

Background

In April 2014, CDC released recommendations for use of pre-exposure prophylaxis (PrEP) to prevent HIV infection¹

A recent CDC Surveillance report suggests that 3.5% of men surveyed during 2014 reported using PrEP in the past 12 months²

Few studies^{3,4} have investigated changes in awareness or actual use of PrEP by MSM, and these have only been small samples in individual metropolitan areas

Objective

To assess changes in awareness of PrEP, willingness to use PrEP, and reported use in the past 12 months between May 2012 and March 2015.

Methods

Data were from 3 nationwide cross-sectional internet surveys of MSM living in the United States: the Web-based HIV behavioral survey⁵ (WHBS: May 2012- August 2012), and the American Men's Survey⁶ (AMIS) cycles for 2013 (AMIS 2013: December 2013 – May 2014) and 2014 (AMIS 2014: October 2014 – March 2015). Methods for the three surveys were similar:

Recruitment – respondents were recruited through Internet-based convenience sampling, using banner ads in English and Spanish, using models of various races and ethnicities, and social media, including email blasts to website members as well as peer referral methods.

Eligibility and analysis samples – To be eligible for the surveys, participants had to be 18 years of age or older, consider themselves to be male, and report that they had oral or anal sex with a man in their lifetime. For this analysis we limited the dataset to men who reported sex with a man in the past year and did not self-report they were HIV-infected.

- In WHBS 1/3 of the total survey sample were randomized to receive questions about PrEP.
- In AMIS 2013 and 2014 all participants received questions about PrEP. In the 2014 survey a new set of PrEP questions was included that more closely follows CDC guidelines for the current FDA-approved PrEP regimen of emtricitabine/tenofovir (FTC/TDF) to prevent HIV infection. Participants were randomized to receive either this new set of questions or the ones asked in both WHBS and AMIS 2013; this analysis is limited to the 4207 men who received the version also used in the prior surveys

Outcome measures and changes over time –

- We aggregated data into groups of months that spanned cycles to perform a segmented regression that accommodated the non-linear trends (Figure 1) observed for our outcomes of interests: percentages of participants reporting awareness of, willingness to use, and actual use of PrEP.

Additional variables included in multi-variate models –

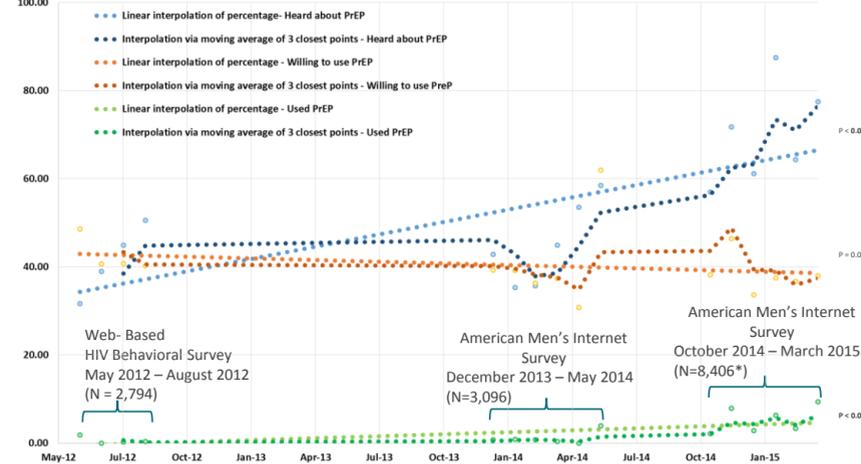
- We used a combination of county and ZIP code of residence to determine city residency and population density (coded as presented in Figure 2)
- Source of recruitment (a geo-location based sexual networking site versus other websites), race, educational attainment, income, and risk behaviors included as indicators for PrEP in CDC guidelines (≥ 10 partners vs. ≤ 9 , and bacterial STI diagnosis in the prior 12 months.) were also included in multi-variate models for each outcome
- For awareness and use of PrEP a Poisson risk model was implemented to estimate prevalence ratios; A log-binomial model was used for willingness to use PrEP because the Poisson model gave estimates of $> 100\%$ willingness for some subgroups (Table 1)

References

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- Sanchez TR, Smeeth RC, Kahle EM, Tregear SJ, Sullivan PS. The Annual American Men's Internet Survey of Behaviors of Men Who Have Sex With Men in the United States: Protocol and Key Indicators Report 2013. JMIR Public Health Surveill 2015;3(1):e3 DOI: 10.2196/publichealth.4314

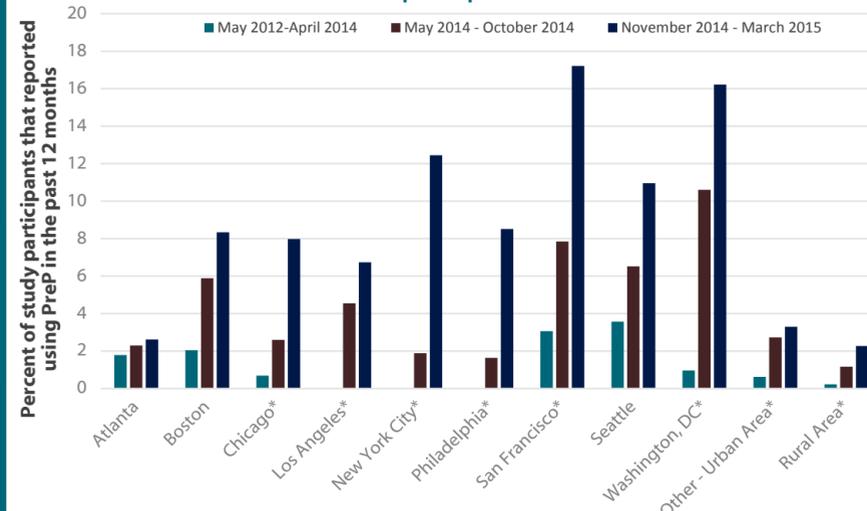
Results

Figure 1: Non-linear changes in PrEP awareness and use over time among US MSM participating on online surveys



Points are monthly percentages observed in 3 cycles of online surveys of MSM conducted May 2012-March 2015. Lines are fitted linear or moving average interpolations for time points between months. P-values represent chi-square test for trend comparing percentages in May 2012-April 2014, May 2014-October 2014 and November 2014-March 2015. These cut-points were chosen after visual inspection of jumps in both awareness and use in May 2014 and November 2014.

Figure 2: Unadjusted percent of survey participants reporting use of PrEP in the past 12 months, by survey time period (see Figure 1 and Table 1) and location of participant residence.



*Significant increase within this region over the 3 time periods. These are bi-variate percentages, unadjusted for race, income, education or HIV risk factors because multivariate models with city/population density and time-period interaction terms did not converge

Table 1: Changing prevalence of awareness, willingness to use, and actual use of PrEP over time among US MSM participating in online surveys, May 2012 – March 2015

Variable	Category	Heard of Prep		Willing to use Prep		Used Prep in the past 12 months	
		Un-adjusted Prevalence	Adjusted ^a Prevalence ratio (95% CI) ²	Un-adjusted Prevalence	Adjusted ^b Prevalence ratio (95% CI)	Un-adjusted Prevalence	Adjusted ^a Prevalence ratio (95% CI)
Time Period ^c	May 2012-April 2014	44.7%	Ref	39.3%	Ref	0.5%	Ref
	May 2014-October 2014	59.0%	1.17 (1.10-1.23)	50.3%	1.09 (1.04-1.14)	2.4%	2.05 (1.09-3.88)
	November 2014-March 2015	68.0%	1.31 (1.24-1.38)	49.6%	1.08 (1.03-1.13)	4.9%	2.94 (1.59-5.44)
Recruitment Site	Geo-Spatial Sexual Networking App	71.0%	1.12 (1.07-1.17)	60.8%	1.14 (1.09-1.19)	6.6%	1.62 (1.28-2.05)
	Other	50.4%	Ref	41.0%	Ref	1.2%	Ref
Bacterial STI in last 12 months	Yes	71.4%	1.18 (1.10-1.26)	65.5%	1.18 (1.12-1.24)	9.8%	2.45 (1.95-3.09)
	No	52.8%	Ref.	42.9%	Ref	1.5%	Ref
≥ 10 sex partners in last 12 months	Yes	69.2%	1.19 (1.14-1.25)	60.9%	1.21 (1.16-1.26)	6.7%	3.47 (2.67-4.49)
	No	50.1%	Ref	40.9%	Ref	0.9%	Ref
Race	White	54.5%	Ref	42.3%	Ref	2.0%	Ref
	Black	56.0%	0.96 (0.87-1.05)	51.6%	1.05 (0.97-1.13)	2.5%	0.95 (0.58-1.54)
	Other	51.8%	0.92 (0.87-0.98)	51.1%	1.05 (1.01-1.10)	2.5%	0.91 (0.65-1.29)
Income (\$ per year)	> 75,000	61.7%	Ref	39.0%	Ref	2.5%	Ref
	> 40,000 – 75,000	55.3%	0.92 (0.88-0.96)	45.5%	1.06 (1.01-1.11)	1.9%	0.88 (0.68-1.12)
	> 19,000 – 40,000	48.7%	0.87 (0.82-0.93)	49.4%	1.09 (1.04-1.14)	2.0%	0.80 (0.59-1.09)
	< 19,000	42.8%	0.87 (0.79-0.96)	49.8%	1.08 (1.02-1.14)	1.4%	1.35 (0.76-2.41)
	Missing	45.5%		45.1%	1.08 (1.01-1.17)	1.9%	0.74 (0.42-1.32)
Education	4 years college	61.9%	Ref	40.7%	Ref	2.5%	Ref
	Some college	46.5%	0.83 (0.78-0.87)	48.6%	1.10 (1.06-1.14)	1.6%	0.84 (0.61-1.17)
	High school	29.8%	0.60 (0.52-0.71)	52.7%	1.15 (1.09-1.22)	1.0%	0.46 (0.26-0.83)
< High school	29.4%	0.47 (0.35-0.63)	56.4%	1.18 (1.04-1.34)	0.8%	0.43 (0.11-1.69)	

Ref=Reference value, CI=Confidence Interval
^aEstimates from a Poisson risk model adjusted for city/population density as coded on the X-axis of Figure 2 and all covariates listed in the table
^bEstimates from a log-binomial risk model adjusted for the same covariates as Model a
^cTime periods were created based on visual inspection of non-linear trends in growth of both reported awareness and use of PrEP (Figure 1) over the three survey periods and do not represent survey cycles directly

Discussion

Overall awareness of PrEP was fairly high even in 2012 (44.7%), and increased over time to 68.7% in the period November 2014 – March 2015

- Awareness of PrEP was higher among those with > 10 partners in the past 12 months, and those diagnosed with a bacterial STI in the past 12 months

Willingness to use PrEP increased slightly during the two later time periods (after April 2014), but has remained relative flat

Use increased significantly over time, and was higher in risk groups for which PrEP is recommended

- Reported use was 9.8% in those with a bacterial STI in the past 12 months and was $> 10\%$ in 4 US cities by early 2015

Race, income and education were associated with having heard of PrEP, but not with use

- Other surveys² have found lower reported use of PrEP among black compared to white MSM. Controlling for income, education and HIV risk led to a slightly reduced but non-significant difference in use for black versus white MSM (Prevalence Ratio = 0.95, 95% CI: 0.58 – 1.54)

Limitations

Data were obtained through convenience samples and therefore are not generalizable to all MSM in the US or to all internet-using MSM

- Though we recruited men from diverse types of websites, these websites comprise a small fraction of those frequented by MSM
- We cannot determine the degree or direction of selection bias by comparing those who completed a survey to those who saw or even clicked on the ad but did not complete a survey

There was under-representation of non-white, lower income and less educated MSM in these survey samples, a limitation common to Internet research

- The small number of black MSM in our samples may limit power to detect differences by race

Comparisons of risk behaviors among MSM between our studies and other published reports (e.g. references 2-4) should be made with caution due to different methodologies

Conclusions

Awareness and use of PrEP are increasing among internet-using MSM in the US. Though it is encouraging that higher risk MSM may be more aware, willing, and likely to have used PrEP, there remains a large gap between the number of MSM who report being willing to use PrEP and those who have actually done so.

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