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Suboptimal awareness and comprehension of published pre-exposure prophylaxis efficacy results among physicians in Massachusetts

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Abstract

In 2010, the CAPRISA 004 and iPrEx trials (microbicide gel containing tenofovir and oral pill containing tenofovir-emtricitabine, respectively) demonstrated that antiretroviral pre-exposure prophylaxis (PrEP) reduced the risk of HIV acquisition among high-risk individuals. To determine facilitators and barriers to PrEP provision by healthcare providers, we conducted an online, quantitative survey of Massachusetts-area physicians following the publication of the CAPRISA and iPrEx results. We assessed awareness and comprehension of efficacy data, prescribing experience, and anticipated provision of oral and topical PrEP among physicians, as well as demographic and behavioral factors associated with PrEP awareness and prescribing intentions. The majority of HIV specialists and generalist physicians were aware of data from these PrEP trials and able to correctly interpret the results, however, correct interpretation of findings tended to vary according to specialty (i.e., HIV specialists had greater awareness than generalists). Additionally provider concerns regarding PrEP efficacy and safety, as well its ability to divert funds from other HIV prevention resources, were associated with decreased intentions to prescribe both oral and topical PrEP. Findings suggest that a substantial proportion of physicians who may have contact with at-risk individuals may benefit from interventions that provide accurate data on the risks and benefits of PrEP in order to facilitate effective PrEP discussions with their patients. Future studies to develop and test interventions aimed at healthcare providers should be prioritized to optimize implementation of PrEP in clinical settings.

Keywords

Pre-Exposure Prophylaxis; PrEP; Physicians; HIV; Prevention

Introduction

Despite the widespread use of behavioral interventions to prevent HIV, more than 2 million new infections occur worldwide annually, including about 50,000 in the US (Hall et al., 2008). In July 2010, the CAPRISA004 (Centre for the AIDS Programme of Research in South Africa) trial was the first to demonstrate the efficacy of topical pre-exposure chemoprophylaxis (PrEP) in South African women through the pericoital use of an intravaginal microbicide gel containing tenofovir to reduce HIV acquisition (Abdool Karim et al., 2010). In November 2010, the iPrEx study established that a once-daily tablet containing a fixed-dose combination of tenofovir disoproxil fumarate and emtricitabine (TDF-FTC) successfully reduced the risk of HIV acquisition among at-risk men who have sex with men (MSM) and transgender women (Grant et al., 2010). These findings warrant the need for at-risk individuals to access healthcare providers who are knowledgeable about HIV transmission and prevention modalities and trained and motivated to prescribe chemoprophylaxis.

Since the release of PrEP efficacy data, few studies have measured healthcare providers' awareness of PrEP and ability to correctly interpret clinical efficacy data (Maznavi, Hardy, & Bredeek, 2011; White, Mimiaga, Krakower, & Mayer, 2012). Given prior research documenting potential barriers to PrEP provision, including historic antiretroviral use for HIV treatment, diversion of limited resources, and concern for unintended consequences (e.g., medication toxicities, behavioral disinhibition, and the emergence of drug resistance) (Arnold et al., 2012; Paltiel et al., 2009; Supervie, García-Lerma, Heneine, & Blower, 2010; Tripathi, Ogbuanu, Monger, Gibson, & Duffus, 2012; Underhill, Operario, Skeer, Mimiaga, & Mayer, 2010), it is essential to understand provider knowledge, attitudes, and prescribing intentions regarding PrEP.

Guided by the Theory of Reasoned Action/Planned Behavior (Ajzen & Madden, 1986; Boldero, Sanitioso, & Brain, 1999), we assessed Massachusetts-area physicians' awareness and comprehension of efficacy data, prescribing experience, and anticipated provision of PrEP using an online, quantitative survey. To inform the content of future educational interventions for physicians, specific concerns and hypothetical motivators around PrEP provision were also assessed.

Methods

Details of this study have been described previously (White et al., 2012). Briefly, Massachusetts HIV specialists and generalist physicians were recruited to complete an anonymous, online survey assessing their attitudes, knowledge, and experiences with biomedical and other HIV prevention interventions. The survey was completed by 115 physicians (response rate 18.4%) and approved by the Institutional Review Board of Fenway Health.

The survey contained 4 domains designed to assess providers' knowledge, experiences, and beliefs regarding PrEP after the release of iPrEx clinical trial data (see Table 1): [1] demographics and provider characteristics; [2] PrEP-related knowledge, experience, and

preferences; [3] perceived motivators and barriers to PrEP provision; and [4] awareness and interpretation of PrEP efficacy data.

To assess differences between provider specialty and the measures described above, t-tests (for continuous measures), chi-square tests (for nominal measures) and Fisher's exact tests (for nominal measures with low cell counts) were performed. Bivariate regression analyses were conducted to examine factors associated with knowledge and intentions to prescribe PrEP. A principal components analysis of the 15 items assessing PrEP-related concerns was conducted to enable these factors to be orthogonal in the multivariable regression models. Using Kaiser's 'rule of one', a scree plot of eigenvalues (Jolliffe, 2002) determined the number of principal components to retain in our analysis, yielding 5. The 5 principal components explained 71% of the total variance of the items and items with a loading of 0.40 absolute value or higher were used to construct corresponding names (DeVellis, 2003) (see Table 2).

Results

Demographic characteristics (n=115) by specialty type are shown in Table 3. Awareness of iPrEx and CAPRISA efficacy data was moderate (64% and 57%, respectively) (Table 4). Overall, 72% correctly interpreted the results of both trials, and 60% specified the correct dosing of the pill (everyday) and gel (before/after every act of vaginal sex). A greater proportion agreed that the gel (70%) versus the pill (40%) should be available to all at-risk persons. Notably, 28% of physicians felt that the pill should not be available to all at-risk persons. The majority indicated they would prescribe the pill (76%) and gel (83%) to the populations in which efficacy had been demonstrated. However, a majority also said they would prescribe the pill (52%) and gel (53%) to uninfected individuals in serodiscordant relationships or to individuals engaged in transactional sex (56%), despite the absence of efficacy trials restricted to these populations.

HIV specialists were more knowledgeable than generalists about the results of iPrEx ($p<0.001$) and CAPRISA ($p<0.001$) and, more often than generalists, indicated that the pill should be prescribed to people who change partners frequently ($p<0.05$) (Table 4).

In the first multivariable model, factors resulting in lower odds of *intending to prescribe oral PrEP* included: data demonstrating greater than 80% efficacy, beliefs that behavioral interventions are safer/more effective, concerns regarding PrEP's efficacy/safety, and concerns regarding decreases in federal funds for other HIV prevention modalities ($p = 0.05$). Conversely, additional clinical efficacy data about MSM was associated with the increased odds of intending to prescribe oral PrEP ($p=0.05$) (Table 5).

In the second multivariable model, factors resulting in lower odds of *intending to prescribe topical microbicides* included: beliefs that behavioral interventions are safer/more effective and concerns regarding decreases in federal funds for other HIV prevention modalities ($p = 0.01$) (Table 5).

Discussion

In 2010, CAPRISA004 (Abdool Karim et al., 2010) and iPrEx (Grant et al., 2010) provided the first proof of antiretroviral chemoprophylaxis for HIV infection. In this study of PrEP awareness and prescribing intentions among 115 Massachusetts physicians, we found that a majority of HIV specialists and generalists were aware of CAPRISA004 and iPrEx data and were able to correctly interpret the results of these studies. However, the finding that participants misinterpreted the results of oral and topical PrEP efficacy data raises concerns about how to best educate physicians to translate the results of PrEP efficacy studies. These concerns suggest that educational interventions designed to increase physicians' awareness and interpretation of PrEP study data may be needed to optimize PrEP provision, given the recent U.S. Food and Drug Administration (FDA) approval of oral PrEP for MSM and at-risk heterosexuals (CDC, 2012; Centers for Disease Control and Prevention, 2012).

We found that generalists were less familiar with PrEP efficacy results than were HIV specialists, which is particularly relevant since most persons at risk for HIV are not likely to seek care from HIV specialists. Given that physicians are not often comfortable discussing sexual behavior with their patients (Bernstein et al., 2008; Epstein et al., 1998; Petroll & Mosack, 2011), innovative provider education programs are needed for PrEP to be effective in decreasing HIV spread. Moderate provider willingness to prescribe oral/topical PrEP to populations for which efficacy data exists suggests that physicians may not always base their prescribing decisions solely on available evidence. Thus, further studies are needed to understand how physicians formulate their prescribing decisions. Additionally, given the links between physicians' concerns about PrEP (behavioral interventions are safer and PrEP would divert HIV prevention resources) and their prescribing intentions, educational interventions that provide information on the safety of PrEP, and its anticipated financial impact on HIV prevention budgets, may be most effective in motivating physicians to appropriately prescribe PrEP.

The findings that many HIV specialists were aware of PrEP and that physicians may be willing to prescribe PrEP to populations with and without efficacy data, are consistent with the findings from another post-iPrEx study of HIV specialists in the US (Maznavi et al., 2011). Moreover our results that safety and efficacy concerns may be important barriers to prescribing PrEP are also consistent with findings from Maznavi and colleagues as well as another study of healthcare providers before the release of PrEP efficacy data (Tripathi et al., 2012). Our study extends the current understanding of physicians' knowledge of PrEP by demonstrating that physicians may misinterpret the results of PrEP efficacy studies. As accurate communication of the potential risks and benefits of PrEP from physicians to their patients will be essential for patients to make informed decisions about PrEP utilization, our results suggest that future studies measuring physician and patient understanding of PrEP clinical efficacy data are warranted.

These results should be interpreted in the context of the cross-sectional study design. Study participants represent a subset of physicians, so findings may not be generalizable to all physicians in Massachusetts, or elsewhere. As the study was conducted soon after iPrEx publication, the results could underestimate physicians' current awareness of PrEP (AIDS

Healthcare Foundation, 2012; Associated Press, 2012; Baeten & Celum, 2012; Mutua et al., 2012; Susman, 2012; Tuller, 2011). However, the perceived motivators and barriers analyzed are similar to those described by providers in a qualitative study of clinicians' perceived challenges to implementing PrEP (Arnold et al., 2012), suggesting it is unlikely that we excluded important factors that would alter our overall conclusions.

This study suggests that a substantial proportion of physicians who may have contact with at-risk individuals may benefit from interventions that provide accurate data on the risks and benefits of PrEP in order to provide effective counseling regarding PrEP utilization. Future studies to develop and test interventions targeted at healthcare providers should be prioritized to optimize implementation of PrEP in clinical settings.

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References

- Abdool Karim Q, Abdool Karim SS, Frohlich JA, Grobler AC, Baxter C, Mansoor LE. Effectiveness and safety of Tenofovir gel, an antiretroviral microbicide, for the prevention of HIV infection in women. *Science*. 2010; 329(5996):1168–1174. doi: 10.1126/science.1193748. [PubMed: 20643915]
- AIDS Healthcare Foundation. FDA AIDS protest targets approval of Gilead's prevention pill. 2012. Retrieved December 12, 2012 from <http://www.aidshealth.org/archives/6488>
- Ajzen I, Madden TJ. Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control. *Journal of experimental social psychology*. 1986; 22(5):453–474.
- Arnold EA, Hazelton P, Lane T, Christopoulos KA, Galindo GR, Steward WT. A qualitative study of provider thoughts on implementing pre-exposure prophylaxis (PrEP) in clinical settings to prevent HIV infection. *PLoS ONE*. 2012; 7(7):e40603. doi: 10.1371/journal.pone.0040603. [PubMed: 22792384]
- Associated Press. FDA panel backs first pill to block HIV infection. 2012. Retrieved December 12, 2012 from <http://www.msnbc.msn.com/id/47386249/ns/health-aids/t/fda-panel-backs-first-pill-block-hiv-infection/#.UNzDCazheSo>
- Baeten J, Celum C. Antiretroviral prophylaxis for HIV prevention in heterosexual men and women. *New England Journal of Medicine*. 2012; 367(5):399–410. doi: 10.1056/NEJMoa1108524. [PubMed: 22784037]
- Bernstein KT, Liu K, Begier EM, Koblin B, Karpati A, Murrill C. Same-sex attraction disclosure to health care providers among new york city men who have sex with men: Implications for hiv testing approaches. *Archives of Internal Medicine*. 2008; 168(13):1458–1464. doi: 10.1001/archinte.168.13.1458. [PubMed: 18625927]
- Boldero J, Sanitioso R, Brain B. Gay Asian Australians' Safer Sex Behavior and Behavioral Skills: The Predictive Utility of the Theory of Planned Behavior and Cultural Behavioral Skills: The Predictive Utility of the Theory of planned Behavior and Cultural Factors1. *Journal of Applied Social Psychology*. 1999; 29(10):2143–2163.
- CDC. CDC Statement on FDA Approval of Drug for HIV Prevention (Press Release). Centers for Disease Control and Prevention; 2012. Retrieved July 16, 2012 http://www.cdc.gov/hiv/prep/pdf/CDC_FDA_Approval_Truvada.pdf
- Centers for Disease Control and Prevention. CDC Statement on FDA Approval of Drug for HIV Prevention. Jul 16. 2012 Retrieved from http://www.cdc.gov/hiv/prep/pdf/CDC_FDA_Approval_Truvada.pdf

- DeVellis, RF. Scale development: Theory and applications. Sage; Thousand Oaks, CA: 2003.
- Epstein, RM.; Morse, DS.; Frankel, RM.; Frarcy, L.; Anderson, K.; Beckman, HB. Awkward moments in patient-physician communication about HIV risk. Vol. 128. American College of Physicians; Philadelphia, PA: 1998.
- Grant RM, Lama JR, Anderson PL, McMahan V, Liu AY, Vargas I. Preexposure chemoprophylaxis for HIV prevention in men who have sex with men. *New England Journal of Medicine*. 2010; 363:2587–2599. [PubMed: 21091279]
- Hall HI, Song R, Rhodes P, Prejean J, An Q, Lee LM. HIV incidence surveillance group. Estimation of HIV incidence in the United States. *JAMA*. 2008; 300(5):520–529. doi: 10.2105/ajph.2006.087551. [PubMed: 18677024]
- Jolliffe, IT. Principal components analysis. Springer; New York, NY: 2002.
- Maznavi, K.; Hardy, D.; Bredeek, F. Pre-exposure prophylaxis (PrEP) for HIV: An online survey of HIV healthcare providers evaluating their knowledge, perception, and prescription of PrEP [409]; 49th Annual Meeting of the Infectious Diseases Society of America; Boston. 2011;
- Mutua G, Sanders E, Mugo P, Anzala O, Haberer JE, Bangsberg D. Safety and adherence to intermittent pre-exposure prophylaxis (PrEP) for HIV-1 in African men who have sex with men and female sex workers. *PLoS ONE*. 2012; 7(4):e33103. doi: 10.1371/journal.pone.0033103. [PubMed: 22511916]
- Paltiel AD, Freedberg KA, Scott CA, Schackman BR, Losina E, Wang B. HIV preexposure prophylaxis in the United States: Impact on lifetime infection risk, clinical outcomes, and cost-effectiveness. *Clin Infect Dis*. 2009; 48(6):806–815. doi: 10.1086/597095. [PubMed: 19193111]
- Petroll AE, Mosack KE. Physician awareness of sexual orientation and preventive health recommendations to men who have sex with men. *Sexually transmitted diseases*. 2011; 38(1):63–67. doi: 10.1097/OLQ.0b013e3181ebd50f. [PubMed: 20706178]
- Reyna VF, Nelson WL, Han PK, Dieckmann NF. How numeracy influences risk comprehension and medical decision making. *Psychological bulletin*. 2009; 135(6):943–973. doi: 10.1037/a0017327. [PubMed: 19883143]
- Supervie V, García-Lerma JG, Heneine W, Blower S. HIV, transmitted drug resistance, and the paradox of preexposure prophylaxis. *Proceedings of the National Academy of Sciences*. 2010; 107(27):12381–12386. doi: 10.1073/pnas.1006061107.
- Susman, E. Prophylaxis fails to prevent HIV in women. 2012. Retrieved from <http://www.medpagetoday.com/MeetingCoverage/CROI/31506>
- Tripathi A, Ogbuanu C, Monger M, Gibson JJ, Duffus WA. Pre-exposure prophylaxis for HIV Infection: Healthcare providers' knowledge, perception, and willingness to adopt future implementation in the Southern US. *Southern Medical Journal*. 2012; 105(4):8. doi: 10.1097/SMJ.0b013e31824f1a1b.
- Tuller, D. Questions on Tactic to Prevent HIV. 2011. Retrieved from http://www.nytimes.com/2011/10/11/health/11hiv.html?pagewanted=all&_r=1&
- Underhill K, Operario D, Skeer M, Mimiaga M, Mayer K. Packaging PrEP to prevent HIV: An integrated framework to plan for pre-exposure prophylaxis implementation in clinical practice. *J Acquir Immune Defic Syndr*. 2010; 55(1):8–13. doi: 10.1097/QA.b)1381e8efe4. [PubMed: 21423876]
- White JM, Mimiaga MM, Krakower DS, Mayer KM. Evolution of Massachusetts physician attitudes, knowledge, and experience regarding the use of antiretrovirals for HIV prevention. *AIDS Patient Care STDS*. 2012; 26(7):395–405. doi: 10.1089/apc.2012.0030. [PubMed: 22694239]

Table 1

Select survey measures (Post-iPrEx: n=115).

Measure	Response Options
Hypothetical Motivators and Barriers to PrEP Provision	
Motivators	
What information would influence your decision to prescribe PrEP to prevent HIV infection? (check all that apply)	(a) Additional clinical efficacy data about MSM; (b) Additional clinical efficacy data about at risk women; (c) Additional clinical efficacy data about HIV discordant couple; (d) Formal recommendations from the CDC; (e) Formal recommendations from third party payers; (f) Recommendations from fellow providers; (g) Successful clinical monitoring outcomes; (h) Positive feedback from patients who had already used PrEP; (i) Other
Which of the following HYPOTHETICAL events would prevent you from prescribing PrEP to patients? (check all that apply)	(a) Limited amount of data on PrEP's clinical efficacy; (b) Observed increases in the risk behaviors of PrEP users; (c) Toxicities in an otherwise healthy population; (d) Insufficient federal funds to support the cost of PrEP use; (e) Decrease in available federal funds for other HIV prevention modalities; (f) Development of antiretroviral drug resistance among patients using PrEP; (g) Time associated with clinical monitoring; (h) Time required to provide counseling and prevention education; (i) Community backlash; (j) Other
iPrEx Efficacy Data	
Efficacy Data Knowledge	
Recent clinical trial results showed that a PrEP pill containing the HIV antiretroviral drugs Tenofovir/Emtricitabine (TDF/FTC) was 44% effective in reducing HIV infections among HIV-uninfected men who have sex with men (MSM) in the United States. Before this survey, had you previously heard of these results?	(a) Yes; (b) No
Efficacy Data Interpretation	
This study showed that the Tenofovir/Emtricitabine (TDF/FTC) pill reduced HIV infections by 44% among HIV uninfected MSM who were assigned to take the active medication daily. How do you interpret these results?	(a) A man taking the pill, who had sex 100 times without a condom, would be protected the first 44 times; (b) A man would be protected from HIV 44% of the time if he takes the pill daily; (c) One pill a day protects against HIV 44% of the time, 2 pills a day protect against HIV 88% of the time; (d) The pill may be expected to prevent 44% of the infections that would occur in a population if the pill wasn't used; (e) If a man had sex while using the pill, his chances of getting HIV will be 44% less than if he hadn't been taking the pill at all; (f) Other; (g) I am not sure how to interpret the results
Dosing Interpretation	
Based on the results of this study, how regularly do you think HIV-uninfected people will need to take the TDF/FTC pill for it to be protective against HIV transmission?	(a) Every day; (b) Within one day of sexual exposure and within one day after exposure; (c) Within one day of sexual exposure and as soon as possible after exposure; (d) At least once a week; (e) At least twice a week; (f) At least three times a week; (g) At least four times a week; (h) At least five times a week; (i) At least six times a week
TDF/FTC Pill Should be Readily Available to All At-Risk Persons	
Based on the results of this study, do you believe that the TDF/FTC pill should be readily available to all persons at-risk for HIV infection?	(a) Strongly agree; (b) Agree; (c) Neutral; (d) Disagree; (e) Strongly disagree
Provision of TDF/FTC Pill by Population Type	
Based on these study results, for which, if any, of these groups, would you prescribe the TDF/FTC pill to prevent against HIV infection? Note: unless otherwise specified, assume groups to be based in the US	(a) Study population (i.e., High-risk men who have sex with men); (b) Injection drug users; (c) People with a sexually transmitted disease; (d) People who change sex partners frequently; (e) People who exchange sex for money, drugs or other goods; (f) Discordant couples; (g) Any person

Measure	Response Options
regardless of risk; (h) None of these; (i) Other	
CAPRISA Efficacy Data	
Efficacy Data Knowledge	
A recent study found that topical coital gel containing the HIV antiretroviral drug tenofovir was effective in reducing HIV infections among HIV uninfected women in Africa. Among the women who were assigned to use the tenofovir gel within 12 hours before and after sex, there were 39% fewer infections compared to women who were assigned to use the placebo gel. Before this survey, had you previously heard these results?	(a) Yes; (b) No
Efficacy Data Interpretation	
Among the women who were assigned to use the tenofovir gel within 12 hours before and after sex, there were 39% fewer infections compared to women who were assigned to use the placebo gel. How do you interpret these results?	(a) If a woman using the gel had sex 100 times without a condom, she would be protected the first 39 times; (b) A woman would be protected from HIV 39% of the time if she uses the gel before and after sex; (c) One dose of the gel protects against HIV 39% of the time - two doses protect against HIV 78% of the time; (d) The gel may be expected to prevent 39% of the infections that would occur in a population if the gel wasn't used; (e) If a woman has sex while using the gel, her chances of getting HIV will be 39% less than if she hadn't been using the gel; (f) Other; (g) I am not sure how to interpret the results
Dosing Interpretation	
How regularly do you think HIV-uninfected people will need to use a vaginal gel for it to be protective against HIV transmission?"	(a) Every day; (b) Before and after every act of vaginal sex; (c) Before every act of vaginal sex and as soon as possible after exposure; (d) At least once a week; (e) At least twice a week; (f) At least three times a week; (g) At least four times a week; (h) At least five times a week; (i) At least six times a week
Tenofovir Gel Should be Readily Available to All At-Risk Persons	
Based on the results of this study, do you believe that the tenofovir gel should be readily available to all persons at-risk for HIV infection?	(a) Strongly agree; (b) Agree; (c) Neutral; (d) Disagree; (e) Strongly disagree
Provision of Tenofovir Gel by Population Type	
Based on these study results, for which, if any, of these groups, would you prescribe the tenofovir gel to prevent against HIV infection? Note: unless otherwise specified, assume groups to be based in the US	(a) Study population (i.e., Women at risk of HIV in Africa); (b) Injection drug users; (c) People with a sexually transmitted disease; (d) People who change sex partners frequently; (e) People who exchange sex for money, drugs or other goods; (f) Discordant couples; (g) Any person regardless of risk; (h) None of these; (i) Other

NOTE: Bolded responses are considered "correct"

Table 2

PrEP-related concerns: principal component (PC) loadings, corresponding Eigen values and proportion of variance explained (Post-iPrEx: n=115).

	Mean (SD)*	PC1	PC2	PC3	PC4	PC5
1. I am concerned that PrEP will not be 100% effective	3.89 (0.85)	30	15	1	-9	82
2. I am concerned about the potential side effects of PrEP	3.99 (0.79)	-17	-1	27	18	84
3. Do not have time to provide clinical monitoring	2.50 (0.94)	1	2	3	90	12
4. Do not have time to engage in prevention counseling	2.22 (0.87)	16	10	5	87	-5
5. The use of PrEP will cause patients to engage in riskier behaviors	3.21 (0.95)	84	5	14	12	-1
6. The provision of PrEP will result in an increase in sexually transmitted disease incidence among patients	3.03 (0.92)	85	5	19	-3	11
7. The use of PrEP will result in less frequent HIV testing among patients	2.68 (1.02)	67	2	-14	11	-1
8. Non-biomedical HIV prevention interventions (behavioral) are more effective than PrEP	3.55 (1.03)	6	25	68	18	-2
9. Non-biomedical HIV prevention interventions (behavioral) are safer than PrEP	2.31 (0.82)	-2	21	82	-1	23
10. PrEP is too costly for most at-risk persons	3.40 (0.91)	2	81	16	7	7
11. Private insurers will not cover the cost of PrEP	3.48 (0.85)	-3	85	24	-2	-1
12. The use of PrEP for prevention will result in less federal funding for HIV treatment	2.53 (0.81)	37	52	-31	19	23
13. Antiretrovirals for prevention will select for, and disseminate, drug resistance	3.58 (0.83)	---	---	---	---	---
14. Non-biomedical HIV prevention interventions (behavioral) should be attempted before prescribing PrEP	3.35 (1.16)	---	---	---	---	---
15. Uncomfortable prescribing drugs for new indications unless there are many years of follow up data	3.04 (0.93)	---	---	---	---	---
Eigen values		3.12	1.94	1.68	1.37	1.16
Proportion of variance explained (total = 0.71)		0.24	0.15	0.13	0.11	0.09
Cronbach's Alpha		0.73	0.64	0.62	0.78	0.65

--- Indicates scale items that were removed from final PC analysis due to complex structure.

PC1: Concerns regarding behavioral risk; PC2: Cost and funding concerns; PC3: Behavioral interventions are safer/more effective; PC4: Time limitation for counseling and monitoring; and PC5: Concerns regarding the efficacy and safety of PrEP.

Note: PC loadings were multiplied by 100 and rounded to the nearest integer. Bolded, italicized loadings indicate items that loaded higher than 0.40 on a given principle component. These items were used to name each component.

* Means and standard deviations for each scale item.

Table 3

Demographic characteristics of Massachusetts-area physicians after (n=115) the release of iPrEx clinical trial data by specialty type.

	TOTAL (n=115)	HIV SPECIALISTS (n=69)	GENERALISTS (n=46)	
	Mean (SD)			t
Age in years (t)	42 (9.8)	43 (9.7)	41 (9.9)	ns
Year began taking care of HIV infected persons	1998 (8.5)	1997 (8.4)	1999 (8.4)	ns
	% (N)			χ ²
Gender				
Male	37 (42/115)	41 (28/69)	30 (14/46)	
Female	63 (73/115)	60 (41/69)	70 (32/46)	ns
Race/Ethnicity ^a				
Asian/Asian American/Pacific Islander	11 (13/114)	13 (9/68)	9 (4/46)	ns
Hispanic/Latino/Chicano	5 (6/115)	7 (5/69)	2 (1/46)	ns
African American/Black	4 (5/115)	2 (1/69)	9 (4/46)	ns
Caucasian/White	77 (89/115)	75 (52/69)	80 (37/46)	ns
Native American/Alaskan Native	1 (1/115)	1 (1/69)	0 (0/46)	ns
Multiracial	3 (3/115)	4 (3/69)	0 (0/46)	ns
HIV Status, Testing and Personal Risk				
Tested for HIV in the past 12 mos.	23 (25/108)	22 (14/65)	26 (11/43)	ns
Never tested for HIV	16 (17/108)	12 (8/65)	21 (9/43)	ns
Perceives risk to be low	97 (105/108)	98 (64/65)	95 (41/43)	ns
HIV-infected	1 (1/108)	0 (0/65)	2 (1/43)	ns
Knows someone with HIV	75 (81/108)	82 (53/65)	65 (28/43)	3.72 *
Physician Training ^a				
Internal medicine	76 (87/115)	81 (56/69)	67 (31/46)	ns
Infectious disease	46 (53/115)	77 (53/69)	0 (0/46)	+ ***
Family medicine	10 (11/115)	4 (3/69)	17 (8/46)	5.43 *
Pediatrics	11 (13/115)	9 (6/69)	15 (7/46)	ns
Obstetrics and gynecology	2 (2/115)	1 (1/69)	2 (1/46)	ns
Psychiatry	2 (2/115)	3 (2/69)	0 (0/46)	ns
Other ^b	3 (4/115)	1 (1/69)	7 (3/46)	ns
Workplace ^a				
Community health center	36 (41/115)	23 (16/69)	54 (25/46)	
Hospital	53 (61/115)	65 (45/69)	35 (16/46)	12.35 ***
Other ^c	11 (13/115)	12 (8/69)	11 (5/46)	
Number of HIV-Infected Persons Ever				

	TOTAL (n=115)	HIV SPECIALISTS (n=69)	GENERALISTS (n=46)	
Treated				
0	2 (2/115)	0 (0/69)	4 (2/46)	59.51 ***
1-5	10 (12/115)	1 (1/69)	24 (11/46)	
5-20	12 (14/115)	3 (2/69)	26 (12/46)	
20-50	14 (16/115)	7 (5/69)	24 (11/46)	
50-100	21 (24/115)	23 (16/69)	17 (8/46)	
100 or more	41 (47/115)	65 (45/69)	4 (2/46)	
Cared for HIV-Infected Persons ^a				
MSM ^d	91 (101/111)	96 (65/68)	84 (36/43)	4.53 *
IDU ^e	93 (104/112)	97 (67/69)	86 (37/43)	4.88 *
Serodiscordant couples	74 (82/111)	83 (57/69)	60 (25/42)	7.21 **
Sex workers (male or female)	46 (51/111)	58 (40/69)	26 (11/42)	10.62 ***
First responders with frequent exposure to blood/intimate bodily fluids	43 (47/110)	59 (40/68)	17 (7/42)	18.86 ***
PrEP Knowledge				
Heard of PrEP	92 (105/114)	99 (67/68)	83 (38/46)	9.56 **
Heard of topical microbicides	83 (94/113)	96 (65/68)	62 (29/45)	18.78 ***

+ Fisher's exact test was used due to low cell count.

Note: Percentages may exceed 100% due to rounding.

*
p < .05;

**
p < .01;

p < .001.

^a Participants checked all that applied. Percentages may exceed 100%.

^b Other specialties include emergency, preventative, gastrointestinal and adolescent medicine.

^c Other workplace = Physician practice group, Independent practice group, AIDS service organization, Health department, Academic or Corporation.

^d MSM= Men who have Sex with Men.

^e IDU=Injection Drug Users.

Table 4

The interpretation of CAPRISA and iPrEx clinical trial data among Massachusetts-area physicians after (n=115) the release of iPrEx clinical trial data by specialty type.

	TOTAL (n=115)	HIV SPECIALISTS (n=69)	GENERALISTS (n=46)	
	% (N)			χ^2
iPrEx RESULTS: Tenofovir/Emtricitabine (TDF/FTC) Oral Pill				
Efficacy Data Knowledge				
Heard of results prior to survey	64 (71/111)	79 (54/68)	40 (17/43)	18.17 ***
Efficacy Data Interpretation ^a				
Correctly interpreted results	72 (79/109)	67 (44/66)	81 (35/43)	ns
Do not know how to interpret results	5 (5/109)	5 (3/66)	5 (2/43)	ns
Dosing Interpretation ^b				
Specified correct dosing	67 (72/107)	63 (41/65)	74 (31/42)	ns
TDF/FTC Pill Should be Readily Available to All At-Risk Persons				
Agree	40 (44/109)	41 (27/66)	40 (17/43)	ns
Neutral	32 (35/109)	35 (23/66)	28 (12/43)	ns
Disagree	28 (30/109)	24 (16/66)	33 (14/43)	ns
Provision of TDF/FTC Pill by Population Type ^c				
Study population (high-risk MSM)	76 (84/111)	78 (52/67)	75 (33/44)	ns
IDU	27 (30/111)	27 (18/67)	28 (12/43)	ns
People with a STI	12 (13/111)	18 (12/67)	2 (1/43)	6.10 ***
People who change partners frequently	24 (27/111)	30(20/67)	14 (6/43)	3.67 *
People who exchange sex for money, drugs or other goods	44 (49/111)	48 (32/67)	40 (17/43)	ns
Serodiscordant couples	52 (58/111)	51 (34/67)	56 (24/43)	ns
Any person regardless of risk	3 (3/111)	4 (3/67)	0 (0/43)	ns
None of these	15 (17/111)	13 (9/67)	19 (8/73)	ns
CAPRISA RESULTS: Tenofovir Topical Gel				
Efficacy Data Knowledge				
Heard of results prior to survey	57 (62/109)	80 (53/66)	21 (9/43)	37.42 ***
Efficacy Data Interpretation ^d				
Correctly interpreted results	71 (76/107)	67 (43/64)	77 (33/43)	ns
Do not know how to interpret results	2 (2/107)	2 (1/64)	2 (1/43)	ns
Dosing Interpretation ^e				
Specified correct dosing	59 (64/108)	60 (39/65)	58 (25/43)	ns
Tenofovir Gel Should be Readily Available to All At-Risk Persons				
Agree	70 (76/108)	71 (47/66)	69 (29/42)	ns
Neutral	20 (22/108)	23 (15/66)	17 (7/42)	ns

	TOTAL (n=115)	HIV SPECIALISTS (n=69)	GENERALISTS (n=46)	
Disagree	9 (10/108)	6 (4/66)	14 (6/42)	<i>ns</i>
Provision of Tenofovir Gel by Population Type^c				
The study population (women at risk for HIV in Africa)	83 (91/110)	84 (56/67)	81 (35/43)	<i>ns</i>
IDU	25 (27/110)	22 (15/67)	23 (10/43)	<i>ns</i>
People with a STI	25 (27/110)	31 (21/67)	14 (6/43)	4.28[*]
People who change partners frequently	39 (43/110)	43 (29/67)	33 (14/43)	<i>ns</i>
People who exchange sex for money or drugs or other goods	56 (62/110)	63 (42/67)	47 (20/43)	<i>ns</i>
Serodiscordant couples	53 (58/110)	55 (37/67)	49 (21/43)	<i>ns</i>
Any person regardless of risk	9 (10/110)	8 (5/67)	12 (5/43)	<i>ns</i>
None of these	10 (11/110)	8 (5/67)	14 (6/43)	<i>ns</i>

Note. Responses are based on the results of the study (iPrEx /CAPRISA).

Italicized p-values indicate a statistically significant association of 0.05 or less

*
p < .05;

**
p < .01;

p < .001.

^a Correct interpretation of efficacy data: "The TDF/FTC pill may be expected to prevent 44% of the infections that would occur in a population if the pill wasn't used".

^b Correct dosing interpretation: "The TDF/FTC pill should be taken everyday to be protective against HIV transmission".

^c Physicians would prescribe oral pill/topical gel to the groups indicated.

^d Correct interpretation of efficacy data: "The gel may be expected to prevent 39% of the infections that would occur in a population if the gel wasn't used".

^e Correct dosing interpretation: "Before and after every act of vaginal sex".

Table 5

Bivariate associations and multivariable logistic regression models examining factors associated with intentions to prescribe oral PrEP and intentions to prescribe topical microbicides based on the results of the iPrEx and CAPRISA clinical trials, respectively (Post-iPrEx; n=115).

	Intentions to RX Oral PrEP iPrEx ^a				Intentions to RX Microbicides CAPRISA ^b			
	Bivariate Associations		Multivariable Model 1		Bivariate Associations		Multivariable Model 2	
	OR	95%CI	P-value	OR	95%CI	P-value	OR	95%CI
Efficacy Required in order to RX PrEP to Patients								
Greater than 80%	0.35	0.12, 0.99	0.05	0.24	0.06, 0.99	0.05	---	---
PrEP-related Concerns								
PC1: Concerns regarding behavioral risk	---	---	---	---	---	0.81	0.63, 1.04	0.09
PC2: Cost and funding concerns	---	---	---	---	---	0.78	0.60, 1.01	0.06
PC3: Behavioral interventions are safer/more effective	0.55	0.40, 0.76	<0.01	0.59	0.37, 0.95	0.03	0.58	0.41, 0.81
PC5: Concerns regarding the efficacy and safety of PrEP	0.65	0.43, 0.98	0.04	0.44	0.21, 0.91	0.03	---	---
Hypothetical Barriers to PrEP Provision								
Decrease in federal funds for other HIV prevention modalities	0.18	0.07, 0.48	<0.001	0.09	0.02, 0.40	<0.01	0.20	0.07, 0.57
Hypothetical Motivator for PrEP Provision								
Additional clinical efficacy data about at-risk women	---	---	---	---	---	---	4.19	1.36, 12.91
Additional clinical efficacy data about MSM	2.77	0.94, 8.19	0.07	5.41	1.00, 29.23	0.05	---	---
OR=Odds Ratio							---	---
---	Not included in model.							

OR=Odds Ratio

--- Not included in model.

Note: Backward elimination was used to fit the most parsimonious final multivariable models. Variables with p-values 0.10 in bivariate associations were included in multivariable models. The following variables were included in the elimination process for the PrEP Intention Model: greater than 80% efficacy required to RX PrEP, PC3, PC5, decrease in federal funds for other HIV prevention modalities, additional clinical efficacy data about MSM; and Microbicide Intention Model: PC1, PC2, PC3, decrease in federal funds for other HIV prevention modalities, additional clinical efficacy data about at-risk women.

PC4 - Time limitation for counseling and monitoring - is not shown here as it was not significantly associated with either outcome in bivariate associations.

^a Participant responses are based on the results of the iPrEx study; Intentions to RX oral PrEP = participant would prescribe the TDF/FTC pill to study population (high-risk MSM).

^b Participant responses are based on the results of the CAPRISA study; Intentions to RX microbicides = participant would prescribe Tenofovir gel to study population (at-risk women in Africa).