consistent results of previous peer reviewed literature indicating a correlation between knowledge and PrEP implementation. Strong evidence for practice change.
Inrungu, E.M. et al. (2019). Training health care providers	CFIR	Design: ISP Purpose of Study: To address the	N= 716 n=541 (completed both	IV = Training on PrEP DV = PrEP knowledge gain	10 question pre/posttest on PrEP knowledge. No information	paired t-test and one- way ANOVA	Pre-test the mean score was 61.7% (standard	LOE: V Strengths: Large sample size;

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to provide PrEP for HIV serodiscordant couples attending public health facilities in Kenya Country: Kenya Funding: National Institute of Mental Health of the US National Institutes of Health Bias: None determined		gap in HCP education on PrEP to increase PrEP implementation Sampling: Convenience sampling. 24 high volume, HIV care clinics and staff who would be engaged in PrEP implementation.	pre/posttest assessments) AR: 24% Demographics: 32.9% were nurses, 20.2% were clinical officers and 21.7% were HIV counsellors.		on validity and reliability of test		deviation [SD] 17.4). Mean post-test score was 86.4% (SD 12.7). There was an overall increase of 24.7% (95% CI 23.3%–26.1%, p < 0.001) in the mean scores among those who completed both the pre-test and post-test evaluations.	Implemented in clinic setting; training developed by nationally recognized organizations; Statistical improvement in knowledge Weaknesses: Convenience sampling of providers familiar with HIV; pre/posttest not validated. 2 day intervention. Conclusion/ Feasibility: Despite being a low level of evidence, the

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								implementation of the intervention is feasible and performed in the real world setting while producing statistically significant outcomes for improving PrEP knowledge. Strong support for practice implementation.
Newman, R., et al.(2019). Enhancing HIV pre-exposure prophylaxis practices via an educational intervention.	CLT (inferred)	Design: Quasi-experimental; Online survey, with pre/posttest analysis	N= 48 participated in educational intervention n= 45 completed preintervention survey	IV: 1- hour Educational intervention PrEP DV1: Willingness to prescribe PrEP DV2: Knowledge of PrEP	Pre-intervention survey consisted of 31-items adapted from the study by Blackstock et al.. Survey was based off of	WSRT for paired data and the KWT for variations related to training level. Significance	DV1: overall comfort in prescribing PrEP (35%/70%, P < 0.015)	LOE: V Strengths: Valid and reliable measurement instrument consistent with prior,

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<p>Country: US Funding: Not disclosed in article. Authors declared no conflict of interest. Bias: None determined</p>		<p>Purpose of study: to evaluate the knowledge, attitude, and practices of residents regarding PrEP before and after an educational intervention Sampling: CS. An anonymous online survey was sent to a medium-sized academic internal medicine residency</p>	<p>n=36 completed postintervention survey AR= 25% Demographics: Resident demographic data was collected, but not disclosed</p>	<p>DV3: Barriers to PrEP implementation</p>	<p>previous qualitative and quantitative on clinician practices regarding ART and PrEP. Post-intervention survey similar in content and consisted of 21-items</p>	<p>was accepted for P < 0.05</p>	<p>DV2: more respondents understood PrEP safety (66%/92%, P , 0.001), effectiveness (78%/94%, P , 0.001), and usefulness of PrEP (56%/89%, P 5 0.008) after training DV3: lack of provider training/education (64%/33%, p, 0.001); lack of clinic guidelines/46r oprotor (69%/39%, p, 0.033); and</p>	<p>peer reviewed literature. Brief educational intervention; Statistically significant improvement in DV1, DV2, and DV3. Weaknesses: Small sample. Convenience sample limits generalizability. Potential for bias due to self-report survey and self-reported intention to prescribe. No control group to further validate findings.</p>

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							lack of insurance coverage and out-of-pocket patient costs (75%/50%, p, 0.015)	Demographics not disclosed. Conclusion/ Feasibility: A short, one-hour educational intervention was shown to have a statistically significant effect on DV1, DV2 and DV3. An educational intervention has shown to be effective in reducing barriers to PrEP implementation. A feasible intervention for practice.

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Sales, J.M. et al. (2019). Impact of PrEP training for family planning providers on HIV prevention counseling and patient interest in PrEP in Atlanta, Georgia.	CLT (inferred)	Design: PIS Purpose of Study: Improve HIV risk assessment and PrEP counseling among heterosexual women. Sampling: Convenience sampling, 4 family planning clinics approached to participate. Eligibility criteria for providers: employed by one of the clinics in a	FP providers N=28 Exit interviews of FP patients N=637 AR=21.5% Demographics: 64% identified as FP providers (3 physicians, 9 APP, 6 RN/NM); (25%) were aware of USPHS guidelines. Patients: ages were 18–69 [mean (M) = 34, SD = 12.9] years; 69% were black/African American, 12% identified as Hispanic/Latina. 77% were	IV =PrEP training DV1 =Provider Knowledge and confidence in PrEP DV2 = PrEP discussion, awareness, and interest	Survey adapted from similar studies in peer reviewed literature. Original survey was developed by the CDC Exit interviews were conducted with patients with a series of yes/no questions related to HIV prevention	Descriptive analyses and PS _t T	DV1 = Providers/staff had significantly higher PrEP knowledge after the PrEP training [pre M = 3.26 (SD = 1.43) vs. post M = 5.13 (SD = 1.18); t(22) = 25.63, P , 0.001] and confident in identifying patients at risk for HIV and patients who could benefit from PrEP [pre M = 8.11 (SD = 1.02) vs. post M = 9.11 (SD = 0.96); t(17) =	LOE: V Strengths: Study focused on PrEP and heterosexual females; Large sample of patients; evaluates not only provider reported PrEP implementation, but real world implementation. Statistically significant improvement in PrEP knowledge. Weaknesses: Lower level of evidence; Small sample of providers; No pre-

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		role where they provided STI/HIV counseling to nonpregnant, HIV-negative, female patients aged 18 years and older who spoke English were eligible. Patient's of the FP clinic were also enrolled in study.	sexually active and 69% in a current sexual relation- ship with a male partner				23.09, P = 0.007 DV2= Among patients that reported discussion of HIV prevention, 74% reported the provider discussed PrEP. Among the 110 women reporting HIV-risk consistent with PrEP indication, 66% reported the provider discussed PrEP. (No pre-intervention data on DV2, so no evidence	intervention data of providers discussions with patients Conclusion/ Feasibility: Focused study on heterosexual females and improving PrEP practices. Brief training showed statistically significant results feasible for real world application. Strong evidence for practice implementation.

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							of effect of intervention)	
Walsh, J.L., et al. (2018). Factors related to pre-exposure prophylaxis prescription by U.S. primary care physicians. <i>American Journal of Public Health</i> . Country: US Funding: Gilead Sciences and National Institute of Mental Health Bias: funding from pharmaceutical manufacturer of PrEP	IMB model	Design: Survey Purpose of Study: To determine if information, motivation, and behavioral skills are associated with PrEP prescriptions Sampling: CS, Participants were recruited through databases of three professional organizations	N= 2088 n= 525 AR=74.9% Demographics: 280 PCPs, 245 HIV providers	IV = information, behavioral skills, and motivation DV1 =PrEP discussion DV2 =PrEP Rx	Survey created by second author. Based off of previous work and theoretic considerations Peer reviewed and pilot tested by 25 providers	Mplus, structural equation modeling; p<0.10 considered significant; Model fit assessed using CFI and TLI values >0.95 and RMSEA values <0.05 For indirect effects, unstandardized coefficients and 95% CIs and ORs are reported	Information was correlated with both motivation (r=0.38, 95% CI=0.27, 0.49) and behavioral skills (r=0.39, 95% CI=0.28, 0.51 DV1: information and motivation had direct, positive associations (OR=1.60, 95% CI=1.36, 1.85 and OR=1.25, 95% CI=1.01, 1.55, respectively) DV2:	LOE: V Strengths: Large sample, in greater geographical area; thorough statistical analysis between theoretical model and outcomes; statistically significant results on outcomes pertinent to identified gaps. Weaknesses: Funded by Gilead (maker of PrEP), lower level of

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Wood, B. et al. (2016). Impact of a telehealth program that delivers remote consultation and longitudinal mentorship to community HIV providers.	SCT, SLT CPT	Design: Longitudinal; pre/posttest design Purpose of Study: Evaluate changes in providers' self-assessed HIV knowledge and confidence to provide essential components of HIV clinical care while engaged in telehealth mentor program. Sampling: 11 clinical sites Pacific	N= 90 n = 45 AR=50% Demographics: Participants re-ported low-volume HIV-positive patient panels (a median of 18 for survey respondents) and few years of experience managing HIV (a median of 4 for survey respondents); 61.2 % were physicians and 60.8 % practiced in an urban setting	IV = educational sessions attended DV1 = self-efficacy in HIV care DV2= HIV knowledge	23 question survey completed at baseline and every 6. months	Paired samples <i>t</i> tests and ANOVA	DV1= statistically significant outcomes (p<0.05), Screen for HIV in the general population, Counsel to reduce HIV transmission, Perform initial HIV-related history/physical, Select tests for monitoring HIV, Evaluate exposures/advise regarding PEP DV2= Pre/post test mean scores (2.89/3.22) Paired Diff. of	LOE: V Strengths: Statistically significant results showing improvement in areas of interest related to HIV care; longitudinal design allows to see changes over time; utilizes peer support and provider network Weaknesses: lower level of evidence; no information on survey reliability; relying on self-

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			Northwest region of the United States				means (0.33) $p=.004$	report of providers could have resulted in bias; long and extensive intervention; high attrition rate Conclusion/Feasibility: Statistically significant improvement of PrEP implementatio n with intervention. Intervention itself is extensive but has strong evidence to inform practice.

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Zhang, C. et al. (2019). HIV pre-exposure prophylaxis implementation cascade among health care professionals in the United States: Implications from a systematic review and meta-analysis Country: US Funding: University of Rochester Center for AIDS Research and School of Nursing at University of Rochester	None stated	Design: SR/MA Purpose of Study: identify and synthesize existing data on PrEP implementation to make recommendations for future programs. Sampling: Between June and December 2018 a comprehensive literature search was conducted from multiple databases including	N=300 n=36 Study inclusion: (1) presented results on PrEP implementation cascade for a sample including at least one type of HCPs and specialty in the United States; (2) used quantitative or qualitative or mixed-method study designs (3) reported quantitative measures for any stages of PrEP implementation (4) were peer reviewed and published in English, and could be searched from	IV=PrEP training/educational intervention DV1= Prevalence of PrEP awareness willingness to prescribe PrEP, PrEP consultation, and PrEP prescription	Preferred Reporting Items for Systematic Reviews and Meta-Analyses Two reviewers independently reviewed articles identified in the initial search and disagreement was resolved by discussion (inter-rater reliability >95%)	BREMRA DSLREM The I ² statistic and its corresponding 95% Cis describe heterogeneity Publication bias was assessed by funnel plots and Egger's test	DV1 = compared with PCPs, IDPs had higher odds of being aware of PrEP (OR = 6.11, 95% CI = 3.56–10.48), willingness to prescribe PrEP (OR = 3.06, 95% CI = 2.27–4.11), and prescribing PrEP (OR = 4.06, 95% CI = 3.12–5.28); the pooled prevalence of PrEP awareness (68%) was similar to the willingness to prescribe	LOE: I Strengths: High level of evidence; large amount of studies; Several statistical analysis of data collected to ensure valid and reliable data that was extracted; Separated data based on provider role (ID, PCP, PA/APRN) Weaknesses: Identified significant publication biases; significant heterogeneity

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Citation	Theory/ Conceptual Framework	Design/ Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis	Findings/ Results	Level/Quality of Evidence; Decision for practice
Medical Center. Bias: None determined		PubMed/ME DLINE, Web of Science, PsycINFO, EMBASE, and Google Scholar. 26 quantitative 10 qualitative	indexed databases or published sources				(66%), but it was almost three times higher than the prevalence of actual prescription (24%)	of studies due to different designs; Conclusion/Feasibility: Statistically significant data in several peer reviewed studies linking knowledge of PrEP to implementation and prescription. High level of evidence to inform practice change.

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Table A2

Synthesis Table

Study	Blackstock, O. J., et al.(2016).	Blumenthal J., et. al (2015).	Bradley et al. (2019).	Henny et al. (2019).	Inrungu, E.M. et al. (2019).	Newman, R., et al.(2019).	Sales, J.M. et al. (2019).	Walsh, J.L., et al. (2018).	Wood, B. et al. (2016).	Zhang, C. et al. (2019).
Design/Level of Evidence:	CSA/V	CSA/V	SR/I	CSA/V	ISP/V	QE; PPT/ V	PIS; V	CSA/V	LS/V	SR/I
Sample Size/ # of Studies Included	246	233	39 (26 focused on women, 13 on providers)	820	541	36	HCP-28 Pts-500	525	45	36
Study Characteristics										
Demographics										
Age (Mean y.o.)	40.9	40	X	X (50% over 50)	X	X	X	50.4	X	44.61
PCP (%)	100	47	80*	100	53.1	100	64	100	81	67
HIV provider/training (%)	0	52	39*	36	21.7	0	0	0	X	31
Female (%)	62	60	67*	59	X	X	X	48	X	51
Caucasian (%)	73	59	X	60	X	X	X	56	X	69
Setting:										
Country	US	US	US	US	Kenya	US	US	US	US	US

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Measurement Tools	PCP PrEP Survey	35-item PrEP KEP Survey	PRISMA guidelines	56-item PrEP KEP Survey	10 item Pre/Posttest	31-item PrEP KEP pre-test/21-item posttest	Pre/post PrEP KEP Survey	Survey	23-item HIV care knowledge test/survey	PRISMA
Duration of Intervention	1 mo.	X	Studies between Jan 2000-April 2018	X	2 days	1 hour	1.5 hour	17 months	3.5 years	X
Interventions/ Independent Variables										
PrEP Education Session					✓	✓	✓			✓
TeleHealth Program									✓	
Infectious disease provider/HIV specialist		✓	✓							✓
HIV knowledge	✓	✓	✓	✓				✓	✓	✓
Outcomes/DV										
Knowledge of PrEP	↑	↑			↑	↑	↑	↑	↑	↑
Willingness to Adopt PrEP/Future Rx	↑	↑	↑	↑	↑	↑	↑		↑	↑
PrEP Rx		↑						↑		↑

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Appendix B

Models and Frameworks

Figure 1

Cognitive Learning Theory Conceptual Model

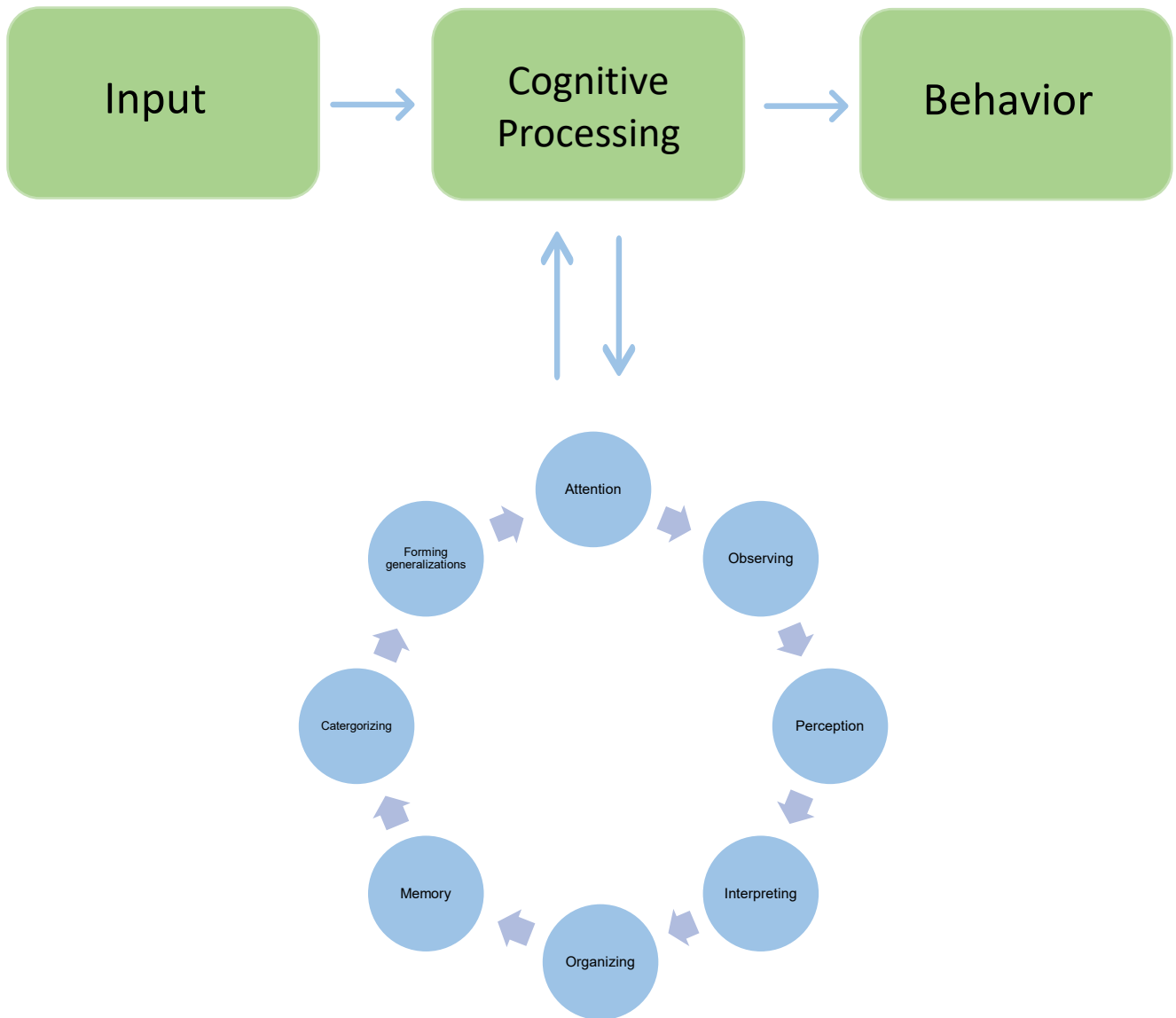
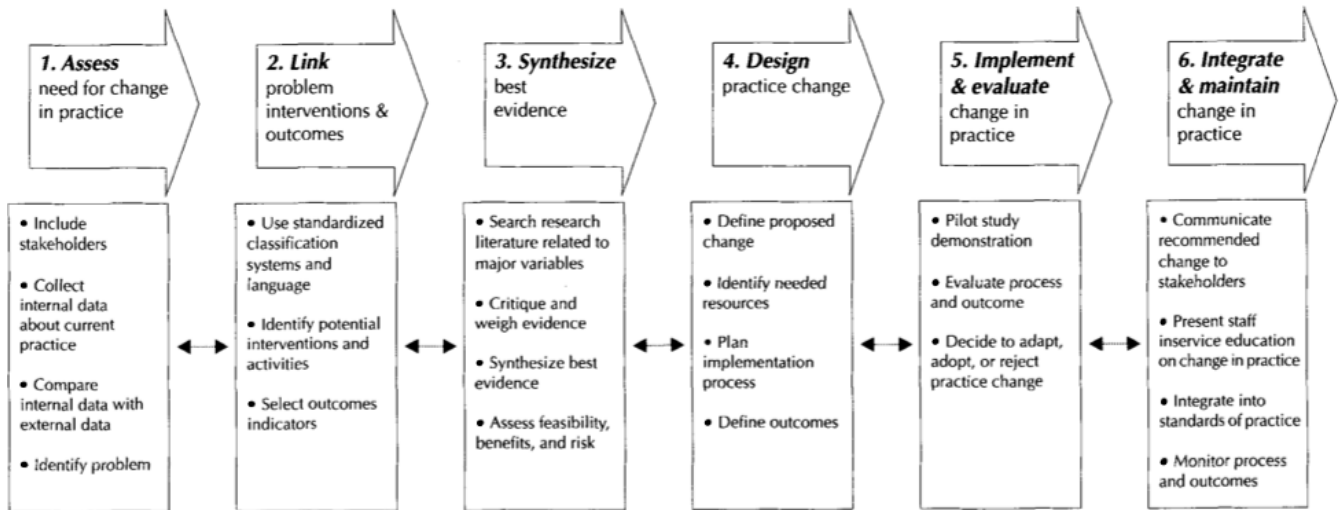


Figure 2

Rosswurm and Larabee's Evidence Based Model



(Rosswurm & Larabee, 1999b)

Appendix C**Provider Survey***Primary Care Provider Survey on PrEP Implementation in Females*

Adapted from Blackstock et al. (2016), Blumenthal et al. (2015), and Sales et al. (2019)

Demographic Questions

1. What is your age (years)
 - 18-30
 - 31-40
 - 41-50
 - 51-60
 - >60

2. With respect to gender, how do you self-identify?
 - Male
 - Female
 - Transgender
 - Gender non-conforming
 - Does not want to report

3. With respect to race, how do you self-identify?
 - White
 - Black or African American
 - Asian or Asian American
 - American Indian
 - Alaskan Native
 - Native Hawaiian
 - Pacific Islander
 - Other (please specify) _____
 - Does not want to report
 - Do not know

4. Do you identify as being Hispanic/Latinx?
 - Yes
 - No

5. How many years have you been a primary care provider?
 - None
 - < 5 years
 - 6-10 years
 - 11-15 years
 - > 15 years

6. What is your primary healthcare provider role?
- Physician (MD, DO)
 - Nurse Practitioner
 - Physician Assistant
 - Medical student/ NP student
7. What percentage of your patients identify as female?
- None
 - 1-25%
 - 26-50%
 - 51-75%
 - 76-100%
8. Do you take care of HIV-uninfected persons at risk for developing HIV?
- Yes
 - No
9. If yes, which populations do you work with (select all that apply)
- Men who have sex with men (MSM)
 - Injection drug users (IDU)
 - HIV discordant heterosexuals
 - Risky heterosexuals
 - Sex workers

Survey Questions

10. Have you ever heard of pre-exposure prophylaxis (PrEP)?
- Yes
 - No
11. Have you ever initiated a conversation about PrEP with a patient identifying as female?
- Yes
 - No
12. If yes, estimate how many female identifying patients have you initiated conversations about PrEP with.
13. Have you ever prescribed PrEP to prevent HIV transmission to a patient who identified as female?
- Yes
 - No
14. If yes, estimate how many female identifying patients you have prescribed PrEP to prevent HIV infection.

15. How would you rate your knowledge of PrEP utilization in females?
- Excellent (5)
 - Good (4)
 - Average (3)
 - Poor (2)
 - Terrible (1)
16. How effective do you believe PrEP is in preventing acquisition of HIV among women who take it every day as prescribed?
- Extremely effective (5)
 - Very effective (4)
 - Moderately effective (3)
 - Slightly effective (2)
 - Not effective at all (1)
17. If a female identifying patient says she is using condoms consistently and correctly, how important is it to offer PrEP in addition to condoms?
- Extremely important (5)
 - Very important (4)
 - Moderately important (3)
 - Slightly important (2)
 - Not at all important (1)
18. In the next 6 months, how likely are you to prescribe PrEP to at-risk patients in each of the following groups to reduce the risk of sexually acquired HIV infection?

	Not likely at all (1)	Somewhat likely (2)	Very likely (3)
At risk HIV-negative cis women			
At risk HIV-negative transgender women			
HIV-negative MSM			

19. To what extent do you think each of the following is an essential part of HIV prevention services during a primary care visit with patients identifying as female?

	Not essential (1)	Sometimes essential (2)	Neutral (3)	Almost always essential (4)	Always essential (5)
HIV risk assessment					
PrEP education/evaluation					
HIV testing					

20. To what extent do you agree or disagree with each of the following statements?

	Strongly agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly disagree (1)
I am confident I can independently identify women at-risk for HIV infection					
I am confident that I can educate and counsel women about PrEP					

Appendix D
Data Analysis

Figure 1*Descriptive Data of Sample*

Variable	<i>n</i>	<i>%</i>
Race		
White	7	63.64
Asian or Asian American	3	27.27
Other	1	9.09
HCP_Role		
MD	3	27.27
NP	8	72.73
Age		
31-40	2	18.18
41-50	3	27.27
51-60	3	27.27
>60	3	27.27
Ethnicity		
Hispanic/Latinx	1	9.09
Non-Hispanic/Latinx	10	90.91
Gender		
Male	2	18.18
Female	9	81.82

Figure 2

Ranked Values of How Likely Providers Are Willing to Prescribe PrEP to HIV Negative, Cis-gender Females

