

Student Education About Pre-exposure Prophylaxis (PrEP) Varies Between Regions of the United States

Samuel R. Bunting, BS¹ , Sarah S. Garber, PhD², Robert H. Goldstein, MD, PhD³, Timothy D. Ritchie, PhD⁴, Tamzin J. Batteson, BSc⁵, and Timothy J. Keyes, BA⁶



¹Chicago Medical School, Rosalind Franklin University of Medicine and Science, North Chicago, IL, USA; ²Pharmaceutical Sciences, College of Pharmacy, Rosalind Franklin University of Medicine and Science, North Chicago, IL, USA; ³Division of Infectious Disease, Department of Medicine, Massachusetts General Hospital and Harvard Medical School, Boston, MA, USA; ⁴Department of Psychology, Saint Xavier University, Chicago, IL, USA; ⁵DeWitt C. Baldwin Institute for Interprofessional Education, Rosalind Franklin University of Medicine and Science, North Chicago, IL, USA; ⁶Stanford University School of Medicine, Stanford, CA, USA.

BACKGROUND: Daily, oral pre-exposure prophylaxis (PrEP) is an effective and safe prevention strategy for people at risk for HIV. However, prescription of PrEP has been limited for patients at the highest risk. Disparities in PrEP prescription are pronounced among racial and gender minority patients. A significant body of literature indicates that practicing healthcare providers have little awareness and knowledge of PrEP. Very little work has investigated the education about PrEP among health professionals in training.

OBJECTIVE: The objective of this study was to compare health professions students' awareness of PrEP and education about PrEP between regions of the US, and to determine if correlations between regional HIV incidence and PrEP use were present.

DESIGN: Survey study.

PARTICIPANTS: A cross-sectional sample of health professions students ($N = 1859$) representing future prescribers (MD, DO, PA), pharmacists, and nurses in the US.

KEY RESULTS: Overall, 83.4% of students were aware of PrEP, but only 62.2% of fourth-year students indicated they had been taught about PrEP at any time during their training. Education about PrEP was most comprehensive in the Northeastern US, the area with the highest PrEP to need ratio (4.7). In all regions, transgender patients and heterosexual men and women were least likely to be presented in education as PrEP candidates, and men who have sex with men were the most frequently presented.

CONCLUSIONS: There are marked differences in education regarding PrEP both between academic programs and regions of the USA.

KEY WORDS: HIV; Pre-exposure prophylaxis; Health professions education; Students.

ABBREVIATIONS

HIV	human immunodeficiency virus
PrEP	pre-exposure prophylaxis
PA	physician assistant

PWID
HMW
TWSM
MSM
CDC
LGBTQ+
ANOVA
ANCOVA
PnR

people who inject drugs
heterosexual men and women
transgender women who have sex with men
men who have sex with men
Centers for Disease Control and Prevention
lesbian, gay, bisexual, transgender, queer
analysis of variance
analysis of covariance
PrEP-to-need ratio

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INTRODUCTION

HIV incidence remains high in the United States (US), with nearly 40,000 new diagnoses in 2017.¹ Daily, oral pre-exposure prophylaxis (PrEP) is recommended to prevent HIV in at-risk individuals.^{2–6} PrEP is a biomedical prevention regimen with over 90% effectiveness^{5, 7, 8}; however, prescribing has been limited in the US.^{9, 10} Recent estimates suggest that less than 10% of patients at risk for HIV are prescribed PrEP.^{11, 12}

Significant disparities in HIV incidence exist in the US. Men who have sex with men (MSM) and transgender women who have sex with men (TWSM) remain disproportionately affected by HIV.¹ Regionally, the Southern US accounted for 51.5%, (19,968) in 2017, representing an incidence of 16.1 per 100,000 people.¹ Furthermore, significant disparities in PrEP use exist, specifically among transgender people and heterosexual, cisgender men and women (HMW).^{13–19}

One of the reported reasons for the limited prescription of PrEP is inadequate healthcare provider awareness and knowledge.^{20–23} Previous research has focused on the knowledge, awareness, and attitudes towards prescribing PrEP among practicing physicians,^{20, 22–40} pharmacists,^{41–49} physician assistants (PAs),^{20, 31, 35–39} and nurses.^{34, 36, 38, 40} Low provider awareness and knowledge leads to patients initiating an estimated 94% of conversations about PrEP.⁵⁰

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Previous studies investigated health professions students' knowledge and attitudes towards patients with HIV,^{51–55} HIV-prevention counseling,⁵⁶ and safe-sex practices.^{57, 58} These studies found high awareness of PrEP, but students' decision-making about prescribing PrEP may be influenced by stigma and racism.^{59–62} To the best of our knowledge, there are no cross-sectional, multi-professional samples of health professions students investigating education about HIV risk or PrEP.^{59–63}

Including instruction on foundational knowledge of PrEP within all health professions curricula will be essential to ensure current disparities in HIV incidence and PrEP prescription are not propagated. Scaling up of PrEP prescription, which is essential to end the HIV epidemic, requires interprofessional collaboration.^{42, 45, 49, 64–71}

We investigated the comprehensiveness of health professions students' education regarding PrEP, and whether education about HIV-risk and PrEP were matched with regional disparities in PrEP prescription and HIV incidence. The methodology and results are reported following published guidelines.⁷²

METHODS

Participants

An online survey was distributed between January and July 2019 to a nationwide, cross-sectional sample of medical (allopathic and osteopathic), pharmacy, PA, and undergraduate nursing students in the US using Qualtrics® (Provo, UT). Participants were identified through partnership with US student professional societies (list of societies provided in Appendix 2). Students were optionally entered in drawings for multiple \$25 Amazon.com gift cards.

Measure Development

Our survey instrument (Appendix 3) was developed for this study and was informed by previous studies of providers regarding PrEP.^{20, 22–24, 29, 34, 41} The survey instrument was reviewed by two infectious disease physicians, two internists, a pharmacist, and a nurse educator. The survey was piloted with a focus group of 20 students (at a single Midwestern institution). Revisions incorporating this feedback were made before nationwide distribution.

Items related to education asked whether a respondent knew what PrEP was (Awareness; Yes/No), and whether PrEP and HIV risk had been taught at any time in their academic program (Yes/No). Additional items queried students' self-reported level of education about PrEP and HIV risk (Fig. 1). All education items were scored on a 5-point Likert scale (1 = No Education, 5 = Comprehensive Education). Students also indicated which patient populations were presented during their education as having PrEP indications.³ The survey instrument asked gender identity, race/ethnicity, sexual orientation, year of training, and

state of school attendance. States were grouped into regions based on CDC classifications.¹

Statistical Analysis

Descriptive statistics were calculated to describe the sample. Academic programs were collapsed into three groups: future prescribers (allopathic and osteopathic medicine, PA), future nurses, and future pharmacists. Year in training was recoded as years 1, 2, 3, and 4+ (representing all students in their fourth year, and whose training programs lasted longer than 4 years). Chi-square tests (χ^2) were used to compare categorical variables and one-way ANOVA with Bonferroni post hoc comparisons were used to compare continuous variables.

Principal component analysis was utilized to organize the education items into discrete factors (Appendix 2). The items in each factor were summed to create two, aggregate education scores: HIV-risk education and PrEP education. Higher scale scores indicated more comprehensive education about HIV risk and PrEP, respectively. Reliability was evaluated with Cronbach's alpha (α). Scale means were evaluated using univariate ANCOVAs.

Mean scores for the HIV-risk education and PrEP education scales were compared between HIV incidence or PrEP-to-need ratio (PnR) for each region, respectively. The PnR describes the ratio between HIV incidence and incidence of PrEP prescriptions.⁷³ All statistics were computed using SPSSV25.0 (Armonk, NY).

RESULTS

Demographics

Overall, 2338 students submitted the survey. Incomplete responses were removed, resulting in the final sample of 1859 students (estimated overall response rate = 2.1%) (Table 1). Due to the distribution methodology, individual response rates were estimated, ranging from 0.86 to 39.9%. Variation is due to the differences in membership size of the national organizations utilized for distribution (Appendix 2). National demographics of health professions students are provided in Appendix 2. The mean age was 26.8 years ($SD = 5.7$). A majority of respondents were female ($n = 1361$, 73.2%), White ($n = 1229$, 66.1%), and heterosexual ($n = 1486$, 79.9%). Most were studying allopathic medicine ($n = 586$, 31.5%), and were in the second year ($n = 571$, 30.7%).

HIV-Risk Education

Overall, 84.5% ($n = 1570$) of responding students indicated HIV risk had been taught in their coursework (Table 2). Among first-year students, 71.2% indicated HIV risk was taught, increasing to 92.8% among fourth-year students ($\chi^2 = 77.7$, $P < 0.001$). Regionally, the highest percentage (87.4%) of students taught about HIV risk was in the South.

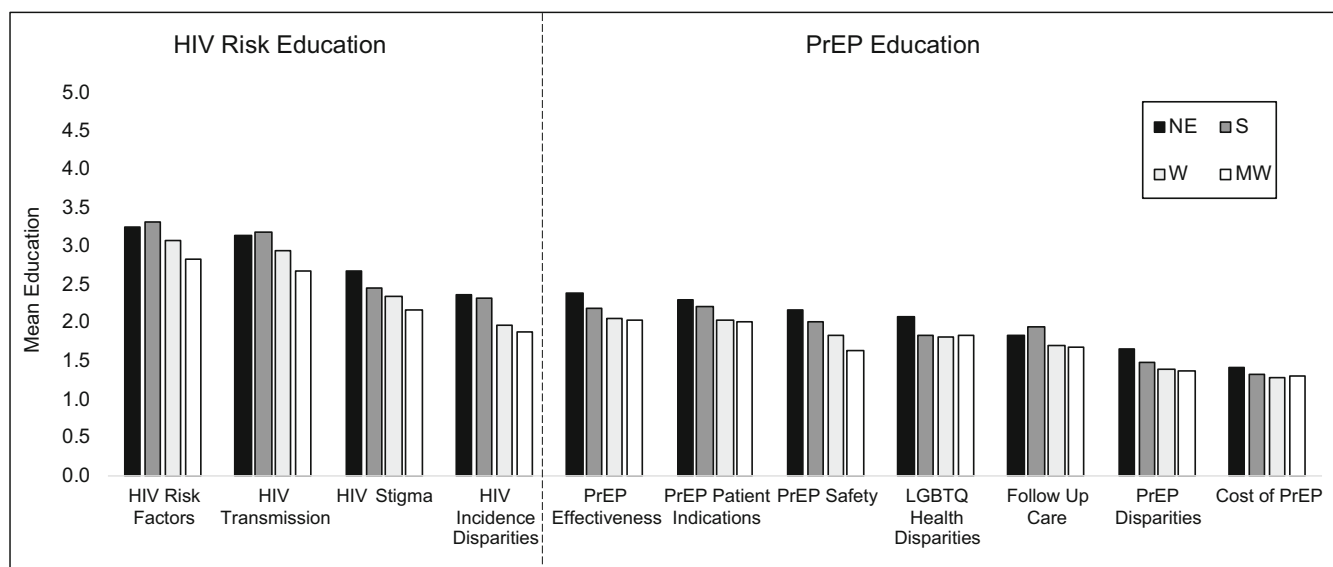


Fig. 1 The mean of student response to each item is compared by region. (NE = Northeast; S = South; W = West; MW = Midwest). Taken together, the items represent the students' rating of how comprehensive their education was regarding each specific item. Overall, students training in the Northeast and South had more comprehensive training about the individual items contained within both the HIV-risk education scale and the PrEP education scale than students in the Midwest. Mean comprehensiveness scores were lower for all items on the PrEP scale, and the regional trend (highest in the Northeast, lowest in the Midwest) were consistent across all items.

The HIV-risk education scale had high reliability ($\alpha = 0.90$, 95% CI[0.89–0.91]). Overall, the most comprehensive education was received regarding HIV risk factors and the least comprehensive education was received about disparities in HIV incidence. (Fig. 1).

Future pharmacists showed the highest mean HIV-risk education scale score ($M = 11.4$, 95% CI[10.8–12.0]) indicating more comprehensive education about HIV risk factors. The most comprehensive education about HIV risk factors was reported by students in their fourth year of training ($M = 11.7$, 95% CI[11.3–12.1]). This was more comprehensive than students in their first ($M = 9.8$, 95% CI[9.2–10.3], $P < 0.001$) and second year ($M = 10.6$, 95% CI[10.2–11.0], $P = 0.001$). Because the HIV-risk education scale mean differed between year of training, ANCOVA regional comparisons controlled for year.

HIV-risk education scale scores differed between regions of the US (Fig. 2a). The most comprehensive education about HIV risk was reported by students training in the Northeast ($M = 12.0$, 95% CI[11.5–12.6]). The HIV-risk education score was higher in the Northeast than in the Midwest ($M = 10.0$, 95% CI[9.6–10.4], $P < 0.001$) and the West ($M = 10.5$, 95% CI[10.0–11.0], $P = 0.001$). Comparison between the Northeast and the South ($M = 11.5$, 95% CI[11.2–11.9], $P = 0.14$) showed that students training in the Northeast had more comprehensive education, but the difference was not significant.

PrEP Education

Among all students, 83.4% ($n = 1550$) of students indicated they were aware of PrEP (Table 2). The greatest percentage of

future pharmacists were aware of PrEP (92.1%, $\chi^2_2 = 126.4$, $P < 0.001$). While the overall percentage of students aware of PrEP was high, only 56.5% ($n = 1050$) of students indicated PrEP was taught in their academic program (Table 2). More future pharmacists indicated they had been taught about PrEP (70.9%). Regionally, more students in the Northeast (62.8%) indicated PrEP was taught in their program. Finally, the percentage of students in their third year (64.3%) who indicated they were taught about PrEP was highest. Only those students who indicated PrEP awareness were included in subsequent analyses ($n = 1550$).

The PrEP Education scale was highly reliable ($\alpha = 0.93$, 95% CI[0.93–0.94]). Considering the individual items comprising the PrEP Education scale, students were most comprehensively educated about the effectiveness of PrEP in preventing HIV (Fig. 1).

Future pharmacists reported more comprehensive education about PrEP ($M = 15.8$, 95% CI[14.9–16.7]), compared to future prescribers ($M = 12.6$, 95% CI[12.2–13.0], $P < 0.001$) and future nurses ($M = 10.5$, 95% CI[10.1–11.0], $P < 0.001$). Third-year students reported the most comprehensive PrEP Education ($M = 13.6$, 95% CI[12.9–14.3]). This mean was higher than students in their first ($M = 11.0$, 95% CI[10.3–11.6], $P < 0.001$) and second year ($M = 12.4$, 95% CI[11.8–12.9], $P = 0.04$). ANCOVA models for the PrEP Education scale also controlled for year.

Again, the most comprehensive education about PrEP was reported by students training in the Northeast ($M = 15.6$, 95% CI[14.8–16.5]). Because the South has the lowest PnR (1.5), it was used as the reference group (Fig. 2b).⁷³ PrEP Education comprehensiveness was lower in the South ($M = 13.9$, 95%

Table 1 Demographics of Survey Respondents (N=1859)

	Full sample N = 1859		Allopathic med. n = 586 (31.5%)		Osteopathic med. n = 316 (17.0%)		Pharmacy n = 292 (15.7%)		PA n = 144 (7.0%)		Nursing n = 521 (28.0%)	
Total sampled population	87,599		11,087		14,916		732		476		60,388	
Response rate	2.1%		5.3%		2.1%		39.9%		30.3%		0.86%	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age (years)	26.8	5.7	25.7	3.2	26.3	3.0	24.8	4.0	27.7	5.1	29.1	8.7
Gender	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>
Male	472	25.4	209	35.7	110	34.8	59	20.2	29	20.1	65	12.5
Female	1361	73.2	364	62.1	203	64.2	232	79.5	114	79.2	448	86
Transgender/other	26	1.4	13	2.2	3	0.9	1	0.3	1	0.7	8	1.5
Sexual orientation												
Heterosexual	1486	79.9	449	76.6	246	77.8	239	81.8	127	88.2	425	81.6
Gay	231	12.4	89	15.2	44	13.9	42	14.4	8	5.6	48	9.2
Bisexual	142	7.6	48	8.2	26	8.2	11	3.8	9	6.3	48	9.2
Year in training												
1st year	403	21.7	156	26.6	105	33.2	35	12	49	34	58	11.1
2nd year	571	30.7	149	25.4	117	37	74	25.3	80	55.6	151	29
3rd year	387	20.8	136	23.2	55	17.4	90	30.8	11	7.6	95	18.2
4th year and up	498	26.8	145	24.7	39	12.3	93	31.8	4	2.8	217	41.7
Race												
African American (Black)	145	7.8	67	11.4	11	3.5	23	7.9	7	4.9	37	7.1
Caucasian (White)	1229	66.1	348	59.4	211	66.8	203	69.5	108	75	359	68.9
Hispanic/Latino	130	7	29	4.9	15	4.7	15	5.1	8	5.6	63	12.1
Native American	14	0.8	3	0.5	1	0.3	1	0.3	3	2.1	6	1.2
Asian	245	13.2	100	17.1	59	18.7	44	15.1	9	6.3	33	6.3
Other	96	5.2	39	6.7	19	6	6	2.1	9	6.3	23	4.4
Region												
South	674	36.3	170	29	121	38.3	120	41.1	67	46.5	196	37.6
Northeast	287	15.4	77	13.1	32	10.1	47	16.1	22	15.3	109	20.9
West	356	19.2	102	17.4	88	27.8	28	9.6	18	12.5	120	23
Midwest	542	29.2	237	40.4	75	23.7	97	33.2	37	25.7	96	18.4

Northeast: CT, ME, MA, NH, NJ, NY, PA, RI, VT; Midwest: IL, IN, IA, KS, MI, MN, MO, NE, ND, OH, SD, WI; South: AL, AR, DE, DC, FL, GA, KY, LA, MD, MS, NC, OK, SC, TN, TX, VA, WV; West: AK, AZ, CA, CO, HI, ID, MT, NV, NM, OR, UT, WA, WY

CI[13.3–14.4]) compared to the Northeast ($P = 0.001$). PrEP Education in the South was more comprehensive than that in the Midwest ($M = 12.7$, 95% CI[12.0–13.3], $P = 0.005$).

Patient Populations

Across all respondents, the patient group most frequently presented as being a candidate for PrEP was MSM (53.7%). A smaller percentage of students indicated they had been taught about people who inject drugs (PWID) (41.0%, $\chi^2_1 = 59.6$, $P < 0.001$), TWSM (24.3%, $\chi^2_1 = 337.0$, $P < 0.001$), and HMW (29.9%, $\chi^2_1 = 216.0$, $P < 0.001$) as candidates for PrEP compared to MSM. Presentation of patient populations was compared across regions (Fig. 3). However, the highest percentages of students training in the Northeast reported being taught about MSM (60.6%), PWID (48.1%), TWSM (34.1%), and HMW (39.0%) compared to all other regions. Across all regions, TWSM were the least frequently presented patient population indicated for PrEP. Additional comparisons of both scales and patient populations separated by region are in Appendix 1.

DISCUSSION

PrEP has the potential to significantly decrease HIV incidence and increasing PrEP prescriptions is a priority of the US

President's policy framework to end the HIV epidemic.⁷⁴ To accomplish this goal, healthcare professionals, both current and future, must be educated about PrEP and feel confident in discussing PrEP with patients at risk for HIV, especially in primary care.⁷⁵ To the best of our knowledge, this is the first study to investigate awareness and comprehensiveness of education regarding PrEP and HIV risk in a diverse, cross-sectional group of health professions students. The students who responded to the survey represent three groups of future healthcare professionals and provide a nationwide perspective on PrEP education. We show there are marked differences in education regarding PrEP between both academic programs and regions of the US. Future pharmacists in the Northeast received the most comprehensive education about HIV risk and PrEP, while future nurses in the Midwest reported the least comprehensive education about both topics.

This study identified multiple areas in which health professions curricula may not sufficiently train students regarding PrEP. In general, a majority of students (83.4%) were aware of PrEP. While encouraging, the percentage of students indicating they had been taught about PrEP during their program's curriculum was much lower (56.5%), suggesting many students learned about PrEP through extracurricular experiences. Furthermore, 37.8% of fourth-year students indicated they had not been taught about PrEP at all, and nearly 15% of fourth-year students were unaware of PrEP. In contrast, 84.5% of

Table 2 Comparison of Students' Awareness of PrEP and the Percentages of Students Indicating if They Had Been Taught About HIV Risk or PrEP. The *P* Values in the Headings Represent Omnibus Chi-square Comparison, with Subsequent Pairwise Comparisons of Frequencies Relative to the Identified Reference Categories

	Aware of PrEP			HIV risk taught			PrEP taught		
	<i>n</i>	%	<i>P</i>	<i>n</i>	%	<i>P</i>	<i>n</i>	%	<i>P</i>
Student group			< 0.001			0.12			< 0.001
Future pharmacists	269	92.1	Ref.	239	81.8	—	207	70.9	Ref.
Future prescribers	927	88.6	0.09	878	83.9	—	628	60.0	0.001
Future nurses	354	67.9	< 0.001	453	86.9	—	215	41.3	< 0.001
Year in training			< 0.001			< 0.001			< 0.001
1st year	298	73.9	Ref.	287	71.2	Ref.	164	40.7	Ref.
2nd year	487	85.3	< 0.001	468	82.0	< 0.001	327	57.3	< 0.001
3rd year	337	87.1	< 0.001	353	91.2	< 0.001	249	64.3	< 0.001
4th year and up	428	85.9	< 0.001	462	92.8	< 0.001	310	62.2	< 0.001
Region			0.35			0.006			0.03
Northeast	230	80.1	—	247	86.1	Ref.	181	63.1	Ref.
South	569	84.4	—	589	87.4	0.49	387	57.4	0.10
West	295	82.9	—	299	84.0	0.53	186	52.2	0.004
Midwest	456	84.1	—	435	80.3	0.04	296	54.6	0.006

students indicated they were taught about HIV risk factors and 92.8% of fourth-year students reported receiving education about HIV risk. This disparity between the proportions of students who were taught about HIV risk factors compared to those that were taught about PrEP suggests a deficiency in curriculum content.

Level of HIV-Risk Education Often Correlates with HIV Incidence

Education about HIV risk varied between regions of the US. The most comprehensive education about HIV risk was found in the Northeast, which has an HIV incidence of 10.6 per 100,000.¹ Students in the South, which has the highest HIV incidence (16.1 per 100,000) in the US,¹ reported less comprehensive HIV-risk education than the Northeast. Less comprehensive education about HIV risk, including knowledge of populations at higher risk for infection and methods of HIV acquisition, may limit efforts to mitigate and ultimately end the HIV epidemic when today's students enter practice. Investment in HIV-risk education in all health professions across regions of the US is essential as one component of a comprehensive HIV prevention agenda.

Levels of PrEP Education Do Not Correlate with Regional Needs

We also found regional variation in the comprehensiveness of education about PrEP. The most comprehensive education about PrEP was found in the Northeast, which is the region with the highest PnR (4.7).⁷³ Students in the South, the region with lowest PnR (1.5),⁷³ reported less comprehensive education about PrEP compared to students training in the Northeast. Based on public health need, one would expect students in the South, the area with the highest HIV incidence and lowest uptake of PrEP, to have the greatest need for comprehensive education about PrEP, but that does not appear to have permeated into the curricula of health professions training programs.

PrEP Potential for At-Risk Patient Populations

Substantial variation was identified in patients presented during PrEP education. MSM were the most frequently presented population, which is consistent with the historical and present high HIV incidence in MSM, and the targeted marketing of PrEP to this population.¹ PWIDs account for approximately 10% of new HIV infections and regional outbreaks of HIV transmission are seen in networks of PWID.¹ PrEP use is lower in PWIDs compared to MSM, despite evidence that PrEP is safe and effective in this population.^{76–79} PWIDs were infrequently presented during PrEP education, which may ultimately contribute to limited prescription of PrEP and may be linked to stigma and misinformation about PWIDs.

A recent meta-analysis estimated prevalence of HIV in TWSM to be 14.1%, increasing to an estimated 44.2% in Black TWSM.⁸⁰ The CDC recommends that TWSM at risk for HIV be offered PrEP.³ Our results demonstrate TWSM are largely excluded from PrEP education, which may represent deficiency of content on transgender health in health professions curriculum and may be a prohibiting factor in efforts to decrease HIV in this community.^{81–83} Recent work has identified a substantial role of stigma in PrEP access for TWSM, particularly TWSM of color.⁸⁴ Avoiding education on these trends and disparities may perpetuate stigma. These findings are concerning, particularly in light of recent work showing that race and ethnicity disparities in PrEP use may be traced to failure of providers to recommend PrEP to TWSM.⁸⁵ Finally, approximately 25% of new HIV infections occur in HMW,¹ yet these patients were infrequently presented as candidates for PrEP in education.

Implications

Regional differences in PrEP education are one barrier to decreasing HIV incidence. Today's students cannot bear responsibility for lagging PrEP prescriptions, but they will be the providers that contribute to PrEP scale up. Having inadequate preparation regarding PrEP is another barrier to reducing HIV

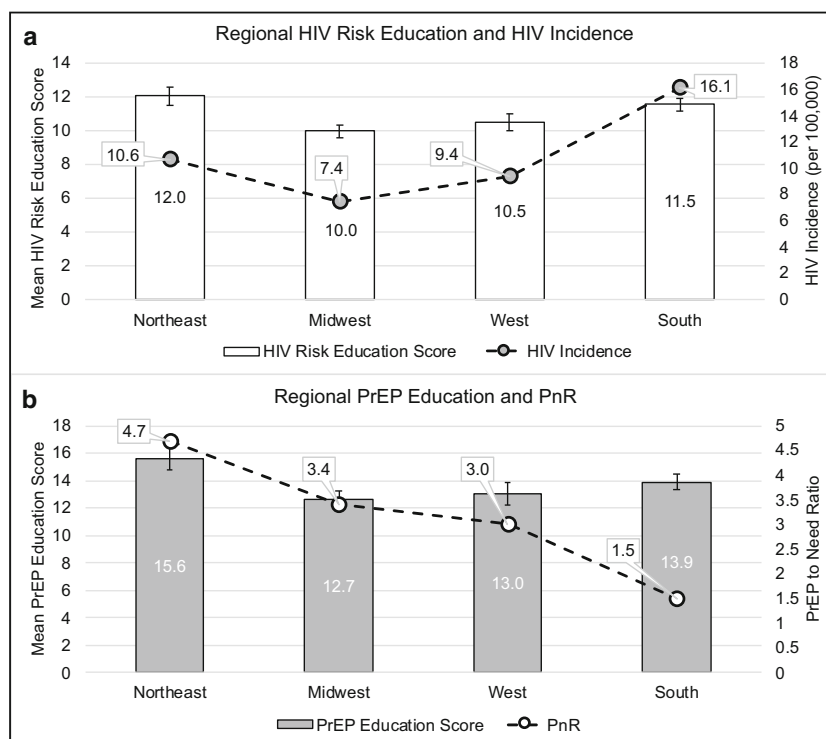


Fig. 2 a Vertical bars represent mean comprehensiveness of education about HIV risk (mean values are presented within bar) and vary geographically. The mean HIV-risk knowledge scores are corrected for between group differences by year in training. The incidence (dotted line) is reported as calculated by the CDC in 2016, the most recent year of finalized numbers. b Vertical bars represent mean comprehensiveness of education about PrEP (presented within bar) in geographic regions. The dotted line represents PnR across regions (73). A higher PnR indicates there are more PrEP prescriptions than new diagnoses of HIV, indicating more prescriptions are being given to patients at risk for HIV. Error bars represent a 95% CI.

that health professionals in training may face, in addition to the numerous structural, political, and cultural factors influencing HIV incidence and PrEP uptake. In studies of healthcare providers, having a high degree of knowledge about PrEP was correlated with higher prescription rates to patients at risk for HIV.^{24, 35} These studies set the precedent for providing comprehensive education about PrEP to the next generation of healthcare providers.

For those who believe that health professions education must acknowledge social justice in curriculum development, HIV incidence and PrEP prescription disparities are critical. The finding that students reported little education about disparities in both HIV incidence and PrEP use is troubling in light of the unequal distribution of current PrEP prescriptions.⁸⁵ In addition, information about PrEP and HIV risk should be presented within formal curricula

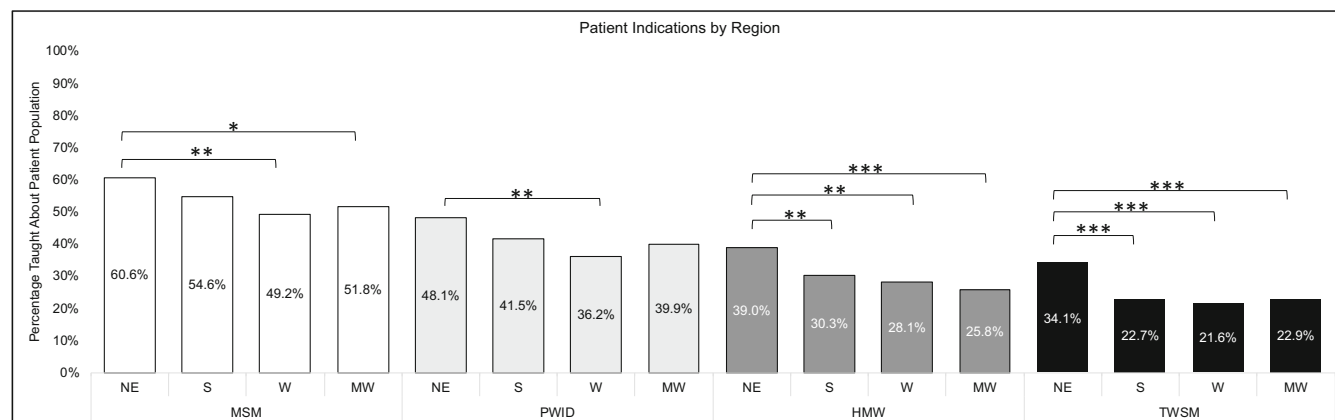


Fig. 3 Vertical bars represent the percentage of students who received training about specific patient populations (MSM = men who have sex with men; PWID = people who inject drugs; HMW = heterosexual, cisgender men, and women; TWSM = transgender women who have sex with men). The greatest percentages of students trained about all specific patient population was in the Northeast. This trend carried through regardless of the patient population. The patient population most often presented was MSM and the least frequently presented patient population was TWSM. *P* values represent pairwise chi-square comparisons; * = *P* < 0.05, ** = *P* < 0.01, *** = *P* < 0.001.

in a bias-free, neutral fashion to avoid propagating stigma.⁸⁶

Limitations

Three limitations should be acknowledged when interpreting these results. First, we present cross-sectional data collected through a self-administered survey. Selection and reporting biases are possible, and the responses may over-represent students with an existing interest in PrEP or HIV care, or those with previous experiences with PrEP. This may bias the results towards including a higher percentage of students taught about PrEP and HIV risk and may suggest the differences between health professions and regions are greater than reported.

Second, the response rates are a limitation of this investigation. The low responses are expected, despite a large overall sample, due to the size of the national partner organizations and the method of distribution. There is also variation between response rates of individual professional groups due to the variation in membership size of the national organizations utilized for distribution. Importantly, there is parity between the racial makeup of the study sample compared to national demographics. However, our sample contains more female students than nationally, and sexual and gender minorities are also over-represented in our sample. The limited amount of publicly available demographic data describing health professionals in training makes a robust comparison of the study sample to national data difficult. The inclusion of only undergraduate nursing students is another limitation, and a future study would benefit from extension to graduate nursing students as these practitioners will have prescriptive authority.

Finally, we acknowledge the need for more robust characterization of education about PrEP. The data reported here represent student's self-report of their curricula and depth of understanding about PrEP. A future study would benefit from a systematic inventory of educational materials regarding HIV risk and PrEP. Such an inventory may inform best practice guidelines or core competencies for education about PrEP.

CONCLUSION

In this cross-sectional study of health professions students, 37.8% of future prescribers, pharmacists, and nurses in the US reported that they were graduating without receiving education about PrEP. Increasing PrEP prescription is an essential component of the strategy for eliminating the HIV epidemic. Given the heterogeneity of education about PrEP and HIV risk among education programs and regions of the US, analysis of content in the curriculum of each profession is warranted to inform improvements. It is incumbent upon health professions education to improve the quality, equity, and comprehensiveness of teaching this material to provide accurate and timely education about PrEP for HIV prevention.

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Corresponding Author: Samuel R. Bunting, BS; Chicago Medical School, Rosalind Franklin University of Medicine and Science, North Chicago, IL, USA (e-mail: Samuel.Bunting@my.rfums.org).

Author Contributions Conception and design: Samuel R. Bunting, Sarah S. Garber, Tamzin J. Batteson
Analysis and interpretation of the data: Samuel R. Bunting, Timothy D. Ritchie, Tamzin J. Batteson
Drafting of the article: Samuel R. Bunting
Critical revision of the article for important intellectual content: Robert H. Goldstein, Sarah S. Garber, Timothy Keyes
Final approval of the article: Samuel R. Bunting, Tamzin J. Batteson, Sarah S. Garber, Timothy D. Ritchie, Robert H. Goldstein, Timothy Keyes
Provision of study materials or patients: Samuel R. Bunting, Sarah S. Garber
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