



# Structural inequalities drive late HIV diagnosis: The role of black racial concentration, income inequality, socioeconomic deprivation, and HIV testing



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## ABSTRACT

In the United States, research is limited on the mechanisms that link socioeconomic and structural factors to HIV diagnosis outcomes. We tested whether neighborhood income inequality, socioeconomic deprivation, and black racial concentration were associated with gender-specific rates of HIV in the advanced stages of AIDS (i.e., late HIV diagnosis). We then examined whether HIV testing prevalence and accessibility mediated any of the associations above. Neighborhoods with highest (relative to lowest) black racial concentration had higher relative risk of late HIV diagnosis among men (RR=1.86; 95%CI=1.15, 3.00) and women (RR=5.37; 95% CI=3.16, 10.43) independent of income inequality and socioeconomic deprivation. HIV testing prevalence and accessibility did not significantly mediate the associations above. Research should focus on mechanisms that link black racial concentration to HIV diagnosis outcomes.

## 1. Introduction

In the United States (U.S.), HIV diagnosis remains concentrated in geographic areas characterized by high economic inequality and neighborhood black racial concentration (Rebeiro et al., 2016; Nunn et al., 2014; Adimora and Schoenbach, 2005, AIDSvu, 2014, Centers for Disease Control and Prevention, 2013a). Those factors are contributing drivers to HIV infection in the population (Barnett and Whiteside, 2006; Gupta et al., 2008; Parker et al., 2000). Moreover, those factors more sufficiently explain geographic HIV-related disparities over and above individual-centered behavioral and biomedical determinants (e.g., injection drug use) (Decosas, 2002; Sutherland and Hsu, 2012; Gillespie et al., 2007; Millett et al., 2012; Maas et al., 2007). We know less, however, about the mechanisms that link socioeconomic and structural factors to HIV diagnosis outcomes (Kippax and Holt, 2009), particularly in the U.S. (El-Sadr et al., 2010).

The political economy of health is a powerful theoretical framework to guide research on socioeconomic and structural determinants of HIV diagnosis outcomes (Johnston et al., 2015; Hunter, 2007; Altman, 1999). A particular strength of this framework is a description about how political and economic power and socio-cultural factors interact to determine the unequal distribution of resources that constrain individuals' agency (Minkler et al., 1994; Phelps, 1985). The political

economy of health framework is particularly relevant for analyzing the role of socioeconomic determinants of HIV diagnosis within the U.S. For instance, the U.S. has the fourth highest income inequality among 34 other developed nations (OECD, 2014). In the U.S.; socioeconomic and structural factors are deeply rooted in historical (Schmitt, 2009; Norton and Ariely, 2011) and current political relations (Sanders, 2016; Lauter, 2015). Racial residential segregation is a fundamental cause of disparities in health (Osypuk and Acevedo-Garcia, 2010; Williams and Collins, 2001).

### 1.1. Socioeconomic and structural drivers of HIV diagnosis

Income inequality and socioeconomic deprivation are two key socioeconomic drivers of HIV diagnosis and transmission outcomes. Income inequality is a relative measure of economic opportunity, which reflects the gap across a continuum of high to low income (Kawachi et al., 1999). High income inequality has been associated with high HIV prevalence and incidence (Durevall and Lindskog, 2012; Lamontagne and Stockemer, 2010; Brodish, 2014; Lim et al., 2014). Socioeconomic deprivation is an absolute measure of economic inequality often operationalized through an index of factors that include education, unemployment, median household income, and percentage of families in poverty (Niyonsenga et al., 2013; Krieger et al., 2003). Higher

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socioeconomic deprivation within neighborhoods has been associated with higher rates of new HIV diagnosis (An et al., 2013) and late HIV diagnosis among individuals (Gueler et al., 2015). Neighborhood racial concentration is a structural factor that is strongly and positively correlated with socioeconomic deprivation (Quillian, 2012), and documented as an antecedent of economic inequality (Shapiro, 2004; Massey and Eggers, 1990). While the two are strongly correlated, limited empirical evidence exists on whether neighborhood racial concentration is a key determinant of HIV diagnosis and transmission outcomes (Nunn et al., 2014; Brawner, 2014).

### 1.2. Mechanisms linking income inequality, socioeconomic deprivation, and black racial concentration to HIV diagnosis

Individual HIV testing and community-level HIV testing accessibility are critical components of HIV prevention in the population (Coates et al., 2014; Moyer, 2013). In fact, currently, the Centers for Disease Control and Prevention (CDC) recommend screening for everyone in the population as routine part of their health care at least once a year (Centers for Disease Control and Prevention, 2010). Empirical studies showed that expanded HIV testing activities are associated with increases in identifying number of HIV-infected persons unaware of their HIV status (Centers for Disease Control and Prevention, 2011), decreases in rates of late HIV diagnosis in the population (Ransome et al., 2015), and more timely entry into HIV care (Castel et al., 2013). HIV testing and HIV testing accessibility are along the pathway between upstream socioeconomic and structural determinants and HIV infection (Pellowski et al., 2013) and transmission in the population (Poundstone et al., 2004).

### 1.3. Motivation for the current study

Despite the empirical evidence linking socioeconomic and structural determinants to HIV diagnosis and transmission, and linking HIV testing to protective effects on HIV outcomes; there is limited empirical research quantifying the extent to which HIV testing mediates the impact of those determinants on HIV outcomes. We theorize below on potential pathways from socioeconomic and structural determinants through HIV testing and the potential mediating impact on late HIV diagnosis.

First, income inequality can create political power imbalances within and across neighborhoods. Relative power theory (in contrast to conflict theory) posits that economic inequality has negative impacts on political engagement because money buys influence (Solt, 2008). Therefore, in neighborhoods with high income inequality, power imbalance could favor those with high socioeconomic status who may have the a greater political clout to ensure they prevail on conflicts of any issues (Solt, 2008). It is plausible also that individuals with high socioeconomic status could use their political power to lobby for the placement and proximity of HIV testing facilities further away from their residences to disassociate themselves from HIV risk and HIV-related stigma (the “NIMBY” (not in my backyard) phenomenon) (Takahashi, 1997, 1998). Income inequality also erodes social capital and weaken social ties (Kawachi et al., 2008), which can influence HIV testing among individuals (Grover et al., 2016) because those with weaker ties may have less access to relevant HIV knowledge and educational resources (Jesmin and Chaudhuri, 2013).

Neighborhoods with high socioeconomic deprivation are often isolated from mainstream social networks and economic opportunities, as a result of disinvestments in capital resources (Wilson, 2012; Massey, 2007). Isolation from mainstream resources such as HIV testing centers can thwart individual's likelihood of timely HIV testing and subsequent diagnosis (Leibowitz and Taylor, 2007). Socioeconomic deprivation may also drive late HIV diagnosis through social observation (Latkin et al., 2010). Socioeconomically deprived neighborhoods tend also to have a higher distribution of persons with poor HIV

prognosis (e.g., lower HIV survival rates and higher mortality) (Harrison et al., 2008; Wallace, 2003). It is plausible then that individuals in socioeconomically deprived communities are at greater exposure to observing persons plagued by worse HIV prognosis (e.g., lower virologic suppression)(Gueler et al., 2015). Therefore, HIV-infected individuals in socioeconomically deprived communities at higher exposure to observing persons with worse HIV prognosis may engender fatalism views about HIV and plausibly delay HIV testing (Simons et al., 2015), which subsequently leads to late HIV diagnosis. Neighborhoods with high black racial concentration disproportionately have poorer housing and social conditions and a greater number of barriers to accessing and attracting prevention services (Williams and Collins, 2001; Massey and Denton, 1993). Evidence also suggests that the success or failures of HIV prevention efforts in neighborhoods with high black racial concentration are influenced by stigma and attitudes among [fewer number of] non-blacks within those communities (Reid et al., 2014). Next, a direct association between high neighborhood black racial concentration and high rates of late HIV diagnosis is a function of two primary factors. These include greater exposure to a high HIV prevalence pool of individuals (i.e., especially among African Americans) in geographically isolated areas and sexual mixing patterns among persons of the same racial and ethnic group (Brawner, 2014; Adimora and Schoenbach, 2005; Chopel et al., 2015). The indirect association between neighborhood black racial concentration and HIV testing predicting late HIV diagnosis rates is complex. Neighborhoods with high black racial concentration are often characterized by “racialized risk environments” (Cooper et al., 2015), typified by indicators such as racialized housing, discrimination in medical and social services, and racialized policing and incarceration (Friedman et al., 2009). Features of the racialized risk environment such as incarceration have been correlated with higher HIV infection and transmission risk behaviors (Pouget et al., 2010). Another possible pathway is that high incarceration rates weaken social networks (Roberts, 2004), which in turn could limit one's knowledge of HIV prevention resources in the community (Jesmin and Chaudhuri, 2013). A third potential pathway is that norms reflecting social distrust and HIV/AIDS conspiracy beliefs, which can inhibit accessing HIV prevention services (Bogart and Thorburn, 2005; Bogart et al., 2010), may be more pervasive in neighborhoods with high black racial concentration. On the other hand, research showed that some aspects racialized risk environments, including perceived discrimination, were associated with health promoting HIV prevention behaviors. For example, one study showed that higher perceived everyday racism, at the individual level, was associated with higher HIV testing rates among African Americans (Ford et al., 2009). Another study showed that higher perceived provider racial discrimination was associated with higher HIV testing among black men who have sex with men (Irvin et al., 2014).

Next, there also may be a selection effect where high neighborhood income inequality, socioeconomic deprivation, and black racial concentration may drive higher HIV testing. This is because testing resources may be diverted to those communities to address the HIV high burden (Myers et al., 2012, New York City Department of Health and Mental Hygiene, 2011).

In this study, we investigate the role of neighborhood income inequality, socioeconomic deprivation, and black racial concentration on late HIV diagnosis in a large urban U.S. city. We then examine whether HIV testing prevalence and HIV testing accessibility mediate the associations between the determinants above and late HIV diagnosis. Given the empirical evidence on the topic, Fig. 1 shows a heuristic model displaying the proposed directions of associations from the exposures and mediators to late HIV diagnosis.

## 2. Methods

We examined late HIV diagnosis because, in the United States, 24%

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