

RESEARCH ARTICLE

Awareness, knowledge and comfort of pharmacy students on pre-exposure prophylaxis (PrEP) and post-exposure prophylaxis (PEP) for HIV prevention

Jennifer Bhuiyan^{ID}, Nicole Bradley^{ID}, Yuman Lee^{ID}, John Michael Conry^{ID}

St. John's University, College of Pharmacy and Health Sciences, New York, United States

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Correspondence

Jennifer Bhuiyan
Department of Clinical Health Professions
St. John's University
College of Pharmacy and Health Sciences
8000 Utopia Parkway Queens
New York
United States
bhuiyanj@stjohns.edu

Abstract

Introduction: Pharmacists are uniquely qualified to promote Pre-Exposure Prophylaxis (PrEP) and Post Exposure Prophylaxis (PEP). The objective of this study was to measure pharmacy students' awareness, knowledge, and comfort regarding PrEP and PEP in an urban setting. **Methods:** A 23-point questionnaire was distributed to pharmacy students between 2 May 2019 and 31 May 2019. **Results:** Eighty six pharmacy students responded to the survey. Most of them correctly identified FDA-approved regimens for PrEP and PEP. Most students thought that a pharmacist or intern counselling patients on PrEP or PEP was beneficial; however, a minority felt confident counselling patients on PrEP or PEP. Students who met criteria for composite knowledge were significantly more likely to report confidence in counselling. **Conclusion:** Pharmacy students have strong awareness, but limited knowledge and comfort regarding PrEP and PEP. Results from the survey will be used to assess the learning needs of pharmacy students and inform future curricular changes.

Introduction

Human Immunodeficiency Virus (HIV) is a serious global health threat. In 2016, there were over 1.2 million HIV positive individuals living in the United States (US), with 37,968 new infections occurring in 2018 (CDC, 2020). Over two-thirds of these new diagnoses were among gay, bisexual and other men who have sex with men (MSM) (CDC, 2020). From 2014 to 2018, HIV diagnoses decreased about 7% among adults and adolescents in the US (CDC, 2020). Despite this decline, rates of HIV infection continue to rise among some populations. Rates have increased among Black, Hispanic/Latinx, Asian, American Indian/Alaska Native, and Native Hawaiian/Pacific Islander men who have sex with men (CDC, 2020). In New York City, there are an estimated 127,297 individuals currently living with HIV, and over 1,000 new infections occurred in 2018 (NYCDOHMH, 2019). Similar to the rest of the country, there is a

disproportionate number of infections occurring in Black and Hispanic/Latinx individuals (NYCDOHMH, 2019).

Pre-Exposure Prophylaxis (PrEP) is a daily antiretroviral regimen to prevent the acquisition of HIV among individuals most at risk. It was FDA-approved in 2012 after data from several clinical trials demonstrated the safety and efficacy of PrEP in MSM (Grant *et al.*, 2010; Grohskopf *et al.*, 2013; Hosek *et al.*, 2013; Molina *et al.*, 2015), heterosexual women and men (Peterson *et al.*, 2007; Baeten *et al.* 2012; Thigpen *et al.*, 2012; Van Damme *et al.*, 2012; Murnane *et al.*, 2013; Marrazzo *et al.*, 2015) and persons who inject drugs (Choopanya *et al.*, 2013) who were prescribed a fixed-dose combination of tenofovir disoproxil fumarate 300mg/emtricitabine 200mg (Truvada). PrEP has been shown to be up to 92% effective in reducing the risk of HIV infection from sex among MSM (Grant *et al.*, 2010), up to 90% effective in

reducing the risk of HIV infection among heterosexual women and men (Baeten *et al.*, 2012), and up to 74% effective in reducing the risk of HIV infection among persons who inject drugs who were highly adherent to PrEP (Choopanya *et al.*, 2013). In 2014, the Centers for Disease Control and Prevention (CDC) established the first set of guidelines for clinicians on the safe and effective use of PrEP in at-risk adults and has since provided updates (CDC, 2019). In 2018, the FDA approved the use of PrEP in adolescents weighing at least 35kg (Tanner, 2020). Recently, in 2019, the FDA approved the use of tenofovir alafenamide 25mg/emtricitabine 200mg (Descovy) in at-risk adults and adolescents for PrEP to reduce the risk of HIV infection from sex, excluding those who have receptive vaginal sex (FDA, 2019).

Post Exposure Prophylaxis (PEP) is a means of reducing the risk of HIV acquisition after a single, high-risk HIV exposure (CDC, 2016). High-risk exposures include condomless insertive or receptive vaginal or anal sex, percutaneous exposure to blood, or occupational mucous membrane or non-intact skin contact with bodily fluids of a person with HIV or of unknown HIV status (CDC, 2016). Although randomised controlled trials of non-occupational post-exposure prophylaxis (nPEP) and occupational post-exposure prophylaxis (oPEP) have not been conducted for ethical and logistical reasons, data from the case and observational studies in humans and primates support the use of PEP after a high-risk HIV exposure (Young *et al.*, 2007; Bryant *et al.*, 2009; Irvine *et al.*, 2015). A case-control study of oPEP among healthcare workers has shown an 81% risk reduction in HIV transmission (Cardo *et al.*, 1997). According to the CDC, tenofovir disoproxil fumarate 300mg/emtricitabine 200mg (Truvada) plus raltegravir (Isentress) or dolutegravir (Tivicay) are considered a preferred regimen for both nPEP and oPEP. PEP should be administered within 72 hours of the exposure and consists of a 28-day antiretroviral therapy regimen (CDC, 2016).

There are racial/ethnic disparities in PrEP and PEP use among certain populations. Populations at the highest risk of HIV are less likely to utilise PrEP or PEP as a method of HIV prevention. In a 2017 CDC analysis of National HIV Behavioral Surveillance (NHBS), data from 23 urban areas in the US found that Black and Hispanic/Latinx MSM were less aware of PrEP, less likely to have discussed PrEP with a healthcare provider within the past year, and less likely to use PrEP (Kanny *et al.*, 2017). The disparity between white and Black MSM remained even after considering factors such as lack of health insurance or a usual source of healthcare (Kanny *et al.*, 2017). In 2014, a study was conducted to determine characteristics predictive of PEP use as a function of demographics, including age group,

orientation, race/ethnicity, and education level among clients at the PEP-LA programme (Beymer *et al.*, 2014). The study showed under-utilisation of PEP by Black and Hispanic/Latinx people (Beymer *et al.*, 2014). Black people made up 8.5% of the study population but accounted for 16.7% of total new HIV infections (Beymer *et al.*, 2014). Hispanic/Latinx individuals made up 32.6% of the study population, but 42.6% of new HIV infections (Beymer *et al.*, 2014). In contrast, whites made up 46.5% of the population, but only 30.4% of new HIV infections (Beymer *et al.*, 2014). These studies underscore the need for additional healthcare professionals, including pharmacists, to improve awareness and utilisation of PrEP and PEP among at-risk populations.

Pharmacists are medication experts and are uniquely qualified to work with patients at risk of HIV infection. Furthermore, pharmacists are highly accessible to the public as they work in community pharmacies and clinics, as well as in institutional settings. Pharmacists have played important roles in the management of HIV infection by counselling patients on appropriate medication use and the importance of medication adherence, ensuring access to medication through insurance coverage or patient assistance programmes, and monitoring patients on HIV medications for efficacy and safety, including drug interactions (Scott *et al.*, 2010; Tseng *et al.*, 2012; Matyanga, 2014). They also provide important drug information for healthcare providers, patients, and the public. Pharmacists provide harm reduction services, including ensuring access to condoms and sterile syringes in community pharmacies (Bratberg, 2017). Recently, community pharmacists have played a larger role in expanding PrEP and PEP access. In October 2019, California became the first state in the US to allow pharmacists to dispense up to a 60-day supply of PrEP and a supply of PEP without a prescription (CA SB-159 §4052, 2019). These laws require that pharmacists ensure that patients meet clinical criteria for treatment eligibility (CA SB-159 §4052, 2019). This includes conducting HIV testing prior to dispensing, ordering labs for kidney function, and referring patients to a primary care provider for additional PrEP refills as necessary (CA SB-159 §4052, 2019). Oregon and Colorado have passed similar laws that allow pharmacists to dispense both PrEP and PEP without prescriptions (Gregory, 2020). In New York, a standing order allows pharmacists to dispense a seven-day prescription of PEP to eligible patients and refer them to a provider for additional supplies (NYSDOH, 2018).

Pharmacy education on HIV pre-and post-exposure prophylaxis is vital to ensure that future pharmacists are prepared to work with patients at risk for HIV infection. Limited data exist on PEP knowledge and

attitudes among US pharmacists, and there are no such known studies among pharmacy students. Results from a study published as an abstract of 250 New York City community pharmacists showed that most had prior PEP knowledge and were willing to dispense PEP starter packs using a Collaborative Drug Therapy Management model (Reid *et al.*, 2015). In 2019, Przybyla and colleagues published a study on the awareness, knowledge, and attitudes towards PrEP among pharmacy students at the University of Buffalo School of Pharmacy in Buffalo, New York. The majority of students (91%) were aware of PrEP, and over half (61%) were familiar with CDC guidelines on prescribing PrEP (Przybyla *et al.*, 2019). Increased PrEP knowledge, attitudes and familiarity with these guidelines were associated with confidence in counselling on PrEP (Przybyla *et al.*, 2019). Despite these findings, this study was solely focused on PrEP, did not assess pharmacy students' beliefs, comfort/experience, intent, or value/acceptability regarding PrEP, and was not conducted in an urban/metropolitan region of the US.

There are limited data on pharmacy student awareness, knowledge, beliefs, attitudes, self-efficacy, intent, and norms regarding PrEP and PEP. The objective of this study was to measure pharmacy students' awareness, knowledge, and comfort regarding both PrEP and PEP on an urban college campus. The hypothesis of this study was that pharmacy students have limited awareness, knowledge, and comfort regarding PrEP and PEP.

Methods

A 23-point questionnaire developed and adapted from a study by Unni and colleagues (Unni *et al.*, 2016) and a validated tool (Legare *et al.*, 2014) were used to measure pharmacy students' knowledge, attitudes, beliefs, self-efficacy, intent, and norms regarding PrEP and PEP use and promotion. The questionnaire was based on the Theory of Planned Behavior (TPB) (Ajzen, 1991), which is the most appropriate theory to predict the clinical practice behaviour of healthcare professionals (Godin *et al.*, 2008).

The questionnaire was distributed as a survey to pharmacy students between 2 May 2019 and 31 May 2019 via Google Forms. Pharmacy students from professional years 1-4 were included in this survey. Completion of the survey was anonymous; respondents were offered an opportunity to enter a raffle as an incentive to participate. This study was reviewed as exempt from approval by the University's Institutional Review Board. Informed consent was obtained from all participants.

Demographic information, baseline knowledge, awareness, beliefs, and attitudes were assessed throughout the survey. Results were analysed and reported using descriptive statistics. Adjusted odds ratios and 95% confidence intervals were calculated to compare differences in knowledge, comfort, and intention between students in different professional years of the pharmacy programme.

Results

Demographics

There were 86 responses to this survey. As seen in Table I, most of the students were between 18-24 years old, identified as female, and were Asian or white. Nearly 85% of students reported working in a pharmacy, with 40.7% working in community pharmacy chains, 22.1% working in hospital pharmacies, and 19.8% working in independent pharmacies.

Table I: Baseline characteristics

Description	Number (%)
Age (n=81)	
<18	0
18-24	80 (98.8)
24-30	1 (1.2)
>30	0
Gender identity (n=86)	
Female	66 (76.7)
Male	19 (22.1)
Prefer not to say	1 (1.2)
Race/ethnicity (n=86)	
Race	
Black/African American	1 (1.2)
White	26 (30.2)
Asian	55 (64)
Native Hawaiian/Pacific Islander	1 (1.2)
American Indian/Alaska Native	1 (1.2)
Other	5 (6)
Ethnicity	
Hispanic/Latinx	2 (2.4)
Not Hispanic/Latinx	83 (97.6)
Work Experience (n=86)	
Community pharmacy	52 (60.5)
Independent	17 (19.8)
Chain	35 (40.7)
Hospital	19 (22.1)
Hospital and community pharmacy	2 (2.4)
None	13 (15.1)
Year in pharmacy program (n=86)	
P1	13 (15.1)
P2	23 (26.7)
P3	27 (31.4)
P4	23 (26.7)
Course experience (n=86)	
Infectious diseases drugs & diseases	64 (74.4)
HIV elective	22 (25.6)
Infectious diseases elective	14 (16.3)

Approximate area for inclusion: Results- demographics

Approximately 15% of students were in their first professional year (P1), 27% in their second professional year (P2), 31% in their third professional year (P3), and 27% in their fourth professional year (P4). Nearly 75% of students identified as having at least one course covering material on PrEP and PEP, 24.4% had at least two courses, and 5.8% had at least three courses. Complete responses to the survey can be found in Table II.

Table II: Survey responses

Description	Number (%)
Which of the following are high-risk exposures/behaviours (select all that apply)? (n=86)	
Contact with urine or saliva	18 (20.9)
Contact with blood, semen, or breastmilk	86 (100)
Contact with contaminated surface	18 (20.9)
Which of the following methods can be utilised for the prevention of HIV infection (select all that apply)? (n=86)	
Condom	84 (97.7)
Sterile needle use	81 (94.2)
Chemoprophylaxis	39 (45.3)
Avoidance of high-risk behaviours	85 (98.8)
Do you know what "Pre-Exposure Prophylaxis (PrEP) is?"	
Yes	74 (86)
No	12 (14)
Have you ever heard of PrEP/PEP?	
PrEP (n=85)	
Yes	76 (89.4)
No	9 (10.6)
PEP (n=86)	
Yes	75 (87.2)
No	11 (12.8)
Do you know what PrEP/PEP is?	
PrEP (n=86)	
Yes	74 (86)
No	12 (14)
PEP (n=86)	
Yes	73 (84.9)
No	13 (15.1)
What is the recommended duration of therapy of PrEP/PEP?	
PrEP (n=86)	
For as long as risk of acquisition is present	45 (52.3)
Indefinite	6 (7.0)
7 days	13 (15.1)
30 days	11 (12.8)
I don't know	11 (12.8)
PEP (n=85)	
For as long as risk of acquisition is present	11(12.9)
Indefinite	7 (8.2)
7 days	10 (11.8)
28 days	57 (67.1)
Which of the following regimens is FDA-approved for PrEP/ a guideline recommended regimen for PEP?	
PrEP (n=84)	
Truvada (tenofovir disoproxil fumarate/emtricitabine)	75 (89.3)
Descovy (tenofovir alafenamide/emtricitabine)	2 (2.4)

Description	Number (%)
Atripla (tenofovir disoproxil fumarate/emtricitabine + efavirenz)	7 (8.3)
PEP (n=84)	
Truvada (tenofovir disoproxil fumarate/emtricitabine)	8 (9.5)
Atripla (tenofovir disoproxil fumarate/emtricitabine + efavirenz) + Sustiva (efavirenz)	10 (11.9)
Truvada (tenofovir disoproxil fumarate/emtricitabine) + Isentress (raltegravir)	45 (53.6)
Truvada (tenofovir disoproxil fumarate/emtricitabine) + Tivicay (dolutegravir)	21 (25)
Do you know where to get PrEP/PEP?	
PrEP (n=86)	
Yes	49 (57.0)
No	37 (43.0)
PEP (n=85)	
Yes	47 (55.3)
No	28 (44.7)
Have you seen PrEP/PEP?	
PrEP (n=86)	
Yes	43 (50)
No	43 (50)
PEP (n=85)	
Yes	29 (34.1)
No	56 (65.9)
Do you know how much PrEP/PEP costs?	
PrEP (n=86)	
Yes	21 (24.4)
No	65 (75.6)
PEP (n=85)	
Yes	21 (24.7)
No	64 (75.3)
Have you ever counselled a patient on PrEP/PEP?	
PrEP (n=86)	
Yes	11 (12.8)
No	75 (87.2)
PEP (n=85)	
Yes	6 (7.1)
No	79 (92.9)

Approximate area for inclusion: Results- demographics

Knowledge

All students were able to correctly identify contact with blood, semen, or breast milk as high-risk exposures/behaviours for the transmission of HIV. Approximately 20% of students incorrectly selected contact with urine or saliva or contact with a contaminated surface as high-risk exposures/behaviours for virus transmission. Of the students who incorrectly identified high-risk exposures/behaviours, 19.2% were P1, 26.9% were P2, 30.8% were P3, and 26.9% were P4.

When asked about methods to prevent HIV infection, 100% of students were able to identify at least one method of prevention (condom use, sterile needle use, chemoprophylaxis, or avoidance of high-risk behaviours), 7% identified two methods of prevention (condom use and avoidance of high-risk behaviours or sterile needle use and avoidance of high-risk behaviours), 46.5%

identified three methods of prevention (condom use, sterile needle use, and avoidance of high-risk behaviours), and 45.3% of students identified four methods of prevention (condom use, sterile needle use, avoidance of high-risk behaviours, and chemoprophylaxis). Most students who were able to identify chemoprophylaxis as a means of prevention were in their P2 (34.2%) or P3 (34.2%) years.

About 86% of students reported that they knew what PrEP was. 75% of students who did not know what PrEP was were in their P1 year. At the time that the survey was distributed, the only FDA-approved regimen for PrEP was tenofovir disoproxil fumarate/emtricitabine (Truvada). Approximately 90% of students correctly

identified this as an FDA-approved regimen for PrEP. Among those who did not correctly identify this regimen, 66.7% were P1 students, 22.2% were P2, and 1.1% were P3. All P4 students were able to identify tenofovir disoproxil fumarate/emtricitabine (Truvada) as an FDA-approved regimen for PrEP. About half (52.3%) of the students correctly identified the appropriate duration for PrEP treatment. Among those who were unable to identify the recommended duration for PrEP treatment, 21.9% were P1 students, 29.3% were P2, 31.7% were P3, and 17.1% were P4. As seen in Table III, there was no observable difference in odds that a student would have greater PrEP knowledge depending on their professional year.

Table III: PrEP and PEP knowledge, comfort, intent stratified by year in programme

	PrEP aOR (95% CI)	PEP aOR (95% CI)
Knowledge		
Duration		
P1	0.52 (-1.87, 1.73)	0.37 (-2.19, 1.23)
P2	0.62 (-1.45, 1.61)	0.20 (-2.6, 0.56)
P3	0.97 (-0.94, 2.42)	3.02 (0.003, 9.075)
P4	2.69 (-0.03, 7.41)	4.68 (0.23, 17.42)
Recommended regimen		
P1	0.09 (-3.88, 0.35)	0.63 (-1.76, 2.32)
P2	0.50 (-2.04, 1.99)	0.24 (-2.47, 0.71)
P3	5.31 (-0.44, 43.76)	3.24 (-0.15, 12.19)
P4	9.73 (-0.60, 172.71)	2.46 (-0.43, 9.36)
Comfort		
Confidence counseling		
P1	0.07 (0.01, 1.15)	0.17 (0.02, 1.39)
P2	0.14 (0.03, 0.67)	0.03 (0.002, 0.57)
P3	3.81 (1.44, 10.09)	6.13 (2.21, 16.97)
P4	2.69 (1.00, 7.29)	1.89 (0.69, 5.19)
Difficulty counseling		
P1	2.17 (0.65, 7.27)	2.29 (0.68, 7.70)
P2	5.28 (1.82, 15.3)	4.26 (1.52, 11.91)
P3	0.38 (0.14, 1.00)	0.32 (0.12, 0.86)
P4	0.32 (0.11, 0.92)	0.45 (0.16, 1.25)
Experience counseling		
P1	0.22 (-4.43, 3.92)	0.43 (-3.79, 8.17)
P2	0.10 (-5.15, 1.82)	0.21 (-4.50, 3.85)
P3	0.79 (-1.63, 3.27)	1.1 (-1.6, 6.4)
P4	10.67 (0.92, 45.13)	6.42 (0.09, 37.84)
Intent		
Intent to counsel		
P1	0.20 (-2.96, 0.75)	0.41 (-2.24, 1.55)
P2	0.52 (-1.88, 1.81)	0.64 (-1.65, 2.14)
P3	15.26 (-0.14, 267.64)	18.8 (0.08, 328.42)
P4	1.26 (-1.16, 5.04)	0.48 (-1.90, 1.55)
Acceptability of counselling		
P1	1.51 (-2.59, 30.25)	3.2 (-1.76, 59.25)
P2	0.34 (-3.09, 2.60)	0.32 (-2.61, 1.41)
P3	3.93 (-1.61, 77.00)	3.5 (-0.89, 29.97)
P4	0.34 (-3.09, 2.60)	0.57 (-2.07, 2.62)
Benefit of counselling		
P1	0.34 (-3.56, 4.03)	0.24 (-3.34, 1.57)
P2	0.72 (-2.78, 8.35)	0.53 (-2.5-, 3.36)
P3	0.91 (-2.54, 10.52)	1.89 (-1.60, 17.7)
P4	2.3 (-2.20, 47.71)	3.97 (-1.57, 75.54)

aOR= adjusted Odds Ratio; CI= Confidence interval; $p < 0.05$; Approximate area for inclusion: Results - knowledge

Approximately 85% reported that they knew what PEP was. Students in their P1 or P2 year accounted for 90.9% of the respondents who had not heard of PEP or who did not know what PEP was. Approximately 79% of students identified either tenofovir disoproxil fumarate 300mg/emtricitabine 200mg (Truvada) plus raltegravir (Isentress) or dolutegravir (Tivicay) as CDC recommended regimens for PEP. A 28-day recommended duration of PEP therapy was correctly identified by 67.1% of students. Of those who were unable to identify the appropriate duration of PEP, 24.1% were P1 students, 48.3% were P2, 17.2% were P3, and 10.3% were P4. The majority of respondents (78.6%) were able to correctly identify a preferred regimen for PEP. 50% of the

students who incorrectly identified a preferred regimen for PEP were in their P2 year. Despite this, there was no observable difference in odds that a student would have greater PEP knowledge depending on their professional year.

As seen in Table IV, students who met the criteria for composite knowledge (knowledge of three or more methods for HIV prevention, risk factors, and recommended treatment regimens) were significantly more likely to report confidence in counselling on PrEP (aOR 10.95; 95% CI [1.3, 32.61]) and PEP (aOR 8.20; 95% CI [1.03, 24.02]).

Table IV: Factors associated with confidence in PrEP/PEP counselling

	PrEP aOR (95% CI)	PEP aOR (95% CI)
Knowledge of three or more methods of HIV prevention	7.27 (-0.92, 132.98)	2.62 (-1.21, 22.94)
Knowledge of risk factors	2.72 (-0.33, 10.37)	2.39 (-0.47, 9.13)
Knowledge of recommended treatment regimen	12.38 (-0.36, 218.94)	4.81 (0.03, 22.59)
Knowledge of treatment duration	5.10 (0.58, 14.52)	9.13 (0.68, 42.21)
Composite knowledge (three+ prevention, correct risk factors, regimen & duration)	10.95 (1.3, 32.61)	8.20 (1.03, 24.02)
Year in the pharmacy programme		
P1	0.07 (0.01, 1.15)	0.17 (0.02, 1.39)
P2	0.14 (0.03, 0.67)	0.03 (0.002, 0.57)
P3	3.81 (1.44, 10.09)	6.13 (2.21, 16.97)
P4	2.69 (1.00, 7.29)	1.89 (0.69, 5.19)
Work experience in community pharmacy	2.76 (-0.03, 7.82)	1.38 (-0.66, 3.69)

Approximate area for inclusion: Results - knowledge

Awareness

Approximately 90% of students had heard of PrEP. About 43% of students did not know where to obtain PrEP, half (50%) had not seen PrEP, and three-quarters of students (75.6%) did not know the cost of PrEP. No significant difference in awareness was found when stratified by type of pharmacy work experience.

87% of students had heard of PEP. However, almost half of the students (44.7%) did not know where to get PEP, 75.3% did not know how much PEP costs, and 65.9% had never seen PEP before. No significant difference in awareness was found when stratified by type of pharmacy work experience.

Comfort/experience

About 90% of students reported that they had never counselled a patient on PrEP. One half (51.2%) of students reported they did not confidently feel that they could counsel patients on PrEP, and the other half (45.4%) reported that counselling patients on PrEP would be difficult or extremely difficult. Although P4 students accounted for the majority of those who

reported previously counselling a patient on PrEP (72.7%), no significant differences in prior counselling experience were observed depending on the programme year. Significantly more P3 (aOR 3.81, CI 1.44, 10.09) and P4 students (aOR 2.69, CI 1.00, 7.29) were confident in counselling a patient on PrEP. P2 students were more likely to find counselling on PrEP to be difficult or extremely difficult (aOR 5.28, CI 1.82, 15.3) compared to other students.

Similarly, 92.9% of students never counselled a patient on PEP, 71% lacked the confidence to do so, and 44.7% stated that counselling patients on PEP would be difficult or extremely difficult for them. There were no significant differences in experience counselling depending on the year of programme, though P4 students accounted for the highest percentage of those who have counselled a patient on PEP (66.6%). Significantly more P3 students (aOR 6.13, CI 2.21, 16.97) were confident in counselling a patient on PEP. Again, P2 students were more likely to find counselling on PEP to be difficult or extremely difficult (aOR 4.26, CI 1.52, 11.91) compared to other students.

Intent

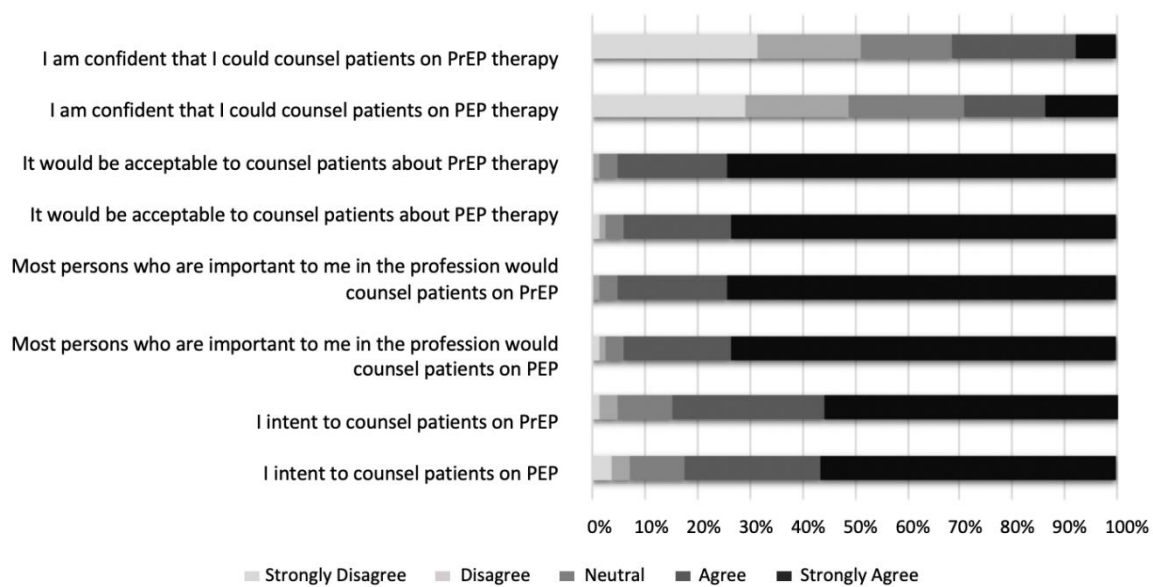
Approximately 85% of students reported that they intend to counsel patients on PrEP and 81% on PEP. No significant differences in intent to counsel on PrEP or PEP depending on the programme year were found.

Value/acceptability

As depicted in Figure 1, approximately 95% of students agreed or strongly agreed that it would be acceptable to counsel patients on PrEP. A majority of students (68.6%) agreed or strongly agreed that most of the people who were important to them within the pharmacy profession would counsel patients on PrEP or PEP. Additionally, 96% of students thought that a

pharmacist or intern counselling patients on PrEP was beneficial. No significant differences in the acceptability of counselling or the perceived benefit of PrEP counselling depending on the year of the programme were found.

With regards to PEP, 90% of students agreed or strongly agreed that it would be acceptable to counsel patients, 72% agreed or strongly agreed that most of the people who were important to them within the pharmacy profession would counsel patients, and 96.4% felt that PEP counselling would be beneficial. No significant differences in the acceptability of counselling or the perceived benefit of counselling on PEP depending on the year of the programme were found.



Approximate area for inclusion: Results - value/acceptability

Figure 1: Student perceptions of PrEP and PEP counselling (%)

Discussion

To the best of the authors' knowledge, this is the first published study to measure the knowledge, awareness and comfort of pharmacy students regarding PrEP and PEP on an urban college campus. Pharmacy students have strong awareness but limited knowledge and comfort regarding PrEP and PEP. Despite these limitations, the majority of students have a strong intent to counsel patients on PrEP or PEP and think that counselling patients on PrEP or PEP are beneficial. These findings have significant implications for curricular changes and can help identify the learning needs of current pharmacy students in order to better

prepare them to fulfil the expanding role of pharmacists in PrEP and PEP management.

Knowledge

Responses to the survey highlight knowledge deficits in HIV transmission and prevention methods. While most pharmacy students knew what PrEP and PEP were, less than half of the students surveyed correctly identified chemoprophylaxis as a method of HIV prevention. Deficits were present across all years of education but were most evident in P1 and P2 students. Students who met the criteria for composite knowledge were significantly more likely to report confidence in counselling on PrEP (aOR 10.95; 95% CI [1.3, 32.61])

and PEP (aOR 8.20; 95% CI [1.03, 24.02]). This finding of PrEP and PEP knowledge as a correlate of confidence is consistent with findings from a previous study among pharmacy students, which found that greater PrEP knowledge was significantly associated with confidence in PrEP counselling (Przybyla *et al.*, 2019). This study also found that familiarity with CDC PrEP guidelines was significantly associated with intent to counsel patients on PrEP (Przybyla *et al.*, 2019). Similarly, a previous study among prescribers showed a positive association between PrEP knowledge and past and future rates of PrEP prescribing as well as future intent to prescribe PrEP (Blumenthal *et al.*, 2015). These findings suggest that additional education/training is warranted in HIV transmission and prevention methods among pharmacy students across all professional years to improve their knowledge, confidence and intention to counsel regarding PrEP and PEP.

Awareness

The majority of pharmacy students had heard of PrEP and PEP, but few knew about how to access them or how much they cost. Interestingly, no difference in awareness related to access of PrEP or PEP was found based on the type of work experience, including community pharmacy practice, where PrEP and PEP are commonly dispensed. This lack of awareness regarding PrEP and PEP access among pharmacy students is especially concerning as about half of the students reported working in community pharmacies. However, only 50% reported they had seen PrEP, and 34% reported they had seen PEP, suggesting there may be barriers to utilisation, prescribing or dispensing of PrEP (Broekhuis *et al.*, 2018) or PEP (Reid *et al.*, 2014). In the US, insurance coverage and the cost of PrEP have been identified as significant barriers to PrEP utilisation for patients and prescribing by providers (Patel *et al.*, 2017). Pharmacy students should be aware of these barriers to PrEP uptake and prescribing, as well as resources available to patients that will cover the costs of PrEP. While the majority of insurance plans and Medicaid programmes cover PrEP, prior authorisations may be required (CDC, 2020). Additional resources include local, state, and federal resources for payment assistance, such as pharmaceutical company/foundation patient assistance programmes (Gilead, 2020), 340B programmes which offer PrEP/PEP at free or reduced cost (NASTAD, 2018), and the recently implemented Ready, Set PrEP nationwide programme by the US Department of Health and Human Services, which offers free PrEP to individuals without insurance (DHHS, 2020).

Comfort/experience

Pharmacy students have limited experience counselling patients on PrEP and PEP; only 13% of students reported having ever counselled patients on PrEP and 7% on PEP. This suggests the need to incorporate learning opportunities on counselling for pharmacy students on PrEP and PEP via simulated experiences and/or experiential learning. Students' limited experience counselling on PrEP or PEP may also reflect poor PrEP and PEP utilisation due to pharmacy barriers to dispensing PEP, or missed opportunities to engage pharmacy students in counselling patients on these regimens at their workplaces. A minority of students in this study reported that counselling patients on PrEP or PEP would be easy. P2 students were more likely to express difficulty in counselling patients on PrEP (aOR 5.28, 95% CI [1.82, 15.3]) and PEP (aOR 4.26 [1.52, 11.91]) than students from other professional years. A possible explanation for this is the lack of exposure to/experience in counselling among P2 students than students in P3 and P4 years since NYS pharmacy law only permits pharmacy interns to counsel patients (under the supervision of a licensed pharmacist) in their P3 year (NYSED, 2017). It is unclear why P1 students, who are junior to P2 students in their pharmacy training, did not express a level of difficulty in counselling patients that was consistent with or even exceeded that of P2 students.

Intent, Value and Acceptability

Despite their low reported confidence, self-efficacy, and limited reported experience in counselling patients on PrEP and PEP, most pharmacy students strongly agreed or agreed with the statement, "I intend to counsel patients on PrEP/PEP." Pharmacy students appear to value prophylaxis and the role of the pharmacist in counselling patients on these HIV prevention methods. The majority of respondents reported that they think a pharmacist or intern counselling patients on PrEP or PEP would be beneficial and that counselling patients about their PrEP or PEP would be acceptable. No significant differences in intent, acceptability, or benefit were found across pharmacy students of all years. The strong intent, acceptability and perceived benefit of counselling patients on prophylaxis are noteworthy given the stigma associated with HIV and populations at-risk for infection (CDC, 2020). Students may also recognise the important role of pharmacists in PrEP and PEP adherence and counselling and HIV prevention at large (Matyanga, 2014; Unni *et al.*, 2016; Broekhuis *et al.*, 2018).

The high level of awareness regarding PrEP and PEP (90% and 87%, respectively) demonstrated among pharmacy students in this study is consistent with findings from Przybyla and colleagues (2016), which found that 91% of pharmacy students at the University of Buffalo were aware of PrEP. Additionally, 51% identified an appropriate medication regimen for PrEP, 55% identified the correct dosing frequency, and 64% of students reported they were confident that they could counsel patients about PrEP (Przybyla *et al.*, 2016). In this study, a higher percentage of students surveyed identified appropriate medication regimens for PrEP and PEP (90% and 78.6%, respectively) and just over half identified the correct duration of therapy for PrEP and PEP (52.3% and 67%, respectively). The 64% of pharmacy students who reported they were confident that they could counsel patients about PrEP in the study by Przybyla and colleagues (2016) was slightly higher than the 49% in this study. Despite these differences, the overwhelming majority of students in both studies (81 to 87%) replied that they intend to counsel patients on PrEP and PEP.

Compared to pharmacists, pharmacy students have similar knowledge about PrEP and PEP regimens but greater confidence and intent regarding PrEP and PEP utilisation. In a study by Unni and colleagues (2016), which examined perceptions and knowledge about PrEP among 251 Midwestern US community pharmacists, about half (46.6%) identified tenofovir/emtricitabine as a medication that can be used for PrEP, and over half (57.7%) disagreed or strongly disagreed that they knew which medications are used in PrEP. Only about 17% of pharmacists reported that they intended to counsel patients on PrEP, and about 20% agreed that they either had the ability to counsel patients on PrEP or were confident that they could counsel patients on PrEP (Unni *et al.*, 2016). In comparison, over half of the pharmacy students in this study identified appropriate regimens for PrEP and PEP (52.3% and 67.1%, respectively). Additionally, a higher percentage of pharmacy students in this study reported that they intended to counsel patients on PrEP or PEP (85% and 81%, respectively), which is consistent with a previous study indicating pharmacy students' high intention to counsel patients about PrEP (Przybyla *et al.*, 2019). Pharmacy students in this study also reported higher levels of confidence regarding counselling patients on PrEP and PEP (48.8% and 29%, respectively).

A study of 250 pharmacists in New York City indicated that about 75% of pharmacists had prior knowledge about PEP, and 81% of pharmacists were somewhat or very willing to dispense PEP starter packs through Collaborative Drug Therapy Monitoring (CDTM) (Reid *et al.*, 2015). Willingness to prescribe PEP did not

significantly differ across factors such as prior PEP or CDTM knowledge (Reid *et al.*, 2015). Major barriers to dispensing PEP using CDTM included discomfort dispensing PEP without a physician-issued prescription, lack of a separate private space within the pharmacy, discomfort asking screening questions, and lack of time to conduct CDTM (Reid *et al.*, 2015). Education and training on PEP and CDTM were identified as key components to address these barriers (Reid *et al.*, 2015). These barriers may explain why less than half of pharmacy students in this survey reported having seen PEP or having experience in counselling patients on PEP.

Strengths and limitations

This study has several limitations. The survey was disseminated toward the end of the semester, which may have led to limited responses from students. The study was conducted at only one pharmacy school, and findings cannot be generalised to pharmacy students at other institutions or geographic areas. A strength of this study was that it investigated the knowledge, attitudes and comfort of pharmacy students related to both PrEP and PEP. Additionally, this study utilised cognitive behaviour theory, including a validated tool, to inform the development of its questionnaire (Legare *et al.*, 2014).

Future directions

Additional qualitative studies regarding beliefs, perceptions of PrEP and PEP among pharmacy students via focus groups may help explain some of the findings from the study. Also, studies among faculty and pharmacy students across the US may help highlight national gaps and trends in pharmacy education and training experiences related to PrEP and PEP, as well as cultural and institutional barriers to implementing these learning opportunities in pharmacy school curricula.

Pharmacy students have strong awareness but limited knowledge and comfort regarding PrEP and PEP. Results from the survey will be used to assess the learning needs of pharmacy students regarding PrEP and PEP and inform future curricular changes.

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