

# Syndemic theory, structural violence and HIV among African–Americans

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## Purpose of review

of review This paper will review recent use of syndemic frameworks in HIV research among African–Americans.

## Recent findings

Researchers have used syndemic theory in diverse African–American study populations, including MSM, cis-women, trans-women, heterosexual men and adolescents. These studies have evaluated the associations between syndemic conditions and a variety of outcomes, such as sexual behaviours, HIV and other sexually transmitted infections, HIV testing, adherence to antiretroviral therapy, HIV suppression and preexposure prophylaxis use. The most frequently evaluated syndemic conditions have been depression, substance use and personal experience of abuse or violence; a few studies have included experience of incarceration and unstable housing.

## Summary

These studies have yielded valuable insights into links between HIV-related outcomes and mental health, experience of violence and abuse, and substance use. But a key feature – and major utility – of the syndemics framework is its potential for examining not only synergistic individual-level risk factors but also the interactions with economic, political and social systems that influence these individual-level factors and thereby shape the HIV epidemic among African–Americans. Research that takes these systems into account is needed to inform policy changes that can help end the HIV epidemic in this population.

## Keywords

African–Americans, HIV, structural violence, syndemic

## INTRODUCTION

Marked racial and ethnic inequities in health have long characterized the USA, with blacks faring substantially worse than whites with respect to many health outcomes, such as diabetes prevalence, colorectal cancer incidence and death, and mortality due to coronary heart disease and stroke [1]. These inequities are dramatically apparent in the racial distribution of HIV incidence and mortality [2]. Considerable evidence indicates that social and economic forces influence health outcomes. Syndemic theory posits that co-occurring diseases and social and environmental factors act synergistically to impact population health [3,4]. The theory is therefore a potentially powerful tool for understanding HIV and related outcomes among African–Americans and for developing interventions to decrease racial inequities. This article will review recent use of syndemic theory for HIV research among African–Americans.

## SOCIAL, ECONOMIC AND ENVIRONMENTAL FORCES THAT AFFECT BLACK HEALTH

Black people comprise about 12% of the USA population but account for roughly 42% of HIV diagnoses [2,5]. Behavioural factors do not account for the higher prevalence of HIV among US blacks than whites. For example, studies have demonstrated that black men who have sex with men (MSM) do not engage in more sexual risk behaviours than

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## KEY POINTS

- Syndemic theory is a potentially powerful tool for understanding HIV and related outcomes among African–Americans and for developing interventions to decrease racial inequities.
- Recent studies that have used a syndemic framework have yielded valuable insights into links between HIV-related outcomes and mental health, experience of violence and abuse, and substance use.
- Research that examines not only synergistic individual-level risk factors but also the interactions with economic, political and social systems that influence these individual-level factors and thereby shape the HIV epidemic among African–Americans, are needed to inform policy changes that can help end the HIV epidemic in this population.

white MSM [6]. And young black adults appear to be at a higher risk for HIV than whites, for any given level of risk behaviour [7]. One reason for the risk difference is the higher existing prevalence of HIV among African–Americans, so that the same behaviour, for example, monthly unprotected intercourse with a new partner, corresponds to a greater risk for African–Americans with African–American partners. However, the greater HIV prevalence itself reflects the influence of syndemic factors. Poverty, a well documented risk factor for HIV infection [8] is much more common among blacks than whites; Black median household income was 58% that of whites in 2018 [9]. Fifty percent of blacks live in areas with concentrated poverty, compared with 20% of whites [10]. Poverty increases exposure to factors that increase risk for HIV, such as drugs and violence. Moreover, blacks in the USA are not only more likely to experience poverty but also more likely to experience racial discrimination, which works in concert with poverty and magnifies its effects. For example, blacks were largely shut out of federal farmers loan assistance and federally backed mortgage programmes, with lasting adverse effects on black land and home ownership and neighbourhoods [11–13]. Banks disproportionately targeted blacks for predatory mortgage loans shortly before the Great Recession, increasing their risk of foreclosure and homelessness [14]. Racial inequities in police contact, criminal charging and sentencing all contribute to the markedly disproportionate incarceration of blacks [15], which in turn increases risk of poverty and homelessness, and disrupts sexual networks [16]. Police killings disrupt and inflict deep psychological trauma on families, communities and the general black population [17].

A unifying characteristic of the context described above is structural violence, a social system characterized by large inequities in power and opportunities that restrict a group of people from realizing their full potential [18] and put them ‘in harm’s way [19]’. The system is *structural* because it is ‘embedded in the political and economic organization of our social world’ and ‘*violent* because it causes injury to people (typically, not those responsible for perpetuating such inequalities) [19]’. Given the role of structural violence in the distribution of HIV, ending the epidemic among African–Americans (and the USA) ‘will require modifying the social and economic systems, structures, and processes that facilitate HIV transmission’ and influence its outcomes [20].

## EARLY USES OF SYNDEMIC FRAMEWORK FOR HIV RESEARCH

Singer’s early descriptions of syndemic theory used a medical anthropology perspective to describe the AIDS crisis among the urban poor. A major contribution of this approach was its focus on the interrelationships between the concurrent endemic conditions (syndemics) of poverty and drug use, as well as the political, economic and social factors that gave rise to these syndemics [21]. This use of syndemic theory provided a framework for understanding larger factors, outside the individual, which influence distribution and outcome of HIV infection.

Subsequent research described the interrelated complex of substance abuse, gang violence and AIDS that characterized the epidemic among Puerto Ricans in Hartford CT, arguing the need for approaches that afford a holistic understanding ‘to address critically pressing health and social issues [4]’. In one of the earliest applications of syndemic theory to MSM, Stall *et al.* [22] identified independent correlations between polydrug use, depression, childhood sex abuse (CSA) and intimate partner violence (IPV) among MSM, including 21% men of colour. Importantly, the study found that increasing numbers of these health problems were associated with HIV infection and concluded that HIV prevention in this population should focus not only on sexual risks but also on these broader health concerns of MSM [22].

## RECENT LITERATURE

Most recent HIV-related studies that have used a syndemic framework among African–Americans have involved MSM [23–25,26<sup>a</sup>,27<sup>a</sup>,28], although some have included heterosexual men [29,30] and

cis [31–34] and transwomen [27<sup>■</sup>,35,36]. Investigators have evaluated a range of outcomes, such as sexual behaviours (e.g. condom negotiation and condomless sex) [27<sup>■</sup>,32,36–38], HIV testing [26<sup>■</sup>,30], HIV or other sexually transmitted infection (STI) [27<sup>■</sup>,39<sup>■</sup>], preexposure prophylaxis (PrEP) use [28] and virologic failure [34,40]. Almost all studies have included depression, substance use and personal experience of abuse or violence in the cluster of syndemic conditions. Some studies have examined the relationship between these conditions, and, less commonly, ameliorating factors such as social networks [27<sup>■</sup>] or resilience [31]. We summarize below findings from some of the more illustrative literature concerning African–Americans that has been published within the past few years.

### **SEXUAL BEHAVIOURS AND RISK OF HIV INFECTION**

Studies have consistently demonstrated relationships between syndemic conditions and condomless sex. Wu evaluated CSA, self-reported HIV status, number of male sex partners, number of acts of condomless anal sex, substance use and IPV among 1002 black MSM in New York City. More than one-quarter (28%) reported CSA, which was associated with greater odds of experiencing two or more syndemic conditions (illicit drug use, binge alcohol consumption, IPV). Having multiple syndemic conditions was associated with an increased risk of HIV infection [24].

Mimiaga *et al.* [36] conducted a longitudinal study to prospectively evaluate the effects of psychosocial syndemic conditions (recent polydrug use, recent heavy alcohol use, CSA, stimulant use, lifetime IPV, depressive symptoms and transgender-specific violence) on condomless anal or vaginal sex among 233 (47% black) young transwomen in Boston and Chicago. The prevalence of most conditions was high and predicted condomless sex. There was a dose–response relationship between number of syndemic conditions and condomless sex. The authors argued for better assessment of psychosocial comorbidities and integration of sex affirming, violence recovery and substance use treatment for transgender women [36]. Parsons *et al.* [35] evaluated syndemic relationships between polydrug abuse, depression, CSA and IPV among 212 transwomen in NYC. Most participants were women of colour (32% black, 33% Latina, 10% multiracial or other). Most (80%) had annual income less than \$20 000, and 35% were HIV-seropositive. Syndemic conditions were associated with each other and most were associated with recent transactional sex and condomless sex with a partner of different or unknown

serostatus. The adjusted rate ratio for either of these risk behaviours exceeded 8 for women with all four syndemic conditions compared with those with none. The authors called for comprehensive psychosocial interventions to address these syndemic conditions [35].

Syndemic conditions also adversely impact ciswomen’s ability to participate in safer sex behaviours. Peasant *et al.* [32] examined the syndemic effects of substance abuse, depression and posttraumatic stress disorder on condom use and negotiation, and fear of condom negotiation among 158 women (65% black, 8% HIV-positive) with recent experience of IPV. They found a relationship between syndemic scores and condom negotiation and use. Women with more severe syndemic experience were more likely to fear condom negotiation and less likely to use condoms, highlighting the need for more female-controlled methods of protection from HIV and other STIs [32].

Studies have revealed similar adverse effects of syndemic conditions on condomless sex, as well as other sexual risk behaviours, among adolescents and young adults. An 18-year longitudinal study by Cordova *et al.* of adolescents in Flint, Michigan, evaluated psychosocial risk factors (drug use, depressive and anxiety symptoms and violence victimization and observation) and their association with subsequent participation in HIV risk behaviours (e.g. condomless sex at last sexual intercourse with their primary and secondary partner, sexual intercourse with someone they just met, four or more sexual partners, and drug use before sexual intercourse). The degree of psychosocial risk was influenced by social conditions (family and peer support, and perceptions of community violence); higher levels of psychosocial risk predicted higher levels of sexual risk behaviour in adulthood [38].

Despite African–Americans’ high rates of criminal justice involvement, relatively few studies have considered the impact of incarceration as a syndemic condition. One notable exception examined both criminal justice involvement and the impact of social networks: Texeira *et al.* evaluated the association of a broad array of syndemic factors (substance use, community violence, depression, poverty, justice system involvement and social networks) with condomless anal sex, group sex and HIV infection in a population-based cohort of 618 16 to 29-year-old black transwomen and MSM in Chicago. Of note, community violence exposure, justice system involvement and poverty were reported by about half of the participants, and were considerably more prevalent than depression and substance abuse. The syndemic conditions were significantly associated not only with the sexual risk behaviours but also with

HIV infection. Social network characteristics moderated the effect of the syndemic conditions [27<sup>¶</sup>].

## **THE HIV PREVENTION AND CARE CONTINUUM**

Investigators have used the syndemic framework to evaluate outcomes along the HIV prevention and care continuum, from HIV screening through viral suppression and PrEP uptake. Chandler *et al.* [26<sup>¶</sup>] evaluated associations of syndemic variables (past 3-month poly-drug use, depression symptomatology, IPV within the past year, binge alcohol consumption) and sexual risk characteristics with HIV screening within the past 6 months among 3297 black MSM in Pittsburgh. Men with one or two syndemic factors were more likely to have undergone screening than men who experienced none of the factors. Results revealed synergy between poly-drug use, binge alcohol consumption, and depression, but the authors noted that these individual-level behaviors did not completely explain lack of testing. The authors suggested that structural factors influence HIV screening behavior of Black MSM more than individual-level factors and that investment in community-based testing has had a salutary effect [26<sup>¶</sup>].

In one of the few studies to specifically evaluate healthcare access, Turpin *et al.* [30] evaluated syndemic factors and their relationship to ever having been tested for HIV infection among 1786 black men, aged 18–54 years, who responded to the Behavioral Risk Factor Surveillance Survey. The authors used latent class analysis to examine associations of HIV testing with poverty status, depression diagnosis, and healthcare access. Models containing classes with either high poverty or high proportions of all risk factors were significantly associated with lower probabilities of HIV testing [30].

The advent of PrEP has dramatically changed the landscape of HIV transmission, so the relatively low uptake of PrEP by black MSM has been of concern [41]. In a study across six USA cities, Chandler *et al.* [28] compared 1431 black MSM using PrEP with those who did not use PrEP, in relation to sexual behaviours, psychosocial conditions and the presence of a syndemic condition (substance use, IPV and depression). Men with several syndemic conditions were significantly more likely to use PrEP than those without multiple syndemic conditions. The authors concluded that PrEP engagement efforts appear to be reaching those at highest risk, but that additional outreach strategies are still required for those at lower risk [28].

Syndemic conditions are also associated with virologic failure among people receiving ART. In a

cross-sectional study, Glynn *et al.* [34] evaluated the prevalence and relationship of a broad range of syndemic conditions (unstable housing, low education, depression, anxiety, binge drinking, drug use, personal experience of violence and HIV-related stigma) with poor adherence to antiretroviral therapy, unsuppressed HIV viral load and condomless sex in the setting of unsuppressed viral load among men and women with HIV who attended a public clinic in Miami. More than two-thirds (69%) of the 800 participants were black, and a substantial proportion were Latinx. The number (mean 3.8) and prevalence of syndemic conditions were high. For example, 18% of participants had unstable housing, and 86% had experienced violence. After adjustment (e.g. for age, sex, sexual orientation, race/ethnicity and partnership status), the number of conditions was associated not only with condomless sex but also with low ART adherence and virologic failure [34].

## **RACIAL DIFFERENCES IN THE CONTRIBUTION OF SYNDEMIC CONDITIONS TO HIV-RELATED OUTCOMES**

Although syndemic conditions have generally been common in study populations reported in the literature, some investigators have reported racial differences in the prevalence of these conditions and in their contribution to the outcomes of interest. For example, in Mustanski's study of syndemic influences on condomless anal sex, the prevalence of several components of individual syndemic conditions (e.g. sexual orientation-based physical victimization and CSA as a component of violence) varied significantly by race/ethnicity. The 'primary syndemic component' of substance use, internalizing mental health factors and violence predicted sexual risk behaviour in the overall sample and among whites, but not among Latinos or blacks, suggesting less relevance of this syndemic to racial/ethnic minorities [25]. Hill *et al.* [39<sup>¶</sup>] identified syndemic psychosocial and behavioural patterns of risk for STI among 18 to 25-year-old men and women (26% black, 25% Hispanic) in a national probability sample, the National Health and Nutrition Examination Survey (NHANES). As seen in other studies, the prevalence of STIs was higher among black and Hispanic women, despite lower prevalence of risk behaviours, leading the authors to suggest that targeting sexual behaviours may therefore not decrease STI risk and that 'based on the syndemic approach, interventions for minority women should focus on environmental stressors, social engagement, and access to health and social resources [39<sup>¶</sup>]'.

## CONCLUSION

The essence of a syndemic is an adverse interaction involving multiple biological, behavioural and/or social health conditions, an interaction that is shaped by social, environmental or economic factors and that worsens health and complicates disease treatment [3]. The syndemic perspective strives towards a 'big-picture awareness', a biosocial framework that extends understanding, leading to new strategies and, ultimately, 'broad-based public health policy initiatives' to change adverse social and physical environments by, for example, improving social conditions, food access, education and healthcare access [3].

The studies discussed above have provided ample evidence of adverse interactions between HIV-related outcomes in African-Americans and various syndemic conditions related to mental health, substance use, experience of violence and abuse, and (based on fewer studies) effects of incarceration and housing instability. But studies of initiatives to change adverse environments have yet to emerge. One potential strategy is multilevel analysis that takes into account contextual factors such as community-level data on arrests, race-related violent hate crimes and police killings of unarmed people. Increasing our ability to alter the social, environmental and economic factors that shape vulnerability to HIV will likely require expanding research 'upstream' to study these contextual factors. Data yielded by such studies could help inform changes in policy that will be critical in ending the HIV epidemic.

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## Conflicts of interest

*Bria Godley has no conflicts of interest.*

## REFERENCES AND RECOMMENDED READING

Papers of particular interest, published within the annual period of review, have been highlighted as:

- of special interest
- of outstanding interest

1. Centers for Disease Control and Prevention. CDC health disparities and inequalities report: United States, 2013. *MMWR Morb Mortal Wkly* 2013; 62(Suppl 3):1–187.
  2. Centers for Disease Control and Prevention. HIV surveillance report, 2018 (preliminary). November 2019.
  3. Singer M, Bulled N, Ostrach B, Mendenhall E. Syndemics and the biosocial conception of health. *Lancet* 2017; 389:941–950.
  4. Singer M. A dose of drugs, a touch of violence, a case of AIDS: conceptualizing the SAVA syndemic. *Free Inquiry Creat Soc* 2000; 28:13–24.
  5. US Census Bureau. Quick facts United States 2019. <https://www.census.gov/quickfacts/fact/table/US/PST045218>. Accessed February 5, 2020
  6. Millett GA, Peterson JL, Wolitski RJ, Stall R. Greater risk for HIV infection of black men who have sex with men: a critical literature review. *Am J Public Health* 2006; 96:1007–1019.
  7. Hallfors DD, Iritani BJ, Miller WC, Bauer DJ. Sexual and drug behavior patterns and HIV and STD racial disparities: the need for new directions. *Am J Public Health* 2007; 97:125–132.
  8. Denning P, E D. Communities in crisis: is there a generalized HIV epidemic in impoverished urban areas of the United States? Division of HIV/AIDS Prevention, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, Centers for Disease Control and Prevention; 2010 [updated 11 December 2019]. <https://www.cdc.gov/hiv/group/poverty.html>. Accessed February 1, 2020
  9. Semega J, Melissa K, John C, Abinash M, U.S. Census Bureau, Current Population Reports, P60-266, Income and Poverty in the United States: 2018, U.S. Government Printing Office, Washington, DC, 2019.
  10. Bishaw A. Changes in areas with concentrated poverty: 2000 to 2010. American Community Survey Reports. Issued June 2014. US Census Bureau. Available at: <https://community-wealth.org/sites/clone.community-wealth.org/files/downloads/report-bishaw.pdf>. Accessed January 14, 2020.
  11. Aaronson D, Hartley D, B M. The effects of the 1930s HOLC 'Redlining' Maps. Federal Reserve Bank of Chicago (REVISED February 2019); 2019. Report No.: Working Paper, No. 2017-12, 2017.
  12. The Editorial Board. Blacks still face a red line on housing. *The New York Times*. 14 April 2018.
  13. Castro A, Willingham Z. Progressive governance can turn the tide for black farmers: Center for American Progress; 2019. [Updated 3 April 2019]. <https://www.americanprogress.org/issues/economy/reports/2019/04/03/467892/progressive-governance-can-turn-tide-black-farmers/>. Accessed February 1, 2020
  14. Rugh JS, Albright L, Massey DS. Race, space, and cumulative disadvantage: a case study of the subprime lending collapse. *Soc Probl* 2015; 62:186–218.
  15. Report of The Sentencing Project to the United Nations Special Rapporteur on Contemporary Forms of Racism, Racial Discrimination, Xenophobia, and Related Intolerance: Regarding Racial Disparities in the United States Criminal Justice System. March 2018. Available at <https://www.sentencingproject.org/publications/un-report-on-racial-disparities/> Accessed January 19, 2020.
  16. Adimora AA, Schoenbach VJ. Social context, sexual networks, and racial disparities in rates of sexually transmitted infections. *J Infect Dis* 2005; 191(Suppl 1):S115–S122.
  17. Bor J, Venkataramani AS, Williams DR, Tsai AC. Police killings and their spillover effects on the mental health of black Americans: a population-based, quasi-experimental study. *Lancet* 2018; 392:302–310.
  18. Galtung J. Violence, peace, and peace research. *J Peace Res* 1969; 6:167–191.
  19. Farmer PE, Nizeye B, Stulac S, Keshavjee S. Structural violence and clinical medicine. *PLoS Med* 2006; 3:e449.
  20. Adimora AA, Schoenbach VJ, Floris-Moore MA. Ending the epidemic of heterosexual HIV transmission among African Americans. *Am J Prev Med* 2009; 37:468–471.
  21. Singer M. AIDS and the health crisis of the US urban poor: the perspective of critical medical anthropology. *Soc Sci Med* 1994; 39:931–948.
  22. Stall R, Mills TC, Williamson J, et al. Association of co-occurring psychosocial health problems and increased vulnerability to HIV/AIDS among urban men who have sex with men. *Am J Public Health* 2003; 93:939–942.
  23. Zhang J, O'Leary A, Jemmott JB III, et al. Syndemic conditions predict lower levels of physical activity among African American men who have sex with men: a prospective survey study. *PLoS One* 2019; 14:e0213439.
  24. Wu E. Childhood sexual abuse among black men who have sex with men: a cornerstone of a syndemic? *PLoS One* 2018; 13:e0206746.
  25. Mustanski B, Phillips G, Ryan DT, et al. Prospective effects of a syndemic on HIV and STI incidence and risk behaviors in a cohort of young men who have sex with men. *AIDS Behav* 2017; 21:845–857.
  26. Chandler CJ, Bukowski LA, Matthews DD, et al. Examining the impact of a psychosocial syndemic on past six-month hiv screening behavior of black men who have sex with men in the United States: results from the POWER study. *AIDS Behav* 2020; 24:428–436.
- This study revealed synergies between substance use and depression but found that the syndemic conditions studied did not entirely explain HIV screening behaviours among black MSM.
27. Teixeira Da Silva D, Bouris A, Voisin D, et al. Social networks moderate the syndemic effect of psychosocial and structural factors on HIV risk among young black transgender women and men who have sex with men. *AIDS Behav* 2020; 24:192–205.
- This study evaluated community violence exposure, criminal justice system involvement and poverty, in addition to other syndemic conditions.

28. Chandler CJ, Bukowski LA, Matthews DD, *et al.* Understanding the impact of a syndemic on the use of preexposure prophylaxis in a community-based sample of behaviorally PrEP-eligible BMSM in the United States. *AIDS Care* 2020; 32:551–556.
  29. McMahon JM, Braksmajer A, Zhang C, *et al.* Syndemic factors associated with adherence to antiretroviral therapy among HIV-positive adult heterosexual men. *AIDS Res Ther* 2019; 16:32.
  30. Turpin RE, Slopen N, Chen S, *et al.* Latent class analysis of a syndemic of risk factors on HIV testing among black men. *AIDS Care* 2019; 31:216–223.
  31. Thurston IB, Howell KH, Kamody RC, *et al.* Resilience as a moderator between syndemics and depression in mothers living with HIV. *AIDS Care* 2018; 30:1257–1264.
  32. Peasant C, Sullivan TP, Weiss NH, *et al.* Beyond the syndemic: condom negotiation and use among women experiencing partner violence. *AIDS Care* 2017; 29:516–523.
  33. Van den Berg JJ, Fernández MI, Fava JL, *et al.* Using syndemics theory to investigate risk and protective factors associated with condomless sex among youth living with HIV in 17 US cities. *AIDS Behav* 2017; 21:833–844.
  34. Glynn TR, Safren SA, Carrico AW, *et al.* High levels of syndemics and their association with adherence, viral nonsuppression, and biobehavioral transmission risk in Miami, a US city with an HIV/AIDS epidemic. *AIDS Behav* 2019; 23:2956–2965.
  35. Parsons JT, Antebi-Gruszka N, Millar BM, *et al.* Syndemic conditions, HIV transmission risk behavior, and transactional sex among transgender women. *AIDS Behav* 2018; 22:2056–2067.
  36. Mimiaga MJ, Hughto JM, Biello KB, *et al.* Longitudinal analysis of syndemic psychosocial problems predicting HIV risk behavior among a multicity prospective cohort of sexually active young transgender women in the United States. *J Acquir Immune Defic Syndr* 2019; 81:184–192.
  37. Mustanski B, Garofalo R, Herrick A, Donenberg G. Psychosocial health problems increase risk for HIV among urban young men who have sex with men: preliminary evidence of a syndemic in need of attention. *Ann Behav Med* 2007; 34:37–45.
  38. Córdova D, Heinze JE, Hsieh H-F, *et al.* Are trajectories of a syndemic index in adolescence linked to HIV vulnerability in emerging and young adulthood? *AIDS* 2018; 32:495–503.
  39. Hill AV, De Genna NM, Perez-Patron MJ, *et al.* Identifying syndemics ■ for sexually transmitted infections among young adults in the United States: a latent class analysis. *J Adolesc Health* 2019; 64: 319–326.
- Investigators used a syndemic framework to evaluate behavioural risk and STI in a national probability sample of young adults.
40. Yellin H, Beckwith C, Kurth A, *et al.* Syndemic effect of mental illness and substance use on viral suppression among recently-incarcerated, HIV-infected individuals in the CARE+ Corrections study. *AIDS Care* 2018; 30:1252–1256.
  41. Finlayson T, Cha S, Xia M, *et al.* Changes in HIV preexposure prophylaxis awareness and use among men who have sex with men: 20 urban areas, 2014 and 2017. *Morb Mortal Wkly Rep* 2019; 68:597–603.