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From Epidemiology to Action: The Case for Addressing Social Determinants of Health to End HIV in the Southern United States

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Epidemiology and the Social Determinants of Health

In response to cholera outbreaks in London during 1853–1854, John Snow conducted an historic investigation that launched the field of modern epidemiology [1]. Snow hypothesized that unsanitary conditions caused by sewage dumped into city cesspools contaminated local drinking water, resulting in the rapid spread of Cholera. To test his hypothesis, he collected data from Londoners who acquired and did not acquire cholera, paying close attention to where individuals who contracted cholera lived and acquired their water. Almost all individuals who acquired cholera drank from wells that were near cesspools in or near the Soho district of London. One well in particular, “the Broad Street pump,” was a primary water source for hundreds of cholera victims in Soho. To intervene, Snow persuaded London city officials to remove the handle from the Broad Street pump to prevent townspeople from consuming the contaminated water. After doing so, the cholera epidemic ceased.

Snow’s investigation provides a good starting point for understanding the epidemiology of HIV in the southern United States (“the South”). Epidemiology is the study of the distribution and determinants of disease, and it is the “core science of public health.” [2] Like Snow did with cholera in the 1850s, the HIV prevention workforce uses epidemiology to identify persons who are at greatest risk for acquiring and transmitting HIV (distribution) and the reasons why (determinants). Epidemiologic data tell us, for example, that persons most at risk for HIV infection are gay, bisexual, and other men who have sex with men (MSM); African Americans; Latinos; transgender women; and, as evidenced by the articles in this special issue, persons in the South [3]. To inform intervention approaches, our workforce uses epidemiology in attempts to prevent behaviors that most commonly result in HIV infection: condomless sex, injection drug use, and nonadherence to HIV antiretroviral therapy (ART) or pre-exposure prophylaxis (PrEP) [4].

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For prevention of HIV, as well as other health problems, epidemiology identifies underlying causes of disease and, most notably, disease disparities. Snow's key observation was that consuming contaminated water in Soho was the primary determinant of cholera acquisition. But, why was this the case? Could it have been that Soho, in and of itself, was the cause? As Snow found, the problem had relatively little to do with Soho as a residential area itself. It had much more to do with living conditions in Soho and, in particular, unhealthy conditions that were unique to it. For epidemiology to appropriately inform HIV prevention, we must not only identify individual-level behaviors that place persons at increased risk for infection. Like Snow, we must also address the underlying conditions that promote these behaviors in the first place, as well as reasons that some groups are at increased risk for HIV even when individual-level risk behaviors cannot explain their increased risk [5].

Over time, epidemiologists have drawn from Snow's work to focus greater attention on physical and social environments that determine population-level risk for disease acquisition. In one of the most cited epidemiology articles from the twentieth century, John Cassel outlined the importance of improving environments characterized by social inequality and oppression in order to create conditions conducive to health [6]. This line of epidemiologic thought has engendered the study of social determinants of health (SDH). SDH are "conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life." [7] SDH include broad-scale sociopolitical factors, such as economic and social policies and systems that create these policies [7]. They also include structural factors like access to health care, discrimination, education level, income, mass incarceration, and fundamental drivers of these conditions (e.g., societal homophobia, racism, poverty, and stigma) [8–17].

SDH are indispensable for understanding the epidemiology of HIV in the South. As was the case for Snow, and as is the case for epidemiologists in other sub-fields, epidemiology is also essential for optimally intervening to prevent HIV infection. However, HIV interventions that seek to address SDH are rare, and nearly all interventions focus on addressing factors caused by SDH rather than addressing SDH themselves [4, 18]. Therefore, the purpose of this article is to articulate the relevance of SDH for understanding the epidemiology of HIV infection in the South and, most importantly, intervention efforts that are necessary to prevent HIV.

Social Determinants of Health as Underlying Causes

The science is clear: with the exception of a few conditions tied to genetics (e.g., Tay-Sachs disease), the underlying causes of health and health disparities are social conditions, both within and across populations [7]. Many of the world's foremost epidemiologists and social scientists have summarized, at length, nearly 200 years of evidence showing that effects of social conditions on health are far greater than the effects of individual-level behaviors and characteristics [2, 6, 7, 13–17, 19–33]. This evidence is much more comprehensive and voluminous than evidence that supports the effectiveness of our key individual-level HIV prevention strategies, such as condom use and adherence to ART or PrEP [34].

Distribution of HIV in the South

One of the greatest benefits of epidemiology is its ability to identify the social groups that are most vulnerable to HIV infection. In 2017, the HIV diagnosis rate in the South was greater than that of the Northeast, Midwest, and West (51.9%, 117.6%, and 71.3% greater, respectively) [3]. Because the South accounted for 49.5% of all HIV diagnoses in 2017, but 38% of the U.S. population [3], persons in the South have relatively more opportunities for exposure to HIV. Additionally, rates of mortality attributable to HIV in the South are greater than rates in other regions [35]. Although the HIV epidemic is concentrated in metropolitan areas, the increased nonmetropolitan burden of HIV in the South is important to note, given that these areas often lack HIV prevention and care resources. In 2017, 8.1% of all HIV diagnoses in the South occurred among persons in rural areas and small towns, which is substantially greater than percentages for the Northeast (1.9%) and West (3.2%) [36].

Several vulnerable populations residing in South have experienced minimal improvement in HIV prevention outcomes in recent years while other populations have experienced worse outcomes. Although HIV diagnosis rates among Latinos throughout the United States were relatively stable during 2012–2016, with a modest decline in 2017 [3], rates significantly increased among Latinos residing in the Deep South during 2012–2017 (0.9% per year on average) [37]. (Deep South states include Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Texas.) Notwithstanding their relatively small number of annual HIV diagnoses, a much larger increase occurred among Native Americans in the Deep South (12.5% per year on average). For gay, bisexual, and other men who have sex with men (MSM)—who accounted for 65.5% of diagnoses in the Deep South in 2017 and among whom diagnoses were relatively stable nationwide during 2012–2017—diagnoses significantly increased (1.5% per year on average) [3, 37]. These data highlight the urgent need for interventions that address the underlying causes of the increased HIV burden in the South, especially in the Deep South.

Determinants of HIV in the South

Despite what we know about the distribution of HIV in the South, this knowledge alone is not sufficient to prevent HIV. SDH-informed epidemiology tells us *why* these groups are more vulnerable and, accordingly, interventions needed to rectify this vulnerability. As Snow did when trying to determine why Soho residents were more affected by cholera than other London residents, we highlight some underlying factors that can help to explain the increased HIV burden in the South. Although not an exhaustive list, these factors include poverty, education, access to health care, racism, homophobia, transphobia, and HIV stigma.

Because poverty is the most robust determinant of health within and across populations [33], socioeconomic deprivation may largely explain why HIV more disproportionately affects this region. In 2010, 30.8% of persons in the South lived in “poverty areas” (i.e., Census tract with a poverty rate of 20% or more), which was greater than percentages for the Midwest (21.5%), Northeast (19.9%), and West (25.9%) [38]. Moreover, alongside increases in the proportion of persons living in poverty nationwide during 2000–2010, the proportional increase in poverty was greater in the South (9.0%) compared with the Northeast (3.3%) and

West (5.9%) [38]. Throughout recent history, median household income, educational attainment, and health insurance coverage have persistently been lower in the South than in other regions [39–41]. This is complicated by the observation that, of all regions, the South has a higher proportion of states that did not adopt Affordable Care Act Medicaid expansion for nonelderly adults [41].

Other SDH help to explain the disproportionate HIV burden in the South and why socially marginalized groups are most vulnerable. The South's protracted history of legalized slavery and Jim Crow segregation suggests that racism, albeit prevalent nationwide, is a greater problem in the South. Southerners are less likely than residents of other regions to espouse principles of racial equality [42]. Moreover, southern whites are less likely than whites in other regions to have attitudes that support social policies beneficial to African Americans [43]. Homophobia is also an issue, as the South has historically had less favorable attitudes toward homosexuality than other regions [44]. Of all regions, the South has the greatest number and proportion of states that either have no hate crime laws or altogether lack laws that protect lesbian, gay, bisexual, and transgender persons [45]. Accordingly, some reports suggest that violence against sexual and gender minorities, especially transgender women, is greater in the South than in other regions [46, 47]. Mass incarceration, most notably for African American men, is also worse in the South [12]. In 2010, the South (vs. other regions) had the highest incarceration rate, which was 84% greater than that of the Northeast [48]. Given this context, it is no surprise that the South also has greater rates of all-cause mortality, adult diabetes, asthma, homicide, infant mortality, obesity, and many other health problems [40, 41].

How Do Social Determinants of Health Affect HIV Risk in the South?

SDH can explain the disproportionate HIV burden among some of the most at-risk populations. In 2015, African American MSM—who account for approximately 33% of all HIV diagnoses in the South [35] —had an HIV incidence rate that was 10.5 times that of white MSM [49]. Individual-level behaviors cannot explain this disparity because, as shown in a meta-analysis of 174 U.S. studies, African American (vs. white) MSM have lower odds of condomless sex, having multiple sex partners, and recent drug use, behaviors that most commonly promote infection [50]. However, socioeconomic deprivation stemming from the United States' enduring legacy of racism [26], may explain this disparity. African American (vs. white) MSM have greater odds experiencing socioeconomic deprivation: lower educational attainment, lower income, greater unemployment, and less health insurance coverage [50]. Because these factors affect access to health care, they, in turn, help explain why African American (vs. white) MSM living with HIV have lower odds of attending medical care visits, adhering to ART, being virally suppressed and, ultimately, increased odds of transmitting HIV to other African American MSM [50]. Clearly, racism and concomitant socioeconomic deprivation undergird this disparity [51].

Throughout recent years, African American women have had an HIV diagnosis rate that has persistently been 15–22 times that of white women [3, 52]. Studies repeatedly show that African American (vs. white) women have a significantly greater prevalence of condom use [53, 54]. However, studies also show that institutionalized racism promotes high rates of

African American poverty, incarceration, and sexual violence, which deprive many African American women of psychosocial and economic resources necessary to maintain stable romantic partnerships [55, 56]. This dynamic is arguably worse in the South, where chattel slavery, Jim Crow segregation, and mass incarceration of African American men have been most prevalent [12]. These factors, in turn, promote partnership concurrency and partner nonmonogamy, which are the primary behavioral drivers of this disparity [53, 57].

During 2012–2017, HIV diagnoses increased 9.0% among Latino MSM nationwide [3] and 18.1% among all Latinos in the Deep South [37]. Using partial HIV-1 polymerase sequences, Oster and colleagues recently found that young Latino MSM were overrepresented in HIV clusters, indicating rapid transmission in this group [58]. In tandem, a recent CDC HIV testing study reported that Latino (vs. white) MSM were more likely to be first-time HIV testees, suggesting that Latino ethnicity is independently associated with never testing for HIV among MSM [59]. SDH data can shed light on these findings. Anti-Latino sentiment has increased in recent years, and stricter immigration policies, family separation, and deportation of Latinos have enhanced their fear of local, state, and federal governments [60, 61]. This fear has undoubtedly amplified in the wake of the August 3, 2019 El Paso mass shooting, in which the white perpetrator deliberately targeted Latinos from Central America and Mexico. Because most public health messages regarding HIV prevention come from local, state, and federal governments, Latino MSM might exhibit limited receptivity to government-endorsed messages regarding HIV testing, PrEP, and ART, our most prized prevention tools [34]. Considering the U.S. government's history of medical mistreatment of Latinos and other persons of color [62], it would appear that racism is an underlying factor to address in order to prevent HIV among Latino MSM.

Recommendations for Addressing Social Determinants of Health

From Snow, we learn that interventions to address a disease must be commensurate with the disease's epidemiology. That is, interventions must address underlying factors that cause the problem. In recognition of this, CDC has begun to set a national tone focused on SDH in order to have meaningful impact on HIV in the South. Via its current strategic plan, CDC's Division of HIV/AIDS Prevention has committed itself to "addressing the social and structural factors that can influence health outcomes." [63] In tandem, CDC's flag-ship notice of funding opportunity specifically encourages its 60 health department jurisdictions to "understand the social determinants of health in relation to HIV and HIV-related health disparities" and "consider social determinants of health in the development, implementation, and evaluation of program-specific efforts." [64] Via this funding opportunity, CDC allocated approximately $216 million (54% of the total) to southern jurisdictions in 2018 [65]. Related, CDC funds capacity building assistance providers to address SDH in their regionally tailored technical assistance to health departments, community-based organizations, and health care organizations [66]. This work is guided by CDC's recognition of the need to address social and structural factors in order to achieve the health equity goals of the *National HIV/AIDS Strategy for the United States: Updated to 2020* [67]. Collectively, other public health agencies should build upon this work.

Although addressing SDH in the South will be challenging, there are beneficial steps that agencies can take. These steps undoubtedly require social change that promotes social equality for persons in the South and, inevitably, the populations in this region that are most marginalized (e.g., African Americans, impoverished persons, MSM, Latinos, and transgender women). Our goal in this article is not to prescribe specific types of SDH interventions. These should vary based upon recognized need and organizational capacity. For example, states that have large foreign-born Latino populations could consider addressing racism associated with anti-immigrant sentiment. Similarly, organizations that focus on criminal justice might work to eliminate HIV criminalization laws that exacerbate HIV stigma and, more often for African American men living with HIV, racism [68].

Some southern agencies have made attempts to address SDH in local settings. For example, the People's Institute for Survival and Beyond based in Louisiana has developed an Undoing Racism® training [69]. It teaches public health workers about how racism operates and what they can do to counteract it. As part of one of its CDC-funded intitiatives, the Louisiana Department of Health used this training alongside trainings focused on homophobia and transphobia to promote engagement with HIV prevention services in the state [70]. Similarly, the Virginia Department of Health established a housing and employment program to promote retention in HIV care and viral suppression for recently released incarcerated persons living with HIV [71]. Although not HIV related, interventions that provided early childhood education and reduced poverty in North Carolina have been efficacious at reducing depression and other psychiatric disorders, respectively, among children [72, 73].

To address SDH more broadly, CDC has offered 3 over-arching approaches as useful starting points for intervention: (1) public health policy; (2) research and research translation; and (3) strategic partnerships and capacity building [10]. Policy is important because it promotes governmental and civic accountability needed to make SDH interventions effective [10]. CDC and other federal agencies have devoted more attention to SDH because of two important policy documents: the *National HIV/AIDS Strategy for the United States: Updated to 2020* [74] and CDC's National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention's white paper on SDH [75]. One result of both policies is that CDC, with special attention to the South, now explicitly mentions the importance of SDH in all flagship funding announcements for HIV prevention, as well as most auxiliary funding announcements. Following suit, 12 states and the District of Columbia currently have jurisdictional policies focused on ending HIV, but Texas is the only state in the South with such a policy [76]. These policies explicitly emphasize the importance of reducing, among other SDH, HIV stigma, homophobia, poverty, and transphobia [77–79]. If other southern states implement such policies, this could galvanize state-level commitment to address SDH throughout the entire South.

Research and research translation are essential for continually bringing attention to SDH. Although research has identified mechanisms linking SDH to health outcomes, more research is necessary to identify the best approaches necessary to address some SDH [9]. Translation of existing research that does, in fact, tell us which interventions are most promising is also necessary. For example, studies among Haitian and South African women

have shown that microfinance interventions that reduce poverty can help to reduce HIV risk behaviors [80, 81]. Although studies focused on African American women in the South suggest that microfinance interventions are feasible and promising for reducing HIV risk [82, 83], some gaps remain with regard to program design and implementation needs. Similarly, evidence supports the feasibility and benefits of anti-homophobia, social marketing campaigns to potentially reduce HIV risk among African American and Latino MSM, but this work is limited to large cities in the Midwest and Northeast [84–86]. The extent to which these campaigns' images and messages might be effective in the South, where homophobic sentiment is more prevalent, is unknown. Research translation can address these gaps.

Finally, strategic partnerships and capacity building are essential because they provide organizations with the tools and motivation needed to implement SDH interventions. It is vital that public health agencies in the South work with nontraditional partners that have vested interests in addressing SDH [8]. For example, the Black Church has historically fought to combat the social oppression of African Americans. Despite many congregations' negative attitudes toward MSM, studies suggest that the Black Church is an underutilized entity that could be a formidable partner for HIV prevention in the South [87]. National, state, and local public health organizations can establish relationships, and build upon existing ones, with the Black Church to ensure that SDH remain at the forefront of church- and public health-based messages regarding social justice, health, and spirituality [88]. Given the Black Church's historic orientation toward social justice, these partnerships could be critical for combating societal homophobia, poverty, and racism [87, 89, 90]. Similar partnerships might involve educational, labor, housing, and criminal justice agencies, critical partners for addressing the lack of employment opportunities that some groups, like transgender women and African American men, encounter. Health departments, community-based organizations, and health care organizations in the South can take advantage of CDC's regionally tailored technical assistance to increase their capacity to address SDH [66].

Conclusion

It is unreasonable to think that one can truly address any problem without addressing its underlying causes. As we move from understanding the epidemiology of HIV in the South to taking action to address HIV, SDH interventions must be at the forefront of our efforts. SDH interventions can promote healthier social conditions that facilitate the behaviors that have the greatest potential to prevent HIV, such as adherence to ART and PrEP [91]. In doing so, they can propel the country towards its goal of ending the HIV epidemic nationwide. We urge health departments, community-based organizations, health care organizations, academic institutions, and civic organizations to adopt SDH-focused paradigms and interventions rather than solely focusing on individual-level behaviors and other downstream factors that result from SDH. Snow has provided us with a time-honored model for using epidemiology to dictate our intervention approaches. As he did more than 150 years ago, it is now time for us to remove the handle from the pump.

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