Public Awareness of HIV Pre-Exposure Prophylaxis in Durham, North Carolina: Results of a Community Survey

Helen L. Zhang, Bhavini Murthy, Barbara Johnston, Marissa Mortiboy, Jiewei Wu, Gregory P. Samsa, Arlene C. Seña, Mehri S. McKellar

BACKGROUND Adoption of HIV pre-exposure prophylaxis (PrEP) remains limited among populations at greatest risk for HIV acquisition. This study aims to assess awareness of PrEP among individuals in Durham, North Carolina, which has one of the highest rates of HIV diagnoses in the state.

METHOD In 2015–2016, we administered a survey including questions to assess PrEP awareness to individuals at multiple venues throughout Durham, North Carolina.

RESULTS A total of 139 respondents were surveyed. The majority were male (66%) and black/African American (75%); 21% were Hispanic/Latino. There were an estimated 53 men who have sex with men (MSM), of which 18 (33%) were black MSM M 24 years of age. Overall, only 53/138 (38%) respondents were aware of PrEP. Awareness was reported among 33/52 (63%) MSM respondents, 29/46 (63%) black MSM, and 10/17 (59%) black MSM M 24 years of age. In multivariate analysis, non-heterosexual orientation, health-insured status, and prior HIV testing were significantly associated with PrEP awareness. Ninety-four (69%) of 137 respondents reported prior HIV testing.

LIMITATIONS Limitations include non-random sampling and limited sample size. Further research needs to be done in other areas of North Carolina, and assessment of PrEP acceptability and uptake needs to be performed.

CONCLUSION This study reveals low overall awareness of PrEP in Durham, North Carolina, indicating that expanded outreach is necessary to increase public awareness and encourage adoption of PrEP among all demographics at risk for HIV.
Carolina counties, Durham ranked 5th highest in newly diagnosed HIV 3-year average rates among adults and adolescents in 2014–2016 [15].

Recruitment
A self-administered survey was conducted in 2015–2016 as part of a countywide HIV testing and awareness initiative, Durham Knows, implemented by the Durham County Department of Public Health and the Partnership for a Healthy Durham. Purposive sampling was performed to obtain a diverse sample of participants who were recruited from a college campus, a Hispanic/Latino community center, a group housing community center, a community health center for the medically underserved, a public Kwanzaa celebration, and a community organization serving the African-American and Latino lesbian, gay, bisexual, and transgender communities. Paper-based surveys were offered in English and Spanish. Participants were not compensated for their participation.

Measures
The questionnaire was developed by the authors and translated into Spanish by a formal translation service. Key survey questions (see Table 1) included the following:

Demographics. Participants were asked to report their age, gender, race/ethnicity, health insurance status, highest completed education level, and sexual orientation. As the survey did not explicitly include questions about sexual behavior, respondents identifying as both male and either homosexual/gay or bisexual were categorized as MSM. Respondents aged 24 and under within the ‘MSM’ category were considered YMSM. Multi-racial MSM identifying as part black/African American were considered black MSM, and those identifying as part Hispanic/Latino were considered Latino MSM.

HIV perceptions. Participants were asked to indicate their level of agreement to a series of statements regarding HIV. Only those responding “yes” were considered to have an affirmative response.

HIV testing. Participants were asked to report whether they knew where to get tested for HIV, hepatitis, and other sexually transmitted diseases (STDs); whether their doctor had ever offered them an HIV test; and whether they had ever been tested for HIV.

PrEP awareness. PrEP awareness was assessed with the question, “Do you know if there is a pill that can prevent a person from getting HIV?” Those who responded “yes” were considered to be PrEP aware.

Data Analysis
Data were analyzed in R v3.3.1 (Vienna, Austria) using RStudio (Boston, MA). All respondents were included in the analysis. Denominators used to calculate simple proportions represent the number of respondents who answered each survey question; missing responses were omitted from the analysis. Bivariate comparisons were conducted using Fisher’s exact test. Logistic regression was performed on the following candidate predictors of PrEP awareness: gender, age > 24 years, sexual orientation, black/African American race, health insurance status, post-secondary education, and prior HIV testing. Forward and backward selection methods were used to obtain a final multivariable model. Two-tailed P-values were used; alpha of 0.05 was used to define statistical significance. Nine respondents received surveys that were missing one page containing questions to assess HIV perceptions. These respondents were included in the analysis of all other questions.

This study was reviewed and approved by the Institutional Review Board (IRB) at the University of North Carolina at Chapel Hill and was approved as an IRB research-exempt protocol at Duke University. No personal health information or identifiers were collected in the survey.

| TABLE 1. Demographic Characteristics of Survey Participants (N = 39) |
|--------------------------------------------------------------|
| Characteristics | % (N) |
|-----------------|------|
| Gender (9 missing) |    |
| Male            | 66% (86) |
| Female          | 31% (40) |
| Transgender     | 3% (4)  |
| Age (18 missing) |     |
| 24 years or younger | 42% (51) |
| 25 years or older       | 58% (70) |
| Sexual orientation (13 missing) |       |
| Heterosexual or straight | 49% (62) |
| Homosexual, gay, or lesbian | 29% (37) |
| Bisexual         | 13% (16) |
| Transgender      | 3% (4)  |
| Not sure or other | 6% (7)   |
| Race/Ethnicity (9 missing) |      |
| Non-black, non-Latino | 7% (9)  |
| Black or African American* | 75% (97) |
| Latino or Hispanic* | 21% (27) |
| Education (10 missing) |        |
| Did not graduate from high school | 15% (19) |
| High school graduate or GED | 36% (46) |
| Some college/associate degree/technical school | 28% (36) |
| Bachelor’s degree | 16% (21) |
| Post-graduate degree | 5% (7)   |
| Health insurance (10 missing) |         |
| No insurance    | 30% (39) |
| Private insurance | 29% (37) |
| Medicaid or Medicare | 28% (36) |
| TRICARE or military insurance | 13% (17) |
| HIV testing status (2 missing) |       |
| Have been HIV tested | 69% (94) |
| Have not been HIV tested | 31% (43) |

*Includes 3 participants identifying as both black/African American and Latino/Hispanic.
Results

Respondent Characteristics

A total of 139 respondents participated in the survey. Of these, 117 completed the English version and 22 completed the Spanish version. The median age was 28 years (range: 14–73 years). Based on self-reported homosexual/gay or bisexual orientation, the respondents included an estimated 53 MSM, 47 black MSM, and 18 black YMSM. Demographic characteristics are summarized in Table 1.

One hundred and four (76%) of 136 respondents reported knowing where they could get tested for HIV and other STDs. Eighty-two (59%) of 138 reported ever having been offered an HIV test by their doctor, while 94 (69%) of 137 respondents reported ever having been tested for HIV. Respondents’ perceptions regarding HIV are summarized in Table 2.

PreP Awareness

Of the entire sample, 53 (38%) of 138 respondents reported awareness of PreP. This included 33 (63%) of 52 MSM respondents, 29 (63%) of 46 black MSM, 10 (59%) of 17 black YMSM, 5 (71%) of 7 Latino MSM, and 3 (75%) of 4 Latino YMSM. Overall, MSM respondents had significantly greater odds of reporting PreP awareness compared to other respondents (odds ratio [OR], 5.6, 95% confidence interval [CI], 2.5–13.1).

In univariate logistic regression analyses, male gender, non-heterosexual orientation, health insurance status, and a history of prior HIV testing were significantly associated with greater odds of PreP awareness. There were no significant differences in PreP awareness among black/African-American respondents compared to non-black respondents, respondents aged ≤24 years compared to older respondents, or respondents with post-secondary education compared to those without post-secondary education. In multivariate regression analysis, a final model was obtained which included sexual orientation, health insurance status, and history of HIV testing as significant predictors of PreP awareness (see Table 3).

Respondents who believed that HIV is treatable (OR, 2.2, 95% CI, 1.0–5.1) or that condoms reduce the risk of acquiring HIV (OR, 2.7, 95% CI, 0.9–8.8) were more likely to report awareness of PreP. Those who reported belief that stigma affects HIV testing (OR, 2.1, 95% CI 0.9–4.8) or that stigma affects HIV treatment (OR, 2.6, 95% CI, 1.1–6.3) were also more likely to report awareness of PreP. There was no significant association between self-reported knowledge of how to protect oneself from HIV with PreP awareness (OR 1.8, 95% CI, 0.7–4.8).

Discussion

There is a growing body of evidence demonstrating the effectiveness of PreP in prevention of HIV acquisition. Unfortunately, despite Centers for Disease Control and Prevention recommendations that PreP be offered to sexually active adult MSM and heterosexually active individuals at risk of HIV acquisition [8], rates of PreP adoption remain low across the United States [16]. Few other studies have examined PreP awareness and use specifically in the South [17-20]. Our findings reveal low overall PreP awareness in an area of relatively high HIV incidence, despite our sample including community organization members and community health center clients who would be expected to have access to HIV prevention messages. This finding reflects a need for increased community education on PreP use and HIV prevention among target groups.

MSM represent a high-priority population for PreP provision. PreP awareness among gay and bisexual men in our study was fairly high, with nearly two-thirds reporting awareness, reflecting trends towards increased PreP awareness among MSM over the past several years [20-22]. However, considering the substantial benefit that MSM are likely to receive from PreP, future efforts to increase PreP knowledge and uptake should still incorporate dedicated outreach toward this population.

We found lower rates of PreP awareness among individuals who lacked health insurance, which could reflect lower utilization of routine preventive services [23]. As the scale-up of PreP proceeds, careful consideration is necessary to implement strategies that are inclusive of those with limited access to preventive services. Such strategies may include educational initiatives for health care providers who serve the uninsured and underinsured populations, as well as support for local health departments and community health centers in community education, linkage to care, and direct provision of PreP-related care [24].

Concerns have been raised about the underrepresentation of black/African-American populations and other racial/ethnic minorities in PreP awareness, access, and utilization [11-13, 18, 25, 26]. Interestingly, racial/ethnic disparities in PreP awareness were not observed in our sample. The lack of observed difference could possibly be an artifact of sampling bias, as surveys were distributed at multiple ven-

---

**TABLE 2.** Participants’ Perceptions Regarding HIV, Durham, North Carolina, 2015–2016 (N = 130)

| Characteristics                                                                 | % (N)    |
|--------------------------------------------------------------------------------|----------|
| Belief that condoms reduce risk of HIV                                          | 80% (102/128) |
| Self-reported knowledge of how to protect oneself from HIV                      | 74% (92/124) |
| Belief that people with HIV can appear healthy                                  | 63% (81/128) |
| Belief that HIV is treatable                                                    | 62% (76/123) |
| Belief that stigma plays a role in whether one gets treated for HIV             | 61% (75/122) |
| Belief that stigma plays a role in whether one gets tested for HIV              | 60% (74/123) |
| Fear of others knowing if one is getting HIV tested                            | 31% (38/123) |

Note. Questions were omitted for 9 respondents; varying denominators reflect missing data for the 130 participants asked to answer these questions.
TABLE 3. Univariate and Multivariate Regression Analyses of Factors Associated with PrEP Awareness Among Individuals in Durham, North Carolina, 2015–2016 (N = 112)

| Characteristics              | PrEP aware n (%) | Univariate OR (95% CI) | Multivariate OR (95% CI) |
|------------------------------|------------------|------------------------|--------------------------|
| Sexual orientation           |                  |                        |                          |
| Heterosexual                 | 12/56 (21.4)     | ref ref                |                          |
| Non-heterosexual             | 33/56 (58.9)     | 5.3 (2.3–12.5)         | 5.6 (2.3–14.2)           |
| Health insurance             |                  |                        |                          |
| Uninsured                    | 7/29 (24.1)      | ref ref                |                          |
| Insured                      | 38/83 (45.8)     | 2.7 (1.3–7.3)          | 3.4 (1.2–10.6)           |
| HIV testing status           |                  |                        |                          |
| Never tested                 | 6/33 (18.2)      | ref ref                |                          |
| Tested                       | 39/79 (49.4)     | 4.4 (1.7–12.8)         | 3.6 (1.3–11.4)           |

Note. CI = confidence interval; OR = odds ratio. Forward and backward selection methods produced the same final multivariable model. The other candidate variables were gender (P < .05 in the univariate model but not the multivariate model), age, race, and education.

uses dedicated to health promotion among minority groups. Regardless of these findings, the disproportionately high rates of HIV infection among minority populations, in particular black and Latino MSM, necessitate targeted outreach toward these at-risk groups.

Limitations

This study is not without limitations. While sample selection was intended to achieve a demographically diverse sample, recruitment of participants from a clinical site could have resulted in a study sample with increased health utilization compared to the overall Durham population. Additionally, Durham represents an urban/suburban environment with likely higher overall access to health information compared to rural North Carolina or elsewhere in the southern United States. The rates of PrEP awareness observed in this sample therefore may not be generalizable to all individuals in Durham, North Carolina, or the South. Further research is still needed to characterize PrEP awareness and knowledge in other settings throughout the South. Our study also included a limited sample of Hispanic/Latino respondents, for whom dedicated research is needed. Finally, respondents were not assessed for specific knowledge about PrEP, willingness to adopt PrEP, or actual PrEP use. These questions should be addressed in future research on PrEP implementation in this population.

Conclusion

In conclusion, the low rates of PrEP awareness observed in this study highlight an urgent need for expanded PrEP outreach to increase utilization among individuals at high risk for HIV acquisition in North Carolina. Since the survey was conducted, several programs have been developed at the local public health department and adjacent academic centers to increase public awareness of PrEP. Concerted efforts should be continued among health care providers and public health leaders statewide to promote interest and ensure equitable access to this potentially life-saving HIV prevention strategy. NCMJ

Helen L. Zhang, MD resident, Department of Medicine, Duke University Medical Center, Durham, North Carolina.

Bhavini Murthy, MD resident, Department of Social Medicine, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina.

Barbara Johnston, MD adjunct associate professor, Department of Medicine, Duke University Medical Center; chief of HIV services, Lincoln Community Health Center, Durham, North Carolina.

Marissa Mortiboy, MPH coordinator, Partnership for a Health Durham, Durham County Department of Public Health, Durham, North Carolina.

Jiewei Wu, MS graduate student, Department of Biostatistics and Bioinformatics, Duke University Medical Center, Durham, North Carolina.

Gregory P. Samsa, PhD associate professor, Department of Biostatistics and Bioinformatics, Duke University Medical Center, Durham, North Carolina.

Arlene C. Seña, MD, MPH medical director, Durham County Department of Public Health, Durham, North Carolina; associate professor, Institute for Global Health & Infectious Diseases, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina.

Mehri S. McKellar, MD associate professor, Division of Infectious Diseases, Duke University Medical Center, Durham, North Carolina.

Acknowledgments

The authors wish to acknowledge the Durham County Public Health Department, the Partnership for a Healthy Durham, Lincoln Community Health Center, Triangle Empowerment Center, El Centro Hispano, North Carolina Central University (NCCU) Student Health and Counseling Services, and Lorraine C. Taylor of the NCCU Juvenile Justice Institute for their contributions to this work.

This publication resulted (in part) from research supported by the Duke University Center for AIDS Research (CFAR), an NIH-funded program (SP30 AI064518); University of North Carolina at Chapel Hill Center for AIDS Research (CFAR), an NIH-funded program (P30 AI050410); and a NCCU Criminal Justice Institute SAMHSA grant (SH79SP02370-02).

Potential conflicts of interest. All authors have no relevant conflicts of interest.

References

1. US Centers for Disease Control and Prevention. Diagnoses of HIV infection in the United States and dependent areas, 2015. https://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-report-2015-vol-27.pdf. Published November 2016. Accessed November 8, 2017.

2. US Centers for Disease Control and Prevention. Trends in US HIV diagnoses, 2005-2014. https://www.cdc.gov/nchhstp/newsroom/docs/factsheets/hiv-data-trends-fact-sheet-508.pdf. Published February 2016. Accessed November 8, 2017.

3. Grant RM, Lama JR, Anderson PL, et al. Preexposure chemoprophylaxis for HIV prevention in men who have sex with men. N Engl J Med. 2010;363(27):2587-2599.

4. Baeten JM, Donnell D, Ndase P, et al. Antiretroviral prophylaxis for HIV prevention in heterosexual men and women. N Engl J Med. 2012;367(5):399-410.

5. McCormack S, Dunn DT, Desai M, et al. Pre-exposure prophylaxis to prevent the acquisition of HIV-1 infection (PROUD): effectiveness results from the pilot phase of a pragmatic open-label randomised trial. Lancet. 2016;387(1003):53-60.

6. Grohskopf LA, Challag KL, Gvetadze R, et al. Randomized trial of clinical safety of daily oral tenofovir disoproxil fumarate among HIV-uninfected men who have sex with men in the United States. J Acquir Immune Defic Syndr. 2013;64(1):79-86.

7. Liu AY, Cohen SE, Vittinghoff E, et al. Preexposure prophylaxis for HIV infection integrated with municipal- and community-based
sexual health services. JAMA Intern Med. 2016;176(1):75-84.
8. US Public Health Service. Centers for Disease Control and Prevention. Preexposure prophylaxis for the prevention of HIV infection in the United States - 2014. A clinical practice guideline. https://www.cdc.gov/hiv/pdf/prepguidelines2014.pdf. Accessed November 10, 2017.
9. Snowden JM, Chen YH, McFarland W, Raymond HF. Prevalence and characteristics of users of pre-exposure prophylaxis (PrEP) among men who have sex with men, San Francisco, 2014 in a cross-sectional survey: implications for disparities. Sex Transm Infect. 2017;93(1):52-55.
10. Krakover DS, Mimiaga MJ, Rosenberger JG, et al. Limited awareness and low immediate uptake of pre-exposure prophylaxis among men who have sex with men using an internet social networking site. PLoS One. 2012;7(3):e33119.
11. Hoots BE, Finlayson T, Nerlander L, Paz-Bailey G, National HIV Behavioral Surveillance Study Group. Willingness to take, use of, and indications for pre-exposure prophylaxis among men who have sex with men-20 US cities, 2014. Clin Infect Dis. 2016;63(5):672-677.
12. Elopere L, Kudroff K, Westfall AO, Overton ET, Mugavero MJ. The right people, right places, and right practices: disparities in PrEP access among African American men, women, and MSM in the deep South. J Acquir Immune Defic Syndr. 2017;74(1):56-59.
13. Pulsipher CA, Montoya JA, Plant A, Curtis P, Holloway IW, Leibowitz AA. Addressing PrEP disparities among young gay and bisexual men in California. https://aplahealth.org/wp-content/uploads/2016/09/APLA_PrEP_FullReport_WEB.pdf. Published September 2016. Accessed November 10, 2017.
14. North Carolina HIV/STD Surveillance Unit. 2015 North Carolina HIV/STD Surveillance Unit. 2015 North Carolina HIV/STD Surveillance Report. http://epi.publichealth.nc.gov/cd/stds/figures/std15rpt_rev10112016.pdf. Published August 2016. Accessed November 10, 2017.
15. North Carolina HIV/STD Surveillance Unit. 2016 North Carolina HIV/STD/Hepatitis Surveillance Report. http://epi.publichealth.nc.gov/cd/stds/figures/std16rpt_rev3.pdf. Published August 2017. Accessed November 10, 2017.
16. Mera R, McCallister S, Palmer B, Mayer G, Magnuson D, Rawlings MK. Truvada (TVD) for HIV pre-exposure prophylaxis (PrEP) utilization in the United States: 2013-2015. Paper presented at: 21st International AIDS Conference 2016; Durban, South Africa. http://programme.aids2016.org/Abstract/Abstract/10159. Accessed November 10, 2017.
17. Auerbach JD, Kinsky S, Brown G, Charles V. Knowledge, attitudes, and likelihood of pre-exposure prophylaxis (PrEP) use among US women at risk of acquiring HIV. AIDS Patient Care STDs. 2015;29(2):102-110.
18. Eaton LA, Driffin DD, Bauermeister J, Smith H, Conway-Washington C. Minimal awareness and stalled uptake of pre-exposure prophylaxis (PrEP) among at risk, HIV-negative, black men who have sex with men. AIDS Patient Care STDs. 2015;29(8):423-429.
19. Kelley CF, Kahle E, Siegler A, et al. Applying a PrEP continuum of care for men who have sex with men in Atlanta, Georgia. Clin Infect Dis. 2015;61(10):1590-1597.
20. Goedel WC, Halkitis PN, Greene RE, Hickson DA, Duncan DT. HIV risk behaviors, perceptions, and testing and preexposure prophylaxis (PrEP) awareness/use in grindr-using men who have sex with men in Atlanta, Georgia. J Assoc Nurses AIDS Care. 2016;27(2):133-142.
21. Delaney KP, Sanchez T, Bowles K, Orake E, DiNenno E, Sullivan P. Awareness and use of PrEP appear to be increasing among internet samples of US MSM. Paper presented at: CROI; February 22-25, 2016; Boston, Massachusetts. http://www.croiconference.org/sessions/awareness-and-use-prep-appear-be-increasing-among-internet-samples-us-msm. Accessed November 10, 2017.
22. Grov C, Whitfield TH, Rendina HJ, Ventuneac A, Parsons JT. Willingness to take PrEP and potential for risk compensation among highly sexually active gay and bisexual men. AIDS Behav. 2015;19(12):2234-2244.
23. Holden CD, Chen J, Dagher RK. Preventive care utilization among the uninsured by race/ethnicity and income. Am J Prev Med. 2015;48(1):13-21.
24. Marcus JL, Volk JE, Pinder J, et al. Successful implementation of HIV preexposure prophylaxis: lessons learned from three clinical settings. Curr HIV/AIDS Rep. 2016;13(2):116-124.
25. Khanna AS, Michaels S, Skaathun B, et al. Preexposure prophylaxis awareness and use in a population-based sample of young black men who have sex with men. JAMA Intern Med. 2016;176(1):136-138.
26. Lelutiu-Weinberger C, Golub SA. Enhancing PrEP access for black and Latino men who have sex with men. J Acquir Immune Defic Syndr. 2016;73(5):547-555.