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Brandi E. Moore
brandimoore80@gmail.com

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**Exploring Thai Physicians' Perceptions of and Willingness to Prescribe Pre-Exposure
Prophylaxis (PrEP)**

Brandi Moore

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Department: Epidemiology of Microbial Diseases, School of Public Health

Advisor/Committee Chair: Laretta E. Grau, PhD

Committee Member: Jeffrey Wickersham, PhD

Abstract

Background: Oral pre-exposure prophylaxis (PrEP) is a daily medication that can prevent HIV infection. PrEP may further support HIV prevention initiatives in Thailand, particularly as it becomes more accessible in the country's government clinics and hospitals. While studies have explored perceptions of PrEP for at-risk people in Thailand, there has been limited investigation into Thai physicians' opinions on and willingness to prescribe PrEP.

Methods: Using convenience sampling, this cross-sectional study recruited 132 Thai physicians to complete an anonymous, online survey. The survey assessed physicians' concerns about PrEP, experience with PrEP, and willingness to prescribe PrEP. Bivariate and multivariable logistic regressions were conducted to assess factors associated with willingness to prescribe.

Results: The majority of the sample had heard of PrEP before the survey (81.1%) and were willing to prescribe it (68.2%), though a minority had experience prescribing (18.2%). Common concerns regarding PrEP included the potential for decreased condom use, antiretroviral resistance, inadequate patient compliance, medication side effects, and an increase in STIs. The most frequently reported barrier to prescribing was a lack of clinical knowledge of PrEP. In a multivariable model, believing that PrEP was essential for addressing the HIV epidemic (aOR=20.87; 95% CI=3.69-118.12) and being willing to attend continuing medical education on PrEP (aOR=9.46; 95% CI=3.27-27.36) were associated with significantly higher odds of being willing to prescribe PrEP.

Conclusion: This is the first study to assess Thai physicians' willingness to prescribe PrEP. While the majority of our sample expressed willingness to prescribe, our results indicate a need to strengthen and promote medical education on PrEP to improve physicians' knowledge of the medication and confidence in its safety and effectiveness. Public health messaging should also address physicians' concerns about risk compensation following PrEP initiation and should further emphasize the potential importance of PrEP in reducing HIV incidence in Thailand.

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Table of Contents

Background.....	4
Methods.....	7
Results.....	11
Discussion.....	15
Conclusions.....	21
References.....	29
Tables	
Table 1. Characteristics of study population.....	22
Table 2: Pearson correlation: feelings towards key population and likelihood of prescribing to individuals in that population.....	23
Table 3: Unadjusted and adjusted associations between study variables and willingness to prescribe.....	24
Figures	
Figure 1. Concerns about PrEP.....	25
Figure 2: Single most significant barrier to prescribing PrEP.....	26
Figure 3: Willingness to prescribe.....	27
Figure 4: Likelihood of prescribing PrEP to different populations.....	28

Background

The HIV epidemic in Thailand

Thailand is a middle-income country with a population of nearly 70 million people and an adult HIV prevalence of approximately 1%—one of the highest national prevalences in Asia and the Pacific.¹ While incidence of HIV in Thailand has continued to decline each year, 5,400 new infections occurred in 2019, with incidence highest among several key populations.¹⁻³ For example, it is estimated that approximately 50% of new infections occur among men who have sex with men (MSM) and transgender people, 10% among sex workers (SW) and their clients, and 12% among people who inject drugs (PWID).^{2,4} Additionally, sexual transmission accounts for an estimated 90% of infections in Thailand.² Incidence is further concentrated among younger members of key populations where, for example, HIV incidence in Bangkok among MSM aged 18 to 21 was 8.8 per 100 person-years compared to 3.7 per 100 person-years for MSM over 30.⁵ While behavioral interventions such as condom use have aided in the reduction of incidence, transmission within key populations still remains high even under national efforts such as the 100% Condom Use campaign.^{6,7} This has signaled a need for additional prevention strategies which can strengthen the country's response to the epidemic.

Pre-exposure prophylaxis (PrEP)

Oral pre-exposure prophylaxis (PrEP) is a daily medication that can help prevent HIV infection for people who are HIV negative. It is a single tablet containing two antiretroviral drugs, Tenofovir and Emtricitabine, and is most commonly known under the brand name Truvada.⁸ The medication's efficacy was first recognized in 2010 in the iPrEX study which administered PrEP to approximately 2,500 MSM and transgender women (TGW) in clinical sites around the world, including in Thailand. While the results of this study demonstrated an overall efficacy of 45%,

this was primarily due to low adherence among participants. For participants with a detectable amount of the study drug in their system, PrEP had an efficacy over 90%.⁹ Similar efficacy has been demonstrated in other pilot studies, including a trial conducted in Bangkok which examined PrEP's efficacy among PWID.¹⁰⁻¹²

Because of the promising results from such trials, in 2014 the national Thai Guidelines on HIV Prevention and Care recommended PrEP as an additional HIV prevention method for people who are at risk.¹³ Following this, several PrEP-delivery pilot programs in Thailand were implemented to explore different strategies which could increase accessibility of the medication for members of key populations. For example, the Thai Red Cross AIDS Research Center implemented a fee-based PrEP provision system where participating high-risk individuals could access PrEP, laboratory testing, and condoms for 30 Thai Baht (~1 USD) per day.^{6,14}

Additionally, private clinics in Thailand such as the Pulse Clinic have focused on providing sexual health care to LGBT+ patients and have been regional leaders in PrEP distribution.¹⁵ The accessibility of PrEP in Thailand is further enhanced by the development of several locally-produced generic versions of the medication which help make the drug more affordable.¹⁶⁻¹⁸ Through these strides in implementation initiatives and drug production, Thailand now has an estimated 21,000-22,000 current PrEP users.¹⁶

Given the success of PrEP delivery in Thailand, along with the recognition that there are still many people who could benefit from the medication, in 2020 PrEP provision was recently included in the country's universal healthcare scheme.^{16,18} This new policy has made PrEP accessible in government facilities for free, a move which will likely help more vulnerable, at-risk individuals receive the medication. While this decision marks an impressive effort to further scale-up PrEP provision, its impact can only be maximized through the widespread acceptance of

PrEP as a prevention method by both eligible individuals and the physicians who can provide PrEP-related care in the coming years.

Acceptability of PrEP

Several studies have examined at-risk individuals' acceptance of and willingness to use PrEP in Thailand. For example, across studies, between 36-80% of Thai MSM and TGW have expressed an interest in using PrEP.¹⁹⁻²¹ What is less known are Thai physicians' opinions of PrEP and their general willingness to prescribe it. This is a critical perspective to explore since physicians often serve as gatekeepers to the medication and can make accessing PrEP more challenging if they are either unwilling to prescribe it or if they have significant concerns about its use. To our knowledge, there has never been a published study examining this subject in Thailand, though it has been explored elsewhere in the world. For example, a number of studies assessing physicians' knowledge and opinions on PrEP, along with their willingness to prescribe it, have been conducted in the United States as well as various other North American, South American, and European countries.²²⁻²⁹ These studies have frequently found that while the majority of surveyed physicians in recent years are aware of PrEP and support its use, a minority have actually prescribed the medication. Additionally, common concerns about PrEP that physicians have reported include the cost of the medication to the patient, the potential to develop antiretroviral resistance, inadequate medical education on PrEP, an increase in patients' risky sexual behavior, and the potentially low "real-world" effectiveness of PrEP.²²⁻²⁷

While such studies offer some perspective on how willing physicians in Thailand may be to prescribe PrEP, Thailand is unique in that it has been a pioneer in PrEP provision due to its robust demonstration projects, its position as a regional hub for PrEP prescriptions, and its recent inclusion of free PrEP in government facilities. These factors, along with a recognition of the

distinct cultural context that physicians in Thailand are operating in, signal a need to specifically study Thai physicians' perceptions of PrEP. This cross-sectional study aims to address the gaps in our understanding of their concerns and beliefs about PrEP, along with their willingness to prescribe it and the factors associated with willingness. Through this study, we hope to identify possible avenues for intervention which can help strengthen physicians' interest in prescribing PrEP to at-risk patients of all identities.

Methods

Participants and procedures

A cross-sectional study of physicians was conducted from October 2020 to January 2021. Participants (n=132) were recruited using convenience sampling via social media. Information about the study along with a link to the survey were shared in several private Facebook groups dedicated to Thai physicians, as well as through targeted Facebook advertisements. Inclusion criteria for study participation were: 1) identifying as a medically licensed physician in Thailand; and 2) providing medical care to at least one patient in the past 12 months.

Upon clicking the survey link, participants were presented with an information sheet that described the study procedures and purpose. After reading this information sheet, participants could provide their consent by responding affirmatively to a question asking if they agreed to participate. All responses were anonymous, and study participants had the option to complete the survey in either Thai or English. The survey required approximately 10-15 minutes to complete.

The survey was programmed and delivered using Qualtrics online survey software. All study materials including the survey were originally created in English and subsequently translated into Thai. The translation process involved multiple people who were fluent in both languages who

provided feedback on each other's translations and came to an agreement about the final version of the survey which was then programmed into Qualtrics. The survey was then piloted with several Thai physicians to ensure all questions were understandable, that the survey used appropriate clinical terms, and that the format of various survey questions was user-friendly.

Survey measures

The format of the survey and selection of various survey measures were informed by an original survey which assessed Malaysian physicians' knowledge of and willingness to prescribe PrEP.³⁰ Several items from that survey were adapted for our survey to better reflect the Thai context. We also further adapted items from this survey to allow for easier execution of our intended analyses. This primarily involved changing several questions that had answers in a 5-level scale to a 4-level scale so that relevant variables could be more easily transformed into a binary form for regression analyses. Additionally, feedback from piloting the survey further refined our design of survey measures.

Our survey began by providing participants with the following short description of PrEP:

“Pre-exposure prophylaxis, or ‘PrEP’, is a daily, oral medication that can prevent HIV infection for people who are HIV-negative. The PrEP medication is a single tablet containing two antiretroviral drugs, Tenofovir and Emtricitabine. Trade names include: Truvada, Tenvir-EM, Ricovir-EM, Tenof-EM, Tavin-EM, and Teno-EM”

Participants were then asked if they had known about PrEP prior to the survey. If they had, they were subsequently asked questions about where they had acquired information about PrEP, whether they had experience prescribing, and how many patients they had prescribed to. The survey further included questions that assessed physicians' perceptions of PrEP such as their

beliefs about PrEP's safety and effectiveness as well as whether they believed the medication had an essential role in managing the HIV epidemic. Additionally, participants were asked about their level of concern regarding Thailand's HIV epidemic, their willingness to attend continuing medical education (CME) on PrEP, and what they considered to be significant barriers or concerns related to PrEP prescriptions.

General willingness to prescribe PrEP was assessed through a 4-level rating scale (4= "very willing", 3= "somewhat willing", 2= "not very willing", and 1= "unwilling"). Participants were also asked to indicate the likelihood that they would prescribe to people from different populations (e.g., MSM, PWID) through a 5-point rating scale (5= "very likely", 4= "likely", 3= "neutral", 2= "unlikely", and 1= "very unlikely"). Similar 4- or 5-point scales have been used in other studies assessing either physicians' willingness to prescribe PrEP or people's willingness to use the medication.^{19,20,23,24}

Participants' attitudes towards MSM, TGW, PWID, SW, people living with HIV, and general medical patients were measured using "feeling thermometers" which required participants to score their attitudes towards each population on a scale of 1 (very negative) to 100 (very positive), with 50 being neutral. Feeling thermometers have been characterized as reliable survey tools and have been used in other studies to assess attitudes towards those living with or at-risk for HIV.³⁰⁻³²

Relevant sociodemographic and professional characteristics were also measured including participants' gender, age, years practicing medicine, medical specialty, and the medical setting they primarily practice at (e.g., government clinic, private hospital).

Statistical analyses

All analyses were completed using SAS version 9.4. Frequencies and descriptive statistics were used to initially characterize the sample and to report the distribution of participants' willingness to prescribe PrEP and the potential concerns they had about the medication.

Pearson correlations were used to explore associations between attitudes towards each of the key populations (MSM, TGW, SW, PWID) and the likelihood of prescribing PrEP to an individual from that key population.

To further explore general willingness to prescribe PrEP, we dichotomized the 4-level willingness variable such that those who answered that they were "unwilling" or "not very willing" were coded as "unwilling", and those that answered they were "somewhat willing" or "very willing" were coded as "willing." This variable transformation was done for ease of interpretation, to help conduct desired analyses, and because the design of the 4-point scale allowed for a natural construction of a binary option. Similar dichotomization of willingness can be seen in other studies on related subjects.^{23-25,33} This binary willingness variable was used as the primary outcome variable for a series of bivariate logistic regressions assessing potential associations between willingness to prescribe PrEP and various sociodemographic/professional variables, attitudes about PrEP, and attitudes towards specific populations. We then ran a multivariable logistic regression analysis using independent variables with a statistical significance at the $p < 0.05$ level in the bivariate analyses. All variables were checked for collinearity during the establishment of the final model. Odds ratios with 95% confidence intervals were reported for all regression analyses.

For these regressions, several other variables were also dichotomized. For example, specialty was dichotomized by comparing participants in medical fields that provide primary care services (general practice, family medicine, and general internal medicine physicians) to those that were

more specialized (primary care=1; else=0). Clinical setting was dichotomized by comparing those working in government facilities to those practicing in private or university settings (public sector =1; else=0). Similar to the recoding of the willingness-to-prescribe variable, willingness to attend CME was made binary by recoding those who were “somewhat” and “very” willing as “willing,” while those answering otherwise were recoded as “unwilling” (willing=1; else=0). Those who believed PrEP was “very” safe and those who believed PrEP was “very” effective were distinguished from those expressing less confidence in these claims (“very” = 1; else = 0). Finally, those who were “very” concerned about the Thai HIV epidemic were compared to those who expressed less concern (“very” = 1; else=0). These decisions were made after assessing the distribution of respondents’ answers and because, from a conceptual standpoint, we wanted to compare those who expressed high confidence in the safety/effectiveness of PrEP from those who expressed more hesitancy over these statements, and we wanted to compare those who expressed maximum concern over the epidemic from those who reported being less worried.

Ethics

The study protocol, survey, information sheets, and process for providing informed consent were all approved by the Institutional Review Boards at both Yale University and Mahidol University. To protect participants’ identities, the survey was anonymous and no questions required participants to share personally identifiable information (e.g., email addresses, phone numbers, names, etc.). No incentives were provided for survey completion.

Results

Description of sample

The mean age of participants was 39.5 years (SD = 9.2), and the mean years practicing was 14.0 years (SD= 8.6) (Table 1). 50.8% of participants identified as men, 48.5% identified as women, and 1 participant identified as a non-binary gender. The most represented medical specialties in the sample were general practice (29.5%), family medicine (14.4%), and internal medicine (11.4%). Private hospitals (19.7%) and teaching/university hospitals (16.7%) were the 2 most common places of employment for participants. Overall, 48.5% of participants practiced in government facilities, 31.8% practiced in private facilities, 16.7% practiced in a university or teaching hospital, and 3.0% practiced in “other” settings. In terms of perceptions of the local HIV epidemic, 38.6% of participants reported being very concerned about Thailand’s HIV epidemic, 41.7% were somewhat concerned, 18.2% were a little concerned, and only 1.5% were not concerned at all.

The majority of participants (81.1%) had known of PrEP prior to the survey. Of those who had prior awareness of PrEP, participants reported acquiring information about the medication from a variety of sources. These sources included medical school (57.9%), clinical practice guidelines (46.7%), the Internet (43.9%), continuing medical education (29.0%), and colleagues (27.1%). While a high proportion of participants had prior knowledge of PrEP, a minority of them had ever prescribed it (18.2%). Of those who had previously prescribed PrEP, the most frequent number of patients prescribed to was 5 (range: 1-100 patients). Additionally, even though the majority of participants had no experience prescribing, 75.8% of all participants responded that they would initiate a conversation about PrEP with a patient, and 85.6% agreed that PrEP was essential for responding to Thailand’s HIV epidemic. 73.5% of participants were also at least somewhat willing to attend CME on PrEP.

Concerns and opinions about PrEP

The majority of participants believed PrEP was effective and generally safe. More specifically, 54.5% of participants believed PrEP was moderately effective, while 35.6% believed it was very effective. All participants believed PrEP was at least slightly safe, with 62% perceiving it to be moderately safe and 28.8% believing it to be very safe.

In terms of concerns about PrEP, all participants reported at least one concern about the medication, and the majority of participants reported multiple. The most common concerns participants reported include the potential for decreased condom use for patients on PrEP (76.5%), the development of antiretroviral resistance (71.2%), patients' ability to comply with the medication (65.9%), medication side effects (62.1%), and an increase in STIs following PrEP use (50.0%) (Figure 1). Additional concerns reported include concerns about the effectiveness of PrEP (44.7%), the belief that patients will have more sex partners (44.7%), the potential toxicity of PrEP (37.1%), patients' ability to afford PrEP (15.2%), and the increase in follow-up visits required for PrEP-related care (13.6%).

When asked about the single most significant barrier to prescribing PrEP if a participant wanted to, the most common response was having insufficient clinical knowledge of PrEP (42.4%) (Figure 2). Following this, other barriers were a perceived lack of clinical guidelines on PrEP (19.7%), a lack of patient interest (15.9%), the cost of PrEP (13.6%), the increase in follow-up visits required (4.6%), and "other" barriers (3.8%). These "other" barriers included perceived difficulty prescribing in primary care settings, the inability of PrEP to prevent other STIs, a desire to focus on promoting barrier methods for HIV prevention, and a concern about having to diagnose patients with HIV if the medication failed.

Willingness to prescribe PrEP

Overall, 68.2% of participants were at least somewhat willing to prescribe PrEP (39.4% very willing; 28.8% somewhat willing). Of those who expressed less willingness to prescribe, 25.0% reported being not very willing and 6.8% were completely unwilling (Figure 3).

In terms of physicians' likelihood of prescribing PrEP to specific key populations, 87.1% of participants responded that they were likely to prescribe PrEP to MSM, 81.1% were likely to prescribe to TGW, and 83.3% were likely to prescribe to SW (Figure 4). The population that physicians reported the lowest likelihood of prescribing to was PWID, with 66.7% of physicians indicating that they were likely to prescribe.

Attitudes towards different key populations were significantly correlated with likelihood of prescribing to that specific population (Table 2). For all populations examined, more positive feelings towards a population were weakly correlated (as defined by $r = 0.1-0.3$)³⁴ with greater likelihood of prescribing PrEP to a patient from that population.

Factors associated with general willingness to prescribe PrEP

At the bivariate level, participants who believed PrEP was essential for addressing the Thai HIV epidemic (OR=29.92; 95% CI=6.47-138.28), believed PrEP was very safe (OR=2.63; 95% CI= 1.05-6.60), believed PrEP was very effective (OR=4.00; 95% CI= 1.61-9.96), had heard of PrEP prior to the study (OR=4.44; 95% CI= 1.79-11.06), or who were willing to attend CME on PrEP (OR=11.77; 95% CI= 4.79-28.97) had significantly increased odds of being generally willing to prescribe PrEP compared to those who did not meet these criteria (Table 3). Additionally, feelings towards those living with HIV had a marginally significant association with odds of being willing to prescribe PrEP (OR=1.02; 95% CI= 1.00-1.04).

In the multivariable model (Table 3), believing that PrEP was essential for addressing the Thai HIV epidemic or being willing to attend CME were associated with significantly increased odds of being willing to prescribe PrEP. Those who believed PrEP was needed to address the epidemic had 20-fold higher odds of being willing to prescribe PrEP compared to those who did not see PrEP as essential (OR= 20.87; 95% CI = 3.69-118.12). Participants who expressed willingness to attend CME had 9-fold higher odds of being willing to prescribe PrEP compared to those who were unwilling to attend CME (OR = 9.46; 95% CI= 3.27-27.36).

Discussion

To our knowledge, this is the first study to describe Thai physicians' perceptions of PrEP and their willingness to prescribe the medication. The majority of participants in our sample (68.2%) are at least somewhat willing to prescribe PrEP, with over one third of the sample indicating they are very willing to prescribe. Given the progress the country has made in scaling-up PrEP provision and the medication's recent inclusion in the universal healthcare scheme, it is promising that a relatively high proportion of our sample are open to prescribing. These results are comparable to findings from studies in other countries where the proportion of physicians who are willing to prescribe range from 59.5% to 87%.^{23,24,28,29}

Still, 31.8% of participants expressed an unwillingness to prescribe PrEP. This is a substantial portion of our sample and indicates a need for interventions which can address hesitancy to prescribe. When considering the various concerns and barriers participants cited about PrEP prescription, one potential suggestion for enhancing willingness is improvements in medical education, both within medical school and through CME. When asked about the single most significant barrier that exists to prescribing, 42.4% of participants reported that it was a lack of clinical knowledge of PrEP while 19.7% reported that it was a lack of clinical guidelines on

prescription. Additionally, while the majority of participants had heard of PrEP prior to the study, 18.9% had not. These results are concerning given that Thailand has been a global leader in PrEP delivery and demonstrations, while also providing physicians with information on PrEP in clinical guidelines since 2014. As such, there is a clear need to improve the accessibility of guidelines related to PrEP and a need to ensure that current medical education curriculums provide comprehensive education on the medication during clinician training.

More specifically, improving pharmaco-education about PrEP may be an important first step to strengthening physicians' willingness to prescribe the medication. Based on the results from questions inquiring about participants' perceptions of PrEP's safety and effectiveness, misconceptions or substantial concerns about the drug's effect on patients seem to exist. For example, only 28.8% of participants perceived PrEP to be very safe, despite evidence that the medication has a good safety profile and is well-tolerated.³⁵ It is possible that this result may reflect participants viewing "safety" as related to factors like antiretroviral drug resistance or possible increases in patients' risky sexual behavior, rather than the medication's pharmacological safety profile. Still, a substantial portion of our sample reported being concerned about PrEP's side effects (62.1%) and the potential toxicity of the medication for patients (37.1%), indicating that concerns about the drug's direct impact on patients' health do exist. In terms of effectiveness, approximately 9% of participants viewed PrEP as either slightly effective or not effective at all, even though there now exists a large body of evidence that demonstrates its efficacy when patients remain adherent to the medication.⁹⁻¹² Additionally, 44.7% of participants cited the effectiveness of PrEP as a concern they had about the drug. From these findings we see a consistent pattern of a proportion of physicians questioning the safety of PrEP, as well as its ability to effectively prevent HIV. As such, we believe that improving

physicians' knowledge on the safety profile of PrEP, the prevalence and extent of drug-related side effects, and the effectiveness of PrEP in various settings for different populations is an important step towards enhancing physicians' openness to prescribing the medication.

Given the potential impact that improvements in medical education on PrEP can have for enhancing willingness to prescribe, the fact that 73.5% of our sample is at least somewhat willing to attend CME on PrEP (40.9% of the total sample were very willing), makes the implementation of educational interventions a compelling possibility. Also, because willingness to attend CME was significantly associated with willingness to prescribe PrEP in both our bivariate and multivariable models, encouraging and supporting interest in CME on PrEP may also serve to improve people's openness to prescribing. Importantly, to help support the interest and accessibility of CME, research should be conducted to identify how to best implement a PrEP CME course so that physicians—who often have demanding work schedules—are motivated and easily able to participate.

Beyond supporting and improving education on PrEP, addressing physicians' concerns related to risk compensation may be another important step to enhancing willingness to prescribe PrEP. Risk compensation describes a phenomenon where individuals accept a certain level of perceived risk to their health so that they can enjoy the perceived benefits of a particular activity.³⁶ When an intervention that reduces perceived risk is implemented, a person may then increase their risk behavior to maintain the same approximate "risk setpoint." In the context of PrEP, risk compensation often refers to a concern that those on the medication will alter their sexual behavior now that the risk of acquiring HIV has decreased.^{37,38} It is believed that this change in risk perception may lead to decreases in condom use or new engagement in other sexual behaviors that could facilitate transmission of STIs. Indeed, some of the most frequently cited

concerns by our sample included a worry that PrEP use will lead to a decrease in condom use (76.5%), an increase in STIs (50.0%), and an increase in patients' number of sexual partners (44.7%). Such results are similar to findings from other studies where physicians commonly cite a fear of risk compensation as a barrier to prescribing PrEP.^{22,24-27} Evidence of risk compensation actually occurring after PrEP initiation is mixed. For example, several clinical trials on PrEP reported no substantial changes in STI incidence or sexual behavior after PrEP initiation, while a systematic review of 17 open-label studies found that use of PrEP was associated with increases in STI diagnoses for MSM.³⁹⁻⁴² Attempting to assess evidence for risk compensation is further complicated by the potential confounding effects of increased STI testing for PrEP users, background changes in population STI rates, and the incorporation of counseling on risk behaviors in some PrEP trials and demonstration projects.^{37,40,43}

While evidence for risk compensation may currently be inconclusive, addressing concerns that physicians have about it is still critical for improving PrEP dissemination. One possible strategy for alleviating physicians' concerns could be to encourage the prescription of PrEP within a more comprehensive care plan which incorporates repeat STI testing, risk counseling, and motivational interviewing for interested patients. This may reduce concerns about the consequences of potential behavioral changes for individuals who use PrEP. Additionally, while many physicians may be concerned about the impact of PrEP on the incidence of other STIs, it is important for public health messaging to continue to emphasize the medication's efficacy in preventing incidence of HIV. The role of PrEP in further supporting the sexual health of those who may either face challenges in consistently using condoms or who may prefer to incorporate additional prevention strategies, should not be understated particularly since a belief that PrEP was essential for addressing the HIV epidemic was strongly associated with willingness to

prescribe in our sample. Ultimately, working to reframe PrEP from a drug which may encourage individuals to replace one risk for another, to a drug which has a unique and specific role in supporting some individuals' sexual health, is a potentially important move for enhancing physicians' support of PrEP.

When focusing on what our results mean for physicians' openness to prescribing PrEP to patients from specific populations, the majority of the sample reported being likely to prescribe to patients from all of the 4 key populations. More specifically, over 80% of the sample expressed they were likely to prescribe PrEP to MSM, TGW, and SW. The population where likelihood of prescribing was notably lower were PWID where only 66.7% of physicians claimed they would be likely to prescribe to a patient who injected drugs, and 15.2% reported being unlikely to prescribe. In contrast, the proportion of physicians unlikely to prescribe to every other key population was less than 10%. This may not be particularly surprising since the average attitude score towards PWID was substantially lower compared to other key populations (Table 3).

While attitudes towards these different key populations were not significantly associated with general willingness to prescribe PrEP in our regression models, we found that they did have a weak, but significant positive correlation with likelihood of prescribing to individuals from that specific population. As such, it may be important to address negative attitudes towards different key populations in an effort to improve the possibility that individuals can more easily access PrEP if they wish to do so. Potential strategies for improving physicians' attitudes could include ensuring that clinicians are provided with accurate, destigmatizing information about key populations as well as opportunities for clinical interaction with patients from these populations during medical school and through CME. The need for such education is substantial as 83.3% of our sample reported that they did not feel that medical professionals receive enough education on

MSM, TGW, SW, and PWID. Additionally, contact theory posits that increasing one group's exposure to another may help reduce intergroup prejudice and several studies have presented evidence of this phenomenon for a diversity of populations.^{44,45} The impact of contact-based interventions on medical professionals' attitudes towards stigmatized populations has also been explored, typically by providing medical students with opportunities to meet and/or provide care to a member of a stigmatized group.⁴⁶⁻⁴⁹ Such interventions have demonstrated that these interactions can improve providers' attitudes towards a group and positively influence their views on appropriate patient care, making their incorporation into medical training in Thailand a compelling possibility. Ultimately, educational interventions which increase academic and clinical exposure to different key populations may help reduce stigmatizing attitudes towards these groups and subsequently improve the likelihood that physicians would be open to prescribing PrEP to members of these key populations.

There were several limitations to this study. First, participants were recruited through convenience sampling, and as such, the results from this study are not necessarily generalizable to the general population of physicians in Thailand. Those who participated in this study may be unique in their interest in PrEP, and we cannot rule out the possibility that they may be more or less willing to prescribe the medication when compared to their peers who did not participate. There is also the possibility that social desirability bias impacted participants' responses to questions inquiring about their willingness to prescribe, willingness to attend further medical education, and their attitudes towards key populations. By making the survey anonymous, we attempted to reduce this possibility, but we cannot be sure that it did not impact our results. Additionally, while the survey link was disseminated through private Facebook groups dedicated to licensed physicians in Thailand, we had no way of confirming that all participants did meet

our established inclusion criteria. Finally, our sample included physicians from a variety of medical specialties and did not specifically target those who may be most likely to currently be in a position to prescribe PrEP in Thailand. Further studies should attempt to target and understand the attitudes and behaviors of providers who practice in medical fields that are uniquely qualified for prescribing PrEP and that may have more PrEP-related content in their medical training.

Conclusions

Despite the limitations of this study, we believe it is the first to formally evaluate physicians' willingness to prescribe PrEP in Thailand. These results indicate a general willingness to prescribe PrEP—particularly amongst those who see PrEP as essential for addressing the HIV epidemic and those who are willing to dedicate time to learning more about the medication. Importantly, our findings also highlight Thai physicians' concerns about PrEP, the perceived barriers to prescribing, and discrepancies in their likelihood of prescribing to different populations. From these findings, targeted educational and clinical interventions that address some of these challenges to encouraging willingness to prescribe can be developed. Future research should investigate these patterns among specific specialties of physicians and among a larger, random sample of participants. Additionally, exploring similar questions through qualitative methods may provide more insight on physicians' knowledge and attitudes about PrEP and their potential motivation to prescribe PrEP to patients from different populations.

Appendix

Table 1. Characteristics of study population (n=132)

Characteristic	N (%)*
Age (years), mean \pm SD	39.5 \pm 9.2
Years practicing, mean \pm SD	14.0 \pm 8.6
Gender	
Man	67 (50.8)
Woman	64 (48.5)
Non-binary gender	1 (0.7)
Experience prescribing PrEP	
Yes	24 (18.2)
No	108 (81.8)
Specialty	
General practice	39 (29.5)
Family Medicine	19 (14.4)
Internal Medicine	15 (11.4)
Obstetrics/Gynecology	10 (7.6)
Emergency Medicine	4 (3.0)
Infectious Disease	1 (0.8)
Other	44 (33.3)
Place of employment	
Private hospital	26 (19.7)
Teaching/University hospital	22 (16.7)
Government provincial hospital	20 (15.2)
Government district hospital	19 (14.4)
Private clinic	16 (12.1)
Other government hospitals	15 (11.4)
Primary Care Unit/CHC	10 (7.6)
Other	4 (3.0)

*Percentages may not sum to 100% due to rounding

Table 2: Pearson correlations: feelings towards key population and likelihood of prescribing to individuals in that population (n =132)*

	<i>r</i> (95% CI)	p
MSM	0.20 (0.03, 0.36)	0.02
TGW	0.21 (0.04, 0.37)	0.02
SW	0.17 (>0.00, 0.33)	0.049
PWID	0.26 (0.10, 0.41)	<0.01

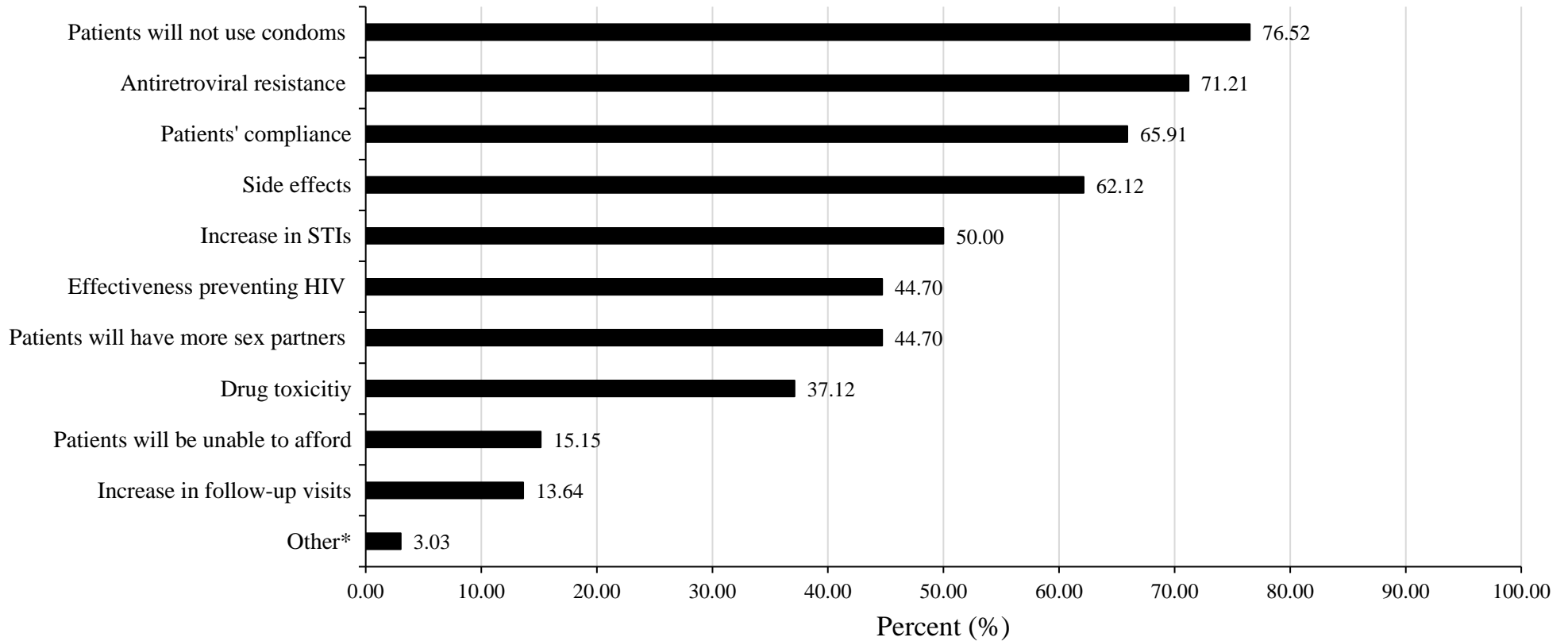
*Key: *r* = Pearson’s correlation coefficient; CI = confidence interval; MSM = men who have sex with men; TGW = transgender women; SW = sex workers; PWID = people who inject drugs.

Table 3: Unadjusted and adjusted associations between study variables and willingness to prescribe (n =132)*

Characteristic	Mean (SD)	N (%)	Unadjusted OR (95% CI)	p	Adjusted OR (95% CI)	p
Sociodemographic and professional factors						
Age	39.5 (9.2)		0.98 (0.94, 1.02)	0.27		
Years practicing	14.0 (8.6)		0.99 (0.94, 1.03)	0.49		
Man		67 (50.8)	1.59 (0.76, 3.34)	0.22		
Practices in public sector		64 (48.5)	1.05 (0.51, 2.19)	0.89		
Primary care		73 (55.3)	1.31 (0.63, 2.73)	0.47		
Attitude score for relevant populations						
PLWHIV	70.1 (21.1)		1.02 (1.005, 1.04)	0.01	1.02 (0.995, 1.04)	0.12
MSM	63.1 (21.9)		1.02 (0.998, 1.03)	0.08		
TGW	63.0 (20.7)		1.01 (0.995, 1.03)	0.14		
SW	55.2 (24.2)		1.01 (0.998, 1.03)	0.08		
PWID	34.6 (28.9)		1.00 (0.996, 1.02)	0.18		
Feelings about the HIV epidemic						
Believes PrEP is essential for addressing epidemic		113 (85.6)	29.92 (6.47, 138.28)	<0.01	20.87 (3.69, 118.12)	<0.01
Very concerned about the HIV epidemic		51 (38.6)	1.20 (0.56, 2.56)	0.64		
Concerns and opinions about PrEP						
Concern: Condom use will decrease		101 (76.5)	0.69 (0.28, 1.70)	0.41		
Concern: ARV resistance		94 (71.2)	0.99 (0.44, 2.21)	0.97		
Concern: Patient compliance		87 (65.9)	1.29 (0.60, 2.78)	0.51		
Concern: Side effects		82 (62.1)	1.18 (0.55, 2.49)	0.67		
Concern: STIs will increase		66 (50.0)	0.66 (0.31, 1.34)	0.26		
Believes PrEP is very safe		38 (28.8)	2.63 (1.05, 6.60)	0.04	1.20 (0.312, 4.57)	0.79
Believes PrEP is very effective		47 (35.6)	4.00 (1.61, 9.96)	<0.01	1.47 (0.41, 5.26)	0.56
Barrier: Insufficient clinical knowledge of PrEP		56 (42.4)	0.636 (0.304, 1.332)	0.23		
Willing to attend CME for PrEP		97 (73.5)	11.77 (4.78, 28.97)	<0.01	9.46 (3.27, 27.3)	<0.01
Clinical practice						
Asks about patients' sexual histories		92 (69.7)	1.98 (0.91, 4.31)	0.08		
Refers for HIV testing		115 (87.1)	2.12 (0.75, 5.95)	0.15		
Clinical experiences with PrEP						
Prior awareness of PrEP		107 (81.1)	4.44 (1.79, 11.06)	<0.01	3.43 (0.96, 12.22)	0.06
Previously prescribed PrEP		24 (18.2)	2.71 (0.87, 8.52)	0.09		

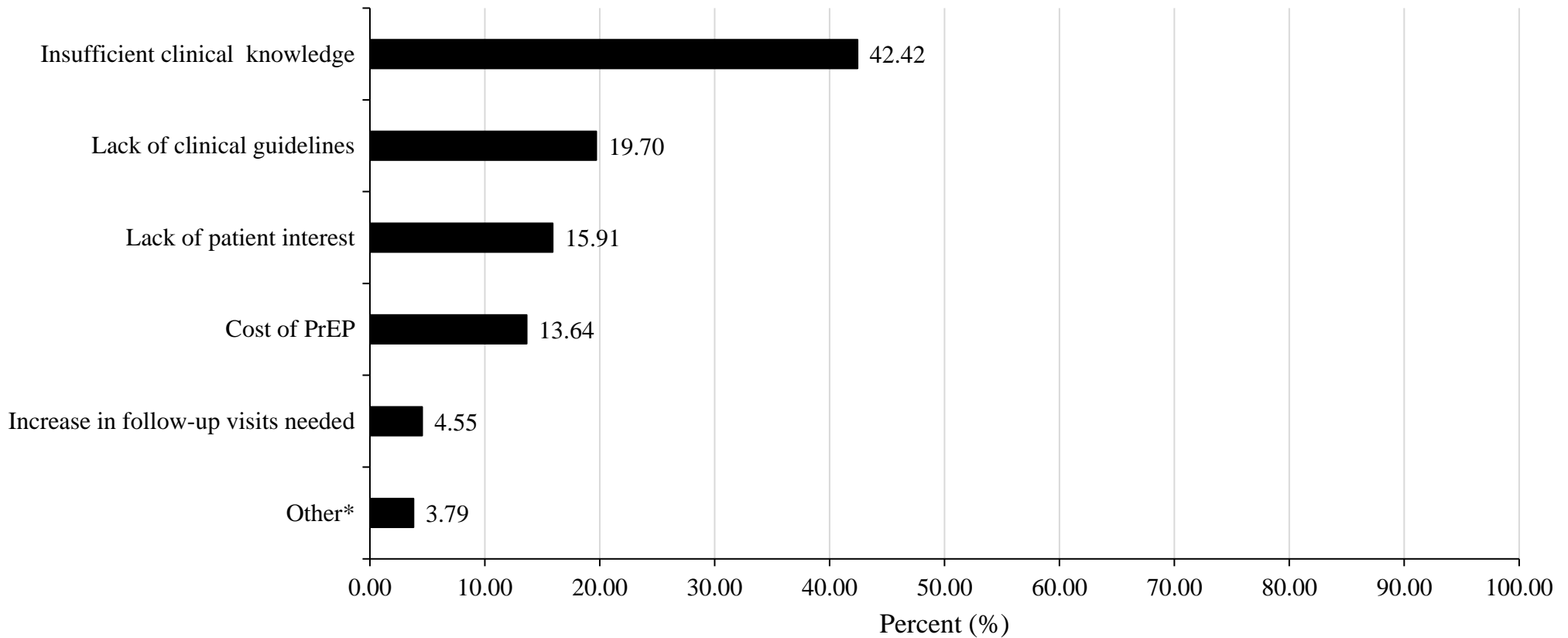
*Key: SD = standard deviation; OR = odds ratio; CI = confidence interval; PLWHIV = people living with HIV; MSM = men who have sex with men; TGW = transgender women; SW = sex workers; PWID = people who inject drugs; ARV= antiretroviral; CME = continuing medical education.

Figure 1. Concerns about PrEP (n = 132)



*Other concerns that participants described include a concern about the lack of long-term data on PrEP, potentially having to diagnose patients with HIV if PrEP fails, the general “social problems” PrEP will cause, and a concern that PrEP will diminish the importance of a “universal precautions” approach

Figure 2: Single most significant barrier to prescribing PrEP (n = 132)



*Other barriers that participants described include the perceived difficulty of prescribing PrEP in primary care settings, the possibility of having to diagnose a patient with HIV if PrEP fails, the inability of PrEP to prevent other STIs, and a preference for promoting barrier methods for HIV prevention.

Figure 3: Willingness to prescribe (n = 132)

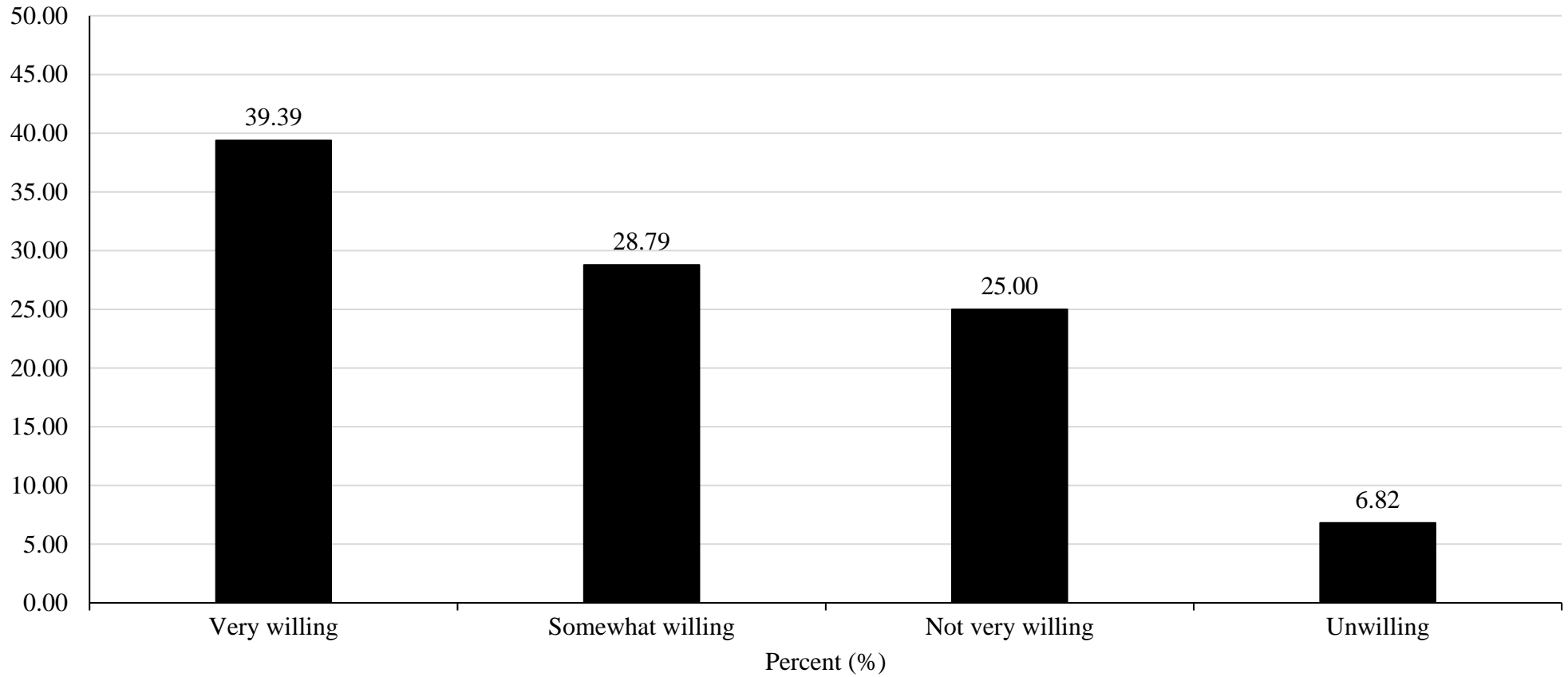
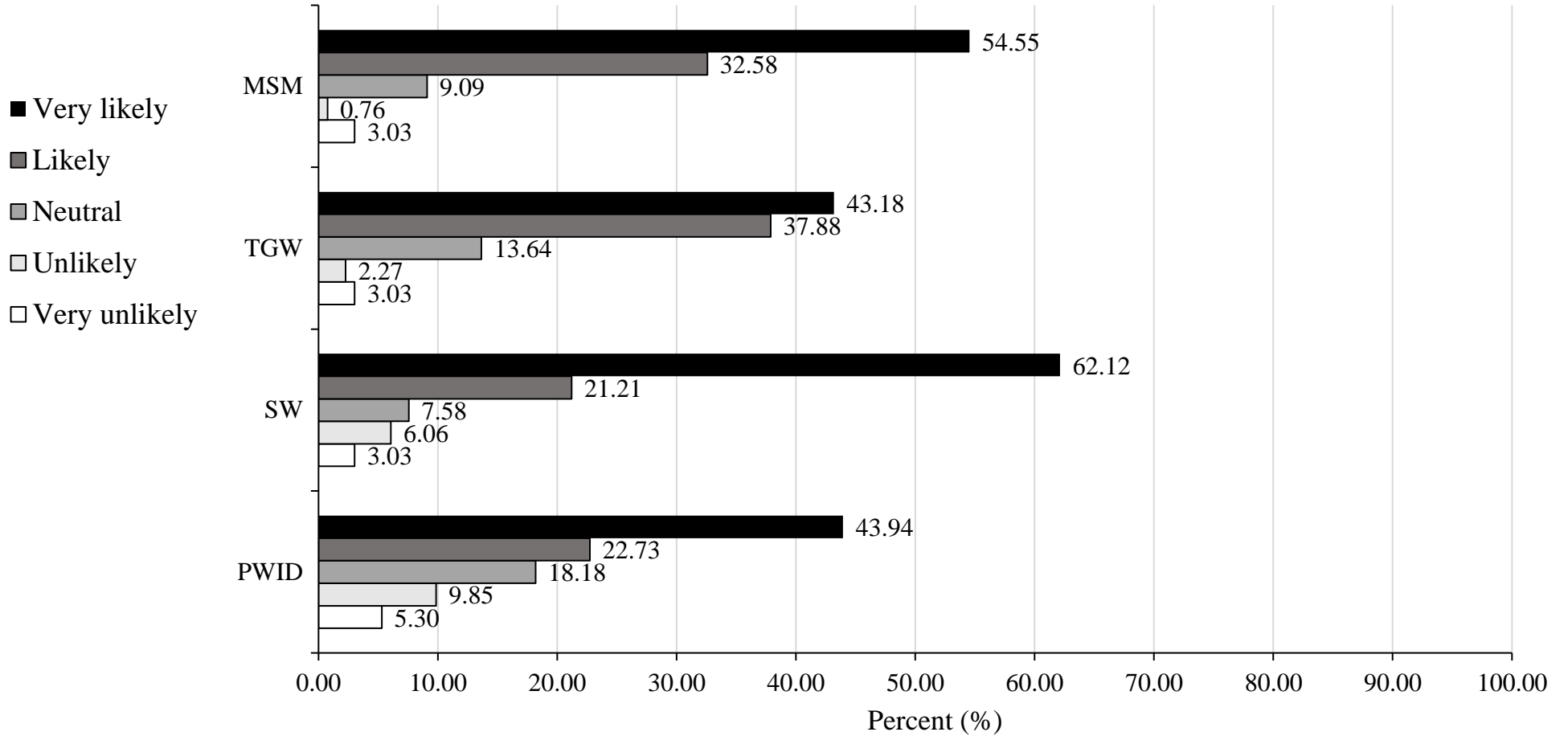


Figure 4: Likelihood of prescribing PrEP to different populations (n = 132)*



*Key: MSM = men who have sex with men; TGW = transgender women; SW = sex workers; PWID = people who inject drugs.

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