



Article

Social capital and HIV/AIDS in the United States: Knowledge, gaps, and future directions



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ARTICLE INFO

Keywords:

Social capital
Social cohesion
HIV
AIDS
USA

ABSTRACT

Purpose: Social capital is a well-established predictor of several behavioral health outcomes. However, we know less about the relationship with prevention, transmission, and treatment of HIV/AIDS outcomes in the United States (US).

Methods: In 2017, we conducted a scoping review of empirical studies investigating the relationships between social capital and HIV/AIDS in the US by searching PubMed, Embase, PsycINFO, Web of Science, and Sociological Abstracts with no restriction on publication date, for articles in English language. Sample search terms included: HIV infections OR HIV OR AIDS OR acquired immunodeficiency syndrome OR human immunodeficiency virus AND social capital OR social control, informal OR social participation OR social cohesion OR generalized trust OR social trust OR collective efficacy OR community mob* OR civic participation.

Results: We identified 1581 unique manuscripts and reviewed 13 based on eligibility criteria. The earliest eligible study was published in 2003. More than half ($n=7/13$) focused on HIV or AIDS diagnosis, then prescribing ART and/or adherence ($n=5/13$), then linkage and or engagement in HIV care ($n=4/13$). Fifty eight percent (58%) documented a protective association between at least one social capital measure and an HIV/AIDS outcome. Seven studies used validated social capital scales, however there was substantial variation in conceptual/operational definitions and measures used. Most studies were based on samples from the Northeast. Three studies directly focused on or stratified analyses among subgroups or key populations. Studies were cross-sectional, so causal inference is unknown.

Conclusion: Our review suggests that social capital may be an important determinant of HIV/AIDS prevention, transmission, and treatment outcomes. We recommend future research assess these associations using qualitative and mixed-methods approaches, longitudinally, examine differences across subgroups and geographic region, include a wider range of social capital constructs, and examine indicators beyond HIV diagnosis, as well as how mechanisms like stigma link social capital to HIV/AIDS.

1. Introduction

Social capital, broadly, is conceptualized as collective resources generated through social connections that individuals or groups can access (Kawachi & Berkman 2014). Social capital has been identified in several theoretical models as a potential determinant that influence Human Immunodeficiency Virus (HIV) prevention and transmission at the individual and population levels (Poundstone, Strathdee, & Celentano, 2004; Latkin & Knowlton 2005; Pellowski, Kalichman,

Matthews, & Adler, 2013). However, relative to socioeconomic determinants such as poverty (Johnston 2013; Buot et al., 2014), the association between social capital and HIV has received limited attention.

Social capital research has evolved beyond a debate that considered the construct as either an attribute of individuals or attribute of groups (Lochner, Kawachi, & Kennedy, 1999; Kawachi & Berkman 2014). Studies now typically include indicators that facilitate measuring the construct at multiple levels. Researchers therefore, need to specify beforehand the conceptual definitions, theory of proposed mechanisms/

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<https://doi.org/10.1016/j.ssmph.2018.05.007>

Received 20 March 2018; Received in revised form 30 April 2018; Accepted 23 May 2018

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pathways, and levels of measurement relevant for their research topic (Halpern 2005; Villalonga-Olives & Kawachi 2015). The validity and choice of measures selected can impact whether empirical studies find that social capital is beneficial, detrimental, or has no association with health (Harpham, Grant, & Thomas, 2002). For instance, social capital has been assessed with numerous indicators that included cognitive-related items such as trust, reciprocity, and a sense of belonging which is conceived of as components of social cohesion. On the other hand, structural-related items include network ties, participation and or membership in civic/social organizations, collective action, and informal social control among residents (Harpham et al., 2002; Kawachi, Kim, Coutts, & Subramanian, 2004).

There has been substantial work documenting the associations between social capital and behavioral health outcomes that include mammography screening (Dean et al. 2014), tobacco use (Lindstrom, Moghaddassi, Bolin, Lindgren, & Merlo, 2003), and dental care use (Pattussi, Hardy, & Sheiham, 2006; Chi & Carpiano 2013). However, there is limited work in relation to sexually transmitted diseases, particularly HIV and Acquired Immune Deficiency Syndromes (AIDS). One systematic review of social capital and health published in 2008 identified only three studies that assessed an association with infectious diseases including gonorrhea, syphilis, Chlamydia, AIDS, and tuberculosis (Kawachi, Subramanian, & Kim, 2008). Based on that 2008 review, there remains a paucity of research today and there is no updated systematic knowledge of the topic since.

To date, many of the studies that investigated the association between social capital and HIV/AIDS outcomes are based on populations within Sub-Saharan African countries (e.g., Zimbabwe, Swaziland, and South Africa) where HIV is characterized by a generalized epidemic (i.e., HIV prevalence > 1% in the population in some regions and among some key populations). Although the direction and significance of associations of findings across these studies are mixed, the larger weight of evidence suggests that social capital has beneficial or protective impacts (both at the population-level and among individuals) on HIV/AIDS-related outcomes such as lower HIV incidence, risk of infection, and increased adherence to antiretroviral medication use (Gregson, Terceira, Mushati, Nyamukapa, & Campbell, 2004; Ware et al., 2009; Gregson et al., 2011; Campbell et al. 2012; Campbell et al., 2013; Frumence et al., 2014). Both qualitative and quantitative research have identified mechanisms through which social capital facilitates beneficial or protective impacts. For instance, social capital was a conduit to: influence social norms that decreased HIV stigma (Nhamo-Murire, Campbell, & Gregson, 2014a; Nhamo-Murire, Campbell, & Gregson, 2014b); to normalize HIV-prevention behaviors; and to increase economic support, which facilitated agency with sexual decision-making among marginalized groups (Frumence, Eriksson, Nystrom, Killewo, & Emmelin, 2011; Frumence et al., 2014). While those studies among international populations provided rich contributions, we know little about the direct associations and pathways/mechanisms between social capital and HIV/AIDS outcomes in the United States (US) population. Findings from the Sub-Saharan African context may differ from the US context because of dissimilarities in geographic location, socio-political environments, resource availability, and because the US is characterized by multiple concentrated HIV epidemics (i.e., HIV is < 1% in the general population but exceed > 5% in at least one subpopulation) (Denning & DiNenno 2013).

In the US, HIV is a persistent public health problem. More than 1.1 million people are living with HIV today with an estimated 39,782 newly diagnosed in 2016, across the contiguous states (Centers for Disease Control and Prevention 2017). Given the importance of social capital as a potential determinant of HIV prevention and transmission, and because there is limited research on this topic specific to the US context, we conducted a scoping review of empirical studies that investigated the relationships between social capital and primary and secondary HIV care continuum outcomes (e.g., HIV testing, diagnosis, prescription of ART) (Mugavero, Amico, Horn, & Thompson, 2013;

Horn et al., 2016) in the US. In this review, we identify the state of research, current gaps, and discuss implications for prevention, and directions for research.

2. Methods

Scoping reviews are designed to examine the “extent, range, and nature of research activity, summarize and disseminate research findings, and identify gaps in the existing literature” (Levac, Colquhoun, & O’Brien, 2010). Therefore, unlike a systematic review, our scoping review did not assess the quality of included studies nor set out to test a specific hypothesis from the metadata collected within the studies (Levac et al., 2010; Khalil et al. 2016). Rather, this scoping review was intended to assess the breadth and depth of the spectrum of knowledge in these topical areas (Khalil et al., 2016; Tricco et al., 2016). We used a 5-step approach as outlined by Khalil et al. (2016): identifying the research topic; identifying the relevant studies; selecting studies; presenting the data; and collating the results.

2.1. Search strategy

We identified, extracted, and reviewed relevant research studies based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher, Liberati, Tetzlaff, & Altman, 2010). We included quantitative, qualitative, and mixed-methods empirical studies that reported original results across all study design types (e.g., observational, or experimental). In January 2017, we searched PubMed, Embase, PsycINFO, Web of Science, and Sociological Abstracts, with no restriction on publication date, for articles in English language. Search terms were: “HIV infections” OR “HIV” OR “AIDS” OR “acquired immunodeficiency syndrome” OR “human immunodeficiency virus” AND “social capital” OR “social control, informal” OR “social participation” OR “social cohesion” OR “generalized trust” OR “social trust” OR “collective efficacy” OR “community mob*” OR “civic participation” OR “group cohesion” OR “community group membership” OR “community engagement”. Additional manuscripts were added through searching forward citations. At this stage, we kept broad terms such as HIV or AIDS because they also included HIV-continuum specific terms such as diagnosis. Similarly, we also searched broad social capital terms such as social cohesion because results frequently included articles that discussed all forms of social capital such as bridging, bonding, and linking.

2.2. Selection criteria

Inclusion criteria were: (1) peer-reviewed journal articles; (2) conducted on or included a US sample; (3) focused on HIV-related outcomes preceding, along, and after the HIV care continuum (Horn et al. 2016), including: HIV testing, HIV diagnosis, linked to or engaged in HIV care, retained in HIV care, prescribed antiretroviral therapy (ART), viral suppression, and HIV/AIDS-related mortality; and (4) measured directly or conceptually aligned with social capital (e.g., social cohesion and organizational participation) to identify operational and conceptual distinctions. We excluded articles that: (1) only focused on sexual or drug use behaviors related to HIV (e.g., condom use or heroin use) as the primary endpoint and did not quantify those behaviors with any HIV continuum outcome; (2) other systematic reviews and meta-analyses; (3) studies that did not report data or results (e.g. theoretical or conceptual papers); and (4) non-empirical papers. We considered social network analysis as conceptually distinct from social capital, so we did not search social network terms such as egocentric or centralization. A protocol for our search was developed and published online at the International Prospective Register of Systematic Reviews/PROSPERO (ID = CRD42017070026). Two researchers (KT, MS) independently screened titles and abstracts against inclusion and exclusion criteria and YR, LD reviewed results with KT. Any discrepancies

were discussed between KT and YR until consensus was reached. A list of excluded studies is available upon request.

2.3. Data extraction and presentation

We extracted basic elements from each study such as the year, geographic location, stage of the HIV prevention and care continuum as conceptualized by (Horn et al., 2016), and social capital indicators. Measurement of social capital was grouped into three non-mutually exclusive categories: single item indicators, composite scales, and multiple item indicators. We presented descriptive analysis of those elements in a table and figures. We then reviewed each manuscript text in combination with some of the elements from the table to conduct in-depth analysis of the studies. Results from in-depth analysis included whether the study's primary purpose was to analyze social capital (as the primary exposure) and HIV/AIDS (as the primary outcome) or whether either was considered a secondary variable (e.g., mediator or moderator). Results from in-depth analysis also included whether studies specified continuous and/or non-linear associations between social capital and the HIV/AIDS outcome, the covariates adjusted for in the studies, and whether studies included stratified analysis by demographic subgroups (e.g., gender or age) or marginalized and key populations (e.g., men who have sex with men (MSM), people who inject drugs (PWID), or transgender women). For qualitative and mixed methods studies, we focused on any examples of texts that described how respondents or the authors thought social capital influenced HIV/AIDS directly or indirectly. Results from in-depth analysis are discussed directly in the text and do not appear in the tables or figures.

3. Results

3.1. Results of study selection process

Based on the reference databases search and identifying other records through bibliographies, we evaluated and screened 1581 unique studies after duplicates were removed. We excluded 1555 records because either the title or abstract did not discuss social capital and/or HIV continuum outcomes. That stage of exclusion left 26, which we read the full text to assess for eligibility. From those 26 studies, 13 studies fit our five criteria for full review based on the study protocol described in the methods. Fig. 1 displays the PRISMA flow chart.

3.2. Descriptive characteristics of the studies identified

Table 1 summarizes the selected studies and the social capital measures used. One of the 13 studies was a qualitative analysis (Cene et al., 2011) and the remaining 12 were quantitative. Five employed ecological designs at various geographic units such as states, ZIP codes, and Census tracts (Holtgrave & Crosby 2003; Ransome et al., 2016a, 2016c; Ransome, Kawachi, & Dean, 2016b, Ransome et al., 2017; Ransome et al., 2017a). Three studies were of the entire contiguous US (Holtgrave & Crosby 2003; Grosso 2010; Ransome et al., 2017a), three were based on samples from the Northeast region (Ransome et al. 2016; Ransome et al., 2016b; Ransome et al., 2017), two from the Southern region (Cene et al., 2011; Phillips 2011), two from the Midwest and West (Webel et al., 2013; Webel, Sattar, Schreiner, & Phillips, 2016), and two included samples from populations dispersed across selected states within the US (e.g., Texas, California, Massachusetts) (Nokes et al., 2012; Webel et al., 2012).

Fig. 2 displays the distribution of the publication dates of the 13 selected studies, which began in year 2003. The majority of social capital and HIV/AIDS-related studies were published after 2010, with only one (2003) published between 2000 and 2010.

Fig. 3 displays the distribution of the publications across the HIV prevention and care continuum. Only two studies examined the relation between social capital and a prevention measure, which was HIV

testing (Grosso 2010; Cene et al., 2011). Seven studies examined the relationship between social capital and HIV or AIDS diagnosis prevalence (Holtgrave & Crosby 2003; Cene et al., 2011; Webel et al., 2012; Ransome et al. 2016a, 2016c; Ransome et al., 2016b; Ransome et al., 2017a; Ransome et al. 2017b). Two studies examined the association with linkage to HIV care (Ransome et al., 2016b; Ransome et al., 2017b), and two studies with engagement and retention in HIV care (Webel et al., 2013; Ransome et al., 2016b). Five studies examined social capital in relation to some aspect of antiretroviral therapy (ART), mostly with a focus on adherence (Phillips 2011; Nokes et al., 2012; Webel et al., 2012; Phillips et al., 2013; Webel et al., 2016). One study assessed the association with viral suppression (Webel et al., 2012), and one study examined the association with mortality among persons living with HIV (Ransome et al., 2017a).

3.3. Measurement of social capital in the studies identified

Fig. 4 shows a graphical representation of the social capital constructs measured. Of the 13 studies, 10 measured social/civic participation, 9 measured social trust, 7 measured social cohesion, 6 measured social support, 4 measured collective efficacy, and 1 measured social control. Two studies assessed social capital with a single indicator. For instance, Grosso et al. 2010 used a single-item measure of frequency of social and emotional support, and Ransome et al. (2017b) used a single-item measure for social trust. Seven studies used composite scales from instruments that have been previously validated based on face, nomological, and other validity criteria (Lee & Kim 2013). For instance, Holtgrave and Crosby (2003) used a 14-item index from the social capital scale developed by Robert Putnam. Next, Phillips (2011) used three of six subscales based on the Social Capital Integrated Questionnaire (SC-IQ) developed by Grootaert, Narayan, Jones, and Woolcock (2004) which originally included 27 items in the shortened version. Next, Nokes et al. (2012), Webel et al. (2012), Phillips et al. (2013), Webel et al. (2013, 2016) created an index, where each study used a different number of items from a Social Capital Instrument developed by Onyx and Bullen (2000), which originally included 36 items in the shortened version. Next, two studies used multiple composite items that represented different dimensions within social capital. For instance, Ransome et al. (2016a, 2016c) used four different items (civic engagement, political participation, social cohesion, and informal social control). However, some of the items did not contain all the questions within the original scale. For example, only four of five items from the informal social control scale developed by Sampson, Raudenbush, and Earls (1997) were available in the data. Next, Ransome et al. (2016b) used three composite items (social cohesion, social participation, and collective engagement). However, the latter two constructs were based on single-item measures.

3.4. Bivariate, multivariable, and qualitative results of social capital and HIV/AIDS

Social capital is hypothesized to have a protective relationship with health. Seven of the twelve quantitative studies (58%) documented a protective association between at least one social capital measure and an HIV/AIDS outcome, using methods that included correlation and regression analysis (Holtgrave & Crosby 2003; Grosso 2010; Nokes et al., 2012; Phillips et al., 2013; Webel et al., 2013; Webel et al., 2016; Ransome et al., 2017a). However, while a protective association was observed among those seven studies, the association remained significant after adjustment for covariates in all but one study, which did not report the final coefficient to determine whether the direct effect was meaningful (Nokes et al., 2012). Two studies (17%) found no significant associations but did provide the point estimates or confidence intervals (Phillips 2011; Webel et al., 2012). Two studies (17%) found both protective and negative associations between some dimensions of social capital and HIV/AIDS outcomes. Ransome and colleagues

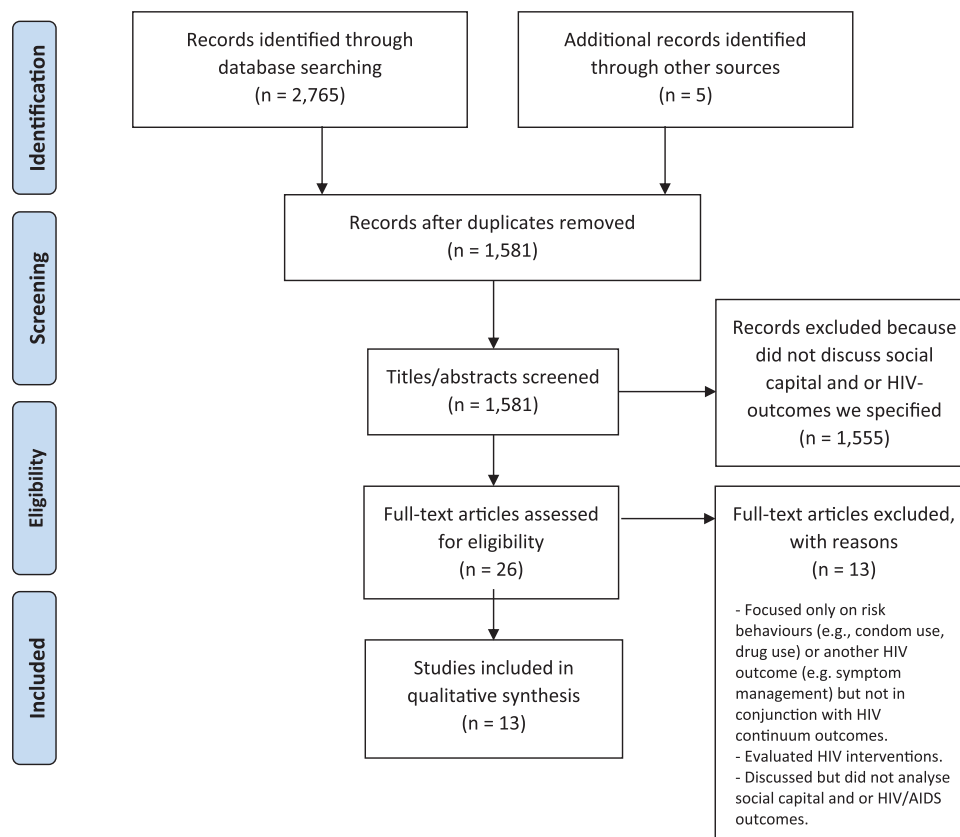


Fig. 1. PRISMA diagram describing the study selection process.

(Ransome et al. 2016a, 2016c) found that, among men, higher civic engagement was associated with higher late HIV diagnosis rates but high informal social control was associated with lower rates. Next, (Ransome et al., 2016b) found that higher social participation was associated with higher linkage to HIV care but higher collective engagement associated with lower linkage to HIV care. One quantitative study did not provide directional associations between social capital and HIV (Ransome, Crawford et al. 2017b). In the qualitative study, results were also mixed. Some participants reported that their community had high social cohesion, which could be good, but that high cohesion also fostered HIV stigma as individuals with HIV were afraid to disclose their status and draw support from residents (Cene et al., 2011).

3.5. In-depth analysis results

The following results are based on in-depth analysis of the manuscript texts and are not contained in the tables or figures. We first assessed the hypothesized role of social capital and HIV/AIDS in each study as exposures, outcomes, or secondary variables (e.g., mediator or moderator). In two quantitative studies, social capital was not the primary predictor variable. Specifically, in Phillips (2011), social capital was investigated as a mediator of the association between several factors including psychological states, partner status, housing status and ART experience, in association with ART adherence. In Nokes et al. (2012), social capital was conceptualized as mediator between cognitive and personal factors such as depressive symptoms, physical functioning and comorbidities, in association with ART adherence self-efficacy. However, in those studies, mediation could not be assessed based on the regression models.

We also examined whether studies analyzed social capital as continuous and or a non-linear/categorical variable in association with HIV/AIDS outcomes. One study (Ransome et al., 2016a, 2016c) examined social capital as a categorical variable to identify threshold

effects by using the data distribution to create three equal groups. However, that study did not report results for the possibility of a linear association.

Across the 12 quantitative studies, the covariates in the regression analyses ranged from none to some. Four ecological studies (Holtgrave & Crosby, 2003; Ransome et al., 2016a, 2016c; Ransome et al., 2016b; Ransome et al., 2017a) included at least one aggregate socioeconomic covariate such as income inequality (Kawachi & Kennedy, 1999), which is hypothesized to influence both social capital and health. The one qualitative study conducted among African Americans in two rural communities in North Carolina suggested that any impact between social capital and HIV infection would likely be influenced by antecedent structural factors such as poverty and segregation within the community (Cene et al., 2011).

Lastly, we examined whether studies examined differences, focused on, or stratified analysis across demographic subgroups or key populations. Two studies stratified the analyses. First, Ransome et al. (2016a, 2016c) analyzed late HIV diagnosis rates by sex at birth (male and female), and Ransome et al. (2017a) conducted the analysis comparing black and Hispanics to whites within the three major HIV transmission categories (heterosexual, male-to-male, and injection drug use).

4. Discussion

4.1. Overview, comparisons, and gaps identified

We undertook this study because in HIV-research, several theoretical models indicate that social capital may be a determinant of HIV/AIDS prevention, transmission, and treatment, yet there were few empirical studies on the topic, specifically in the US. We found that studies of social capital and HIV/AIDS are on the rise but significant gaps remain. Thirteen peer-reviewed published studies met criteria for inclusion with the first being published in year 2003.

Table 1

Summary of peer-reviewed publications included in scoping review of US-based social capital and HIV/AIDS outcomes.

Author, Year	Study Design	Level/Unit of Analysis	Geographic Location	Population / Sample	Social Capital Measure	HIV /AIDS Outcome(s)	Covariates	Direction and magnitude of association
(Holtgrave & Crosby 2003)	Ecological, cross-sectional, quantitative	State	Continental United States	48 States in 1999 Adults with STIs, PLHIV, or AIDS	14-item index on community organizational life, involvement in public affairs, volunteerism, informal sociability, and social trust ^c comprised from the comprehensive social capital measures originated by Robert Putnam (1990) ^a	AIDS case rate per 100,000 population	Poverty and income inequality	$r = -0.498$, $p < 0.01$ $B = -0.362$, $p = 0.010$
(Grosso 2010)	Individual, cross-sectional, quantitative	Individuals	Continental United States	17,793 individuals with at least one risk factor for Hepatitis B (as a measure of HIV risk), ages 18+ in 2007	1 item on frequency of social and emotional support	HIV testing	Age, sex, ethnicity, race, marital status, education, income, mental health	$OR = 1.04$, $SE = 0.02$, $p = 0.036$
(Cene et al., 2011)	Individual, qualitative	Individuals	North Carolina	83 individuals, ages 16+ in 2006–2007	Social cohesion conceptualized as connectedness and values, and social capital conceptualized as social support, social leverage, neighborhood civic participation and informal social control	Perceptions of: HIV risk mediators (individual, interpersonal, social, economic, political and structural); community needs and assets that affect HIV rates	N/A	Social capital was insufficient to reduce HIV infection without addressing antecedent structural factors in the community, which include poverty, poor housing, segregation, institutional racism, and political disenfranchisement
(Phillips 2011)	Individual, cross-sectional, quantitative	Individuals	Florida	160 Black men with HIV and who use illicit drugs, ages 24–63, study date unknown	4 or 6 separate subscales from the 19-item Social Capital Integrated Questionnaire (SC-IQ) originated by Grootaert et al. (2004) ^b	HIV Antiretroviral Therapy (ART) Adherence	Age, education, partner status, employment, income, positive state of mind, psychological distress, current illicit drug use, housing, ART experience, ART tolerability, patient-provider relationship, health care and social services provision	No significant association with ART Adherence (coefficients from the subscales not presented in the study tables)
(Nokes et al., 2012)	Individual, cross-sectional, quantitative	Individuals	United States (California, Massachusetts, Washington, Illinois, New York, Ohio, North Carolina, Texas, Hawaii, New Jersey, and) and Puerto Rico	1,414 PLHIV, age 18+ in 2009–2011	1 index created from summing items across eight subscales from the Social Capital Instrument originated by Onyx and Bullen (2000) ^c + 1-item social support measure	ART adherence	Age, gender, race, education, income, health insurance, HIV indicators, Year diagnosed, AIDS, CD4, Know viral load, physical health, depressive symptoms	$r = 0.09$, $p = 0.09$ after adjustment for adherence self-efficacy, not significant, and coefficient not reported
(Webel et al., 2012)	Individual, cross-sectional, quantitative	Individuals	United States (California, Massachusetts, Washington, Illinois, New York, Ohio, North Carolina, Texas, Hawaii, New Jersey, and) and Puerto Rico	1,454 PLHIV, 18+ in 2009–2010	27-item index based on five factors that were retained from factor analysis of the 36-item Social Capital Instrument ^b originated by Onyx and Bullen (2000) ^c	CD4 count, HIV viral load ART medication Adherence	N/A	No significant association with any of the HIV/AIDS outcomes (coefficients from the models not presented in the study tables so direction is unknown)
(Webel et al., 2013)	Individual, cross-sectional, quantitative	Individuals	Ohio and San Francisco, California	260 women living with HIV, 18+ in 2009–2010	27-item index based on five factors that were retained from factor analysis of the 36-item Social Capital Instrument ^b originated by Onyx and Bullen (2000) ^c	HIV Self-Management Scale with three domains	Age, race, education, income, social roles, access to care, study site	$B = 0.40$ [95% CI: 0.26, 0.55], $p < 0.001$ for Daily self-management health practice $B = 0.42$ [95% CI: 0.18, 0.66], $p = 0.001$ for social support and HIV self-management $B = 0.22$ [95% CI: 0.12–0.31], $p < 0.001$ for chronic nature of HIV self-management.

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Table 1 (continued)

Author, Year	Study Design	Level/Unit of Analysis	Geographic Location	Population / Sample	Social Capital Measure	HIV /AIDS Outcome(s)	Covariates	Direction and magnitude of association
(Phillips et al., 2013)	Individual, cross-sectional, quantitative	Individuals	United States (California, Massachusetts, Washington, Illinois, New York, Ohio, North Carolina, Texas, Hawaii, New Jersey, and) and Puerto Rico, and Canada	1,873 PLHIV, ages 18+ in 2009–2010	31- item index based on five factors that were retained from 36- item from the Social Capital Instrument originated by Onyx and Bullen (2000) ^c .	ART Medication Adherence	Gender, age, ancestry, ethnicity, education, year diagnosed with HIV, HIV	r = 0.17, p < .01 for 30-day adherence r = 0.13, p < .01 for 100% adherent OR = 1.68 [95% CI: 1.37, 2.05] for 100% adherent rho = 0.17, p = 0.10
(Webel et al., 2016)	Individual, cross-sectional, quantitative	Individuals	Ohio	102 PLHIV, 18+ in 2011–2012	36-item Social Capital Instrument originated by Onyx and Bullen (2000) ^c .	ART Medication Adherence	None	
(Ransome et al., 2016a, 2016c)	Ecological, cross-sectional, quantitative, gender-stratified	ZIP-codes	New York City, New York	2,199 PLHIV 18+ in 2005 and 2006 aggregated across 166 ZIP codes	6-item civic engagement index 2-item political participation index 3-item social cohesion index, of 5 items from a validated scale ^d by Sampson et al. (1997) 4-item informal social control index, of 5 items from a validated scale ^d by Sampson et al. (1997)	Rate of late (i.e., stage-3 HIV) HIV diagnosis per 100,000 population	Income inequality, social fragmentation, and % black racial composition	r = -0.04, ns for civic engagement r = -0.20 p < 0.001 for political participation r = -0.37, p < 0.001 for social cohesion r = -0.34, p < 0.001 for informal social control For men: RR = 1.38 [95% CI (1.01,1.89)], p < 0.05 for high vs low civic engagement RR = 0.75 [95% CI (0.51,1.10)], ns for high vs low political participation RR = 0.91 [95% CI: (0.66,1.24)], ns for high vs low social cohesion RR = 0.67 [95% CI: (0.48,0.93)], p < 0.05 for high vs low informal social control For women: RR = 0.82 [95% CI: (0.51,1.11)], ns for high vs low civic engagement RR = 0.59 [95% CI: (0.38,0.91)], p < 0.05 for high vs low political participation RR = 0.85 [95% CI: (0.60,1.20)], ns for high vs low social cohesion RR = 0.91 [95% CI: (0.65,1.27)], ns for high vs low informal social control

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Table 1 (continued)

Author, Year	Study Design	Level/Unit of Analysis	Geographic Location	Population / Sample	Social Capital Measure	HIV /AIDS Outcome(s)	Covariates	Direction and magnitude of association
(Ransome et al., 2016b)	Ecological, cross-sectional, quantitative	Census tract	Philadelphia, Pennsylvania	332 census tracts in 2004–2006	3-item social cohesion index 1-item social participation measure 1-item collective engagement measure	In 2007–2011: Prevalence of late (i.e., state-3 HIV) HIV diagnosis Prevalence of persons linkage to HIV care Prevalence of persons engaged in HIV care	Distance to HIV testing or treatment center, Assault rate, % black racial composition, % male, % 25 and older with < 9 th grade education, % 16 and older and unemployed, median income, and % in poverty	r = 0.15, p < 0.01 and b = -0.45, ns, social cohesion and late HIV diagnosis r = 0.27, p < 0.01 and b = 1.37, p < 0.001, social participation and late HIV diagnosis r = 0.08, ns and b = -0.63, ns, collective engagement and late HIV diagnosis r = 0.03, ns and b = -0.43, ns, social cohesion and linked to HIV care r = 0.08, ns and b = 1.13, p < 0.001, social participation and linked to HIV care r = -0.09, ns and b = -0.62, p < 0.05, collective engagement and linked to HIV care r = -0.04, ns and b = 0.16, ns, social cohesion and engaged in HIV care r = -0.12, p < 0.05 and b = -1.16, p < 0.001, social participation and engaged in HIV care r = -0.12, p < 0.05 and b = -0.01, ns, collective engagement and engaged in HIV care

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Table 1 (continued)

Author, Year	Study Design	Level/Unit of Analysis	Geographic Location	Population / Sample	Social Capital Measure	HIV /AIDS Outcome(s)	Covariates	Direction and magnitude of association
(Ransome, Galea et al., 2017a)	Ecological, cross-sectional, quantitative, race-stratified	State	Continental United States	47 states in 2009–2013	1-item social trust measure	Rate of late (i.e., state-3 HIV) HIV diagnosis per 100,000 population And rate of all-cause mortality per 1000 persons living with HIV and AIDS (PLHIV)	Income inequality, socioeconomic deprivation, religious involvement, have Affordable Care Act, health insurance, population density, % foreign born persons, % living in urban areas, % population between 18 and 34 years of age, residential instability,	r = -0.72, p < 0.001 with late HIV diagnosis r = -0.67, p < 0.001 with all-cause mortality r = -0.26, ns with HIV testing Black (ref: White) ^c : OR = 0.40 [95% CI = 0.38, 0.43] MSM, OR = 0.55 [95%CI = 0.51, 0.59] Hetero, OR = 0.43 [95%CI = 0.40, 0.46] IDU, all p < .05 with late HIV diagnosis rates OR = 0.90 [95%CI = 0.85, 0.95] MSM, OR = 0.87 [95%CI = 0.77, 0.98] Hetero, all p < .05 with all-cause mortality rates among PLHIV Hispanic (ref: White) ^c : OR = 0.66 [95%CI = 0.62, 0.70] MSM, OR = 0.77 [95%CI = 0.70, 0.85] Hetero, OR = 0.76 [95%CI = 0.68, 0.86] IDU, all p < .05 with late HIV diagnosis OR = 0.88 [95%CI = 0.83, 0.95] MSM, OR = 0.95 [95%CI = 0.92, 0.97] IDU all p < .05 with all-cause mortality among PLHIV Moran's I = 0.19, p < 0.001) for social participation and prevalence late HIV diagnosis Moran's I = 0.06, p < 0.001) for social participation and prevalence linked to HIV care
(Ransome, Crawford et al., 2017b)	Ecological, cross-sectional, quantitative	Census tract	Philadelphia, Pennsylvania	12,986 adults 18+ in 2006–2010, aggregated to 378 Census tracts	1-item measure of social participation in civic and social organizations	In 2007–2011: Prevalence of late (i.e., state-3 HIV) HIV diagnosis Prevalence of persons linked to HIV care	N/A	Moran's I = 0.19, p < 0.001) for social participation and prevalence late HIV diagnosis Moran's I = 0.06, p < 0.001) for social participation and prevalence linked to HIV care

r = Pearson correlation coefficient; rho = Spearman's rho; B = standardized beta coefficient; b = unstandardized beta coefficient; OR = Odds ratio RR = Relative risk; N/A = not applicable, CI = Confidence Interval.
Moran's I = measure of spatial clustering that does not indicate direction of association but magnitude only.

We include p-values and or confidence intervals to indicate statistical significance depending on the study, since some reported one only or both.

^a In the seminal work on Bowling Alone, Putnam includes 14 items.

^b In the original study by Grootaert et al., there were 94 items, but that was reduced to 27 core items to be included in shorter surveys.

^c In the original study by Onyx et al. there were 68 items, but that was reduced it to 36 best fitting items across the 8 subscales to be included in shorter surveys;

^d In the original study by Sampson et al. there were 5 items; e = relative to the rate of late HIV diagnosis among Whites.

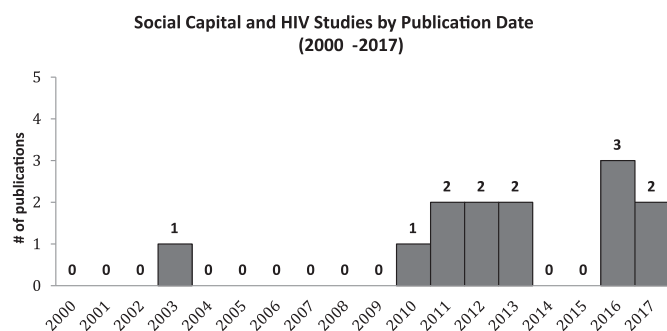


Fig. 2. The number of social capital and HIV/AIDS studies in the US has increased in the past two decades. Note. Year 2000 is displayed for reference only and was not a restriction in our search criteria.

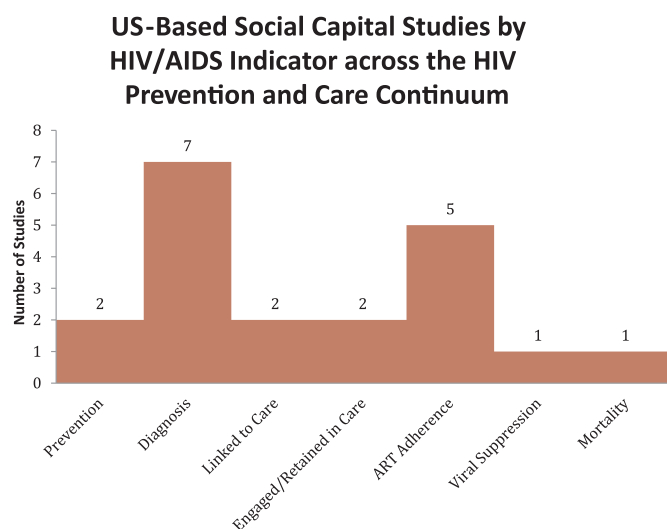


Fig. 3. Most social capital and HIV/AIDS studies in the US focused on HIV diagnosis prevalence and antiretroviral therapy adherence. Note. Some studies examined multiple outcomes and there was one qualitative study, so the number does not sum to 13.

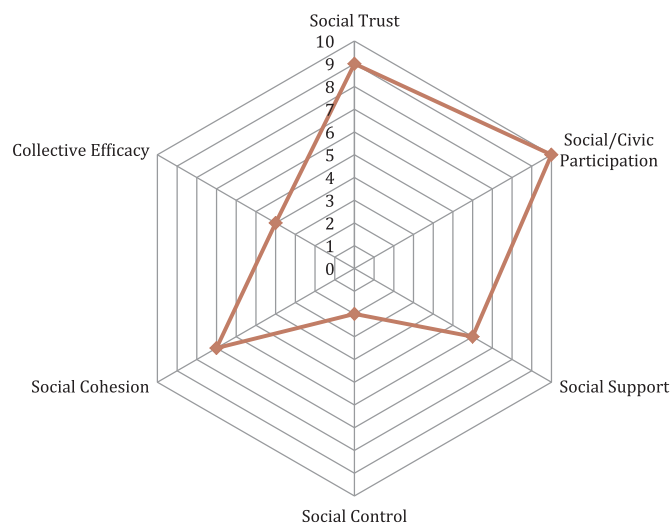


Fig. 4. This radar chart shows that social participation, social trust, and social cohesion are the top social capital constructs assessed in US-based studies, while social control is the least assessed. Note. The legend corresponds to each line of the web, representing the number of times the social capital construct was identified. Most studies examined multiple constructs, so the number does not sum to 13.

Fifty eight percent of the selected studies found a significant protective association between at least one domain of social capital in relation to the HIV/AIDS outcomes, which included HIV diagnosis and aspects related to prescription and adherence of ART medications. We are unclear why studies found negative or null associations, although we speculate this could be related to reasons outlined by others (Halpern 2005; Villalonga-Olives & Kawachi, 2015) such as measures that may not conceptually align with theory and or miss-specification of statistical models if relevant confounders are not assessed or analyses are not stratified.

There is no systematic review of international studies on the topic, so we are unable to contextualize the proportion of studies that reported protective associations. However, as with our findings in the US, studies among international populations have also documented mostly protective associations between social capital and HIV risk behaviors (Sen, Aguilar, & Goldbach, 2010) and HIV infection (Frumence et al., 2014). Similarly, some international studies also found negative associations (Pronyk et al., 2008) as well as non-significant associations (Mukoswa, 2015). Some similarities between US-based and international studies are that a higher proportion conducted among individuals infected with HIV compared to persons at risk and or not HIV-infected and fewer ecological studies compared to individual or multi-level studies.

We identified notable gaps from this review. Foremost, studies in the US were concentrated in the HIV diagnosis stage of the HIV care continuum, although these studies assessed prevalence and not incidence. There were limited studies in association with other care continuum indicators such as linkage and engagement to HIV care, and viral suppression.

Next, we found incongruence in operational definitions and interpretations of social capital, and methodological differences in study design and measures. Some studies used single-items, different scales, and even within the same scale, used different subscales without reporting results from subscales not selected. Some studies also used social and emotional support, which is considered conceptually distinct from social capital (Lochner et al., 1999). Some methodological differences, though, may be related to the fact that there are different theoretical orientations of social capital (e.g., Putnam and Coleman—whose measures tend to be social cohesion-based and Lin and Bourdieu whose measures are social network-based). Nevertheless, there is insufficient research with measures from either perspective, which challenge achieving consensus about the direction and strength of associations. Related, social participation and social cohesion-based measures were widely covered in studies but collective efficacy as well as social network-based measures such as the position-generator were under-represented.

Studies tended to evaluate social capital either as an individual-level or group-level attribute via analysis at the individual or ecological level, respectively. There were no multilevel studies, so we still cannot isolate compositional social capital effects from contextual or group-level effects (Diez Roux & Mair, 2010). Economic variables such as poverty and income inequality have been known to have direct and effect modification effects on the association between social capital and health outcomes (Kawachi & Kennedy, 1999; Uphoff, Pickett, Cabieses, Small, & Wright, 2013). However, the individual-level studies were unable to control for those variables and the ecological-level studies did not assess effect modification (e.g., social capital * poverty) with those variables, and since there are no multilevel studies, cross-level interactions could not be assessed.

Another significant gap is that all the US studies were cross-sectional and observational. With the lack of longitudinal studies, randomized or quasi-experimental designs or instrumental variable analysis, causal analysis remains unknown. Last, there is limited work among subgroups or among key populations. For example, analysis among key populations have been conducted among MSM and among female sex workers in Swaziland (Fonner et al., 2014; Grover et al., 2016) but few

among MSM or transgender women in the US, which is unfortunate given the highest incidence of HIV in these groups.

4.2. Recommendations for future research

Given the gaps identified through this scoping review, we suggest that future studies of social capital and HIV:

4.2.1. Include additional focus on multiple HIV continuum indicators, and stratify analysis across subpopulations and geography

US-based studies predominantly focused on social capital and HIV/AIDS outcomes among people living with HIV. There is a need for continued focus on reducing acquisition among HIV-negative populations (i.e. primary prevention) (Horn et al., 2016), so future work should examine the association with prevention technologies such as Pre-exposure Prophylaxis.

The US is characterized by multiple concentrated epidemics, with high HIV incidence rates among African Americans, MSM, PWID, transgender individuals, and in impoverished communities (Centers for Disease Control and Prevention, 2017). Therefore, future social capital and HIV research should stratify analysis, when possible, across socio-demographic characteristics such as gender, race and ethnicity, sexual minority status or transmission group as evidenced in these studies (Ransome et al., 2016a, 2016c; Ransome, Galea et al., 2017a).

In addition to stratified analysis by sociodemographic and transmission group, we recommend examining geographic differences in the association between social capital and HIV/AIDS. For instance, the Southern region has a higher burden of HIV infection and typically have fewer safety nets or policies that support HIV prevention (Adimora, Ramirez, Schoenbach, & Cohen, 2014). Given that changes in policies through political involvement is one pathway through which social capital can positively influence HIV prevention, (Fuchs, Shapiro, & Minnite, 2001; James, Schulz, & van Olphen, 2001), stratified analysis can potentially begin focusing on the Southern region. Lastly, replication of social capital and HIV/AIDS studies across multiple demographic subgroups and geography can improve generalizability of findings, which have potential implications for implementing and scaling interventions in the population.

4.2.2. Expand collection of social capital measurement

Currently, social capital has been mainly assessed through population surveys of individuals, which are sometimes aggregated at geographic units to study group-level effects (Subramanian, Lochner, & Kawachi, 2003). Social capital measures collected within household surveys are not routinely available throughout the US. There have been some targeted projects such as the Social Capital Community Benchmark Survey (Harvard University, nd), yet although data were collected in multiple states, only two waves of data exist, in 2001 and in 2006. Moreover, even though those data were available in multiple states, the sample sizes were small and only available for larger geographic units, which limited the utility of linking data to HIV surveillance registries or other clinical or general population data. Some challenges of measuring social capital through surveys such as the Current Population Survey is consensus on which items to include, which for social capital indicators can be challenging to know which measurement tool is most useful and have high assurance of validity (National Research Council, 2014).

Despite the need for population-based measures of social capital, there is criticism that surveys should not be used to collect these data because of lack clarity of what is being measured with some indicators such as trust and reciprocity (Pope, 2000). However, measuring social capital in population surveys, if done well, have several advantages. For instance, just as it is important to analyze surveillance of HIV transmission to identify trends and predict areas for intervention, consistent longitudinal measurement of social capital can be facilitated through health surveys. For instance for over a decade, in Philadelphia, PA, several social capital measures have been collected through the

Southeastern Pennsylvania Household Health Survey (SPHHS) (Public Health Management Corporation Community, 1983). Longitudinal data can be then used to examine trends in social capital among subgroups as well as facilitate longitudinal analysis in association with HIV/AIDS outcomes, neither of which has been done in the US.

4.2.3. Expand the range of social capital measures studied

Neighborhoods have well-documented effects on health (Macintyre & Ellaway, 2003), and access to and quality of social capital vary as a function of race and ethnicity (Gilbert & Dean, 2013) and socio-economic and power structures (Navarro, 2002). Therefore, disenfranchised groups can be excluded from the benefits of social capital (Portes & Landolt 1996) and exclusion can affect health negatively for those individuals. To date, research has focused on the 'bonding' type of social capital, which considers connections among groups that share similar characteristics (e.g., neighborhood) (Villalonga-Olives & Kawachi, 2015). Future research should analyze subgroup-specific social capital (e.g., social capital within poor neighborhoods or among African Americans) in association with HIV/AIDS outcomes within and across populations. That research step focuses on the 'bridging' type of social capital, which considers resources among individuals or groups loosely connected or dissimilar (Villalonga-Olives & Kawachi, 2015), but which may have consequences for multiple subpopulations. Both bonding and bridging are considered horizontal forms of social capital. Future research also needs to investigate the association between vertical or 'linking' type of social capital and HIV. Specifically, linking social capital considers the connections between individuals and groups with persons and institutions of power or gradients in authority (Szreter & Woolcock, 2004). Research of this type may include, for example, investigating how individuals' relationships with their local political representative influences community resources such as extended hours of HIV testing services, which in-turn may provide opportunities for timely HIV diagnosis and lower rates of delayed HIV diagnosis in a demographic subgroup or geographic area.

Another important direction for the future is collecting structural measures of social capital, which are nearly absent in HIV studies in the US, as most studies have examined cognitive measures such as perception of trust among neighbors. Some have argued and shown with empirical data, that measures such as trust and consensus among actors that dominate public health discourse perpetuate hegemonic constructions that ignore other types of social capital such as informal social norms, collective action, and communication, which might be more relevant for disenfranchised communities (Friedman et al., 2007).

Recent work on structural social capital measures have included census responses rates (Martin & Newman, 2015) and neighborhood block parties (Dean et al., 2015), which are ripe for consideration. Collection of structural measures such as participation rates in volunteer organizations are often available in the US Census data, however, such measures would also require theoretical rationale for appropriateness of use in the specific context being studied.

There is a need also for econometric measures or integral variables (i.e., those directly observable). Developing those measures could use ethnography, community based participatory research that incorporates information communication technologies (ICT) such as photo-elicitation, and other methods including activity space mapping (Petteway, 2015) that incorporates technologies such as global positioning systems (GPS) or other directly observable measures. Another potential avenue is to study the built environment factors that are proposed to improve social capital, such as economic and sustainable investments in communities (e.g., sustainable housing, walkable neighborhoods, shared 'third' places for interaction or community hubs) (Leyden, 2003; LaMore, Link, & Blackmond, 2006; Eicher & Kawachi, 2011). Other avenues to explore the presence of social capital include participation in the political process, and on a macro-level, whether an area had been redistricted which could indicate power differentials of neighborhoods with respect to the local government that

dictates their resources.

Social capital research in public health has infrequently used social network-based approaches (Kawachi & Subramanian, 2017), and studies of social capital and HIV/AIDS in the US are dominated by the social cohesion approach (i.e., measures such as trust and reciprocity). We recommend research integrate social network-based approaches by considering, for example, how individuals or groups are connected to people across varying hierarchies and the quality of resources within or across groups. Potential studies of this type could consider traditional variables in social network analysis, such as size, density and overlap, clustering and centrality (Valente, 2010), but conceptualized in-terms of social capital, for instance considering homophily as a form of linking capital (Lakon, Godette, & Hipp, 2005). Measurement of social capital using the social network approach includes the position generator, which lists a set of occupations with varying prestige and resources, and asks individuals how many individuals they know in each category and how long they know the person (Lin, 1999). There is also the resource generator, which assesses the actual resources available in the specific networks (Van der Gaag & Webber, 2005). From an analytic standpoint, future research could use cross-classified multilevel modeling (Subramanian & Jones, 2003) to examine potential cross-level interactions between social capital and network measures. For instance, an analysis can investigate whether the association between neighborhood social cohesion and individual HIV infection risk is moderated by the size of one's network or the quality of available resources in a network.

4.2.4. Study mechanisms linking social capital to HIV prevention, transmission, and care outcomes

We recommend nuanced investigations among social, environmental, and behavioral mechanisms on the causal pathway (Diez Roux & Mair, 2010) from social capital (at the individual and contextual level) to HIV/AIDS. For example, in international research on the topic, social capital was used to change social norms around HIV stigma, which led to increased individual's likelihood of getting tested for HIV (Nhamo-Murire et al., 2014a, 2014b). Social capital was also used to empower individuals with behavioral resources, which contributed to a decline in future HIV incidence overall (Frumence et al., 2010) and among vulnerable women (Gregson et al., 2011). Therefore, possible pathways to investigate in future research would include HIV stigma and discrimination and sexual minority/structural stigma.

4.3. Limitations of this scoping review

This analysis focused on studies that specifically examined markers of primary and secondary HIV care continuum indicators, and not sexual or other related risk factors (e.g., drug use, condom use, etc.) if they were not studied in association with HIV/AIDS endpoints. We considered social network analysis conceptually distinct from social capital research. While there are social network approaches to measuring social capital, we did not include social network-specific words such as egocentric nor social capital network-specific terms such as position generator, in our search terms. Nevertheless, we do not think excluding those terms would have significantly biased our findings since almost all studies contained social capital in the keywords, and thus would have been included in the initial search for title and abstract review.

We conducted a scoping review and so did not test hypotheses about the magnitude of associations between social capital and the HIV/AIDS outcomes. Next, the sample sizes of the studies varied greatly between 83 and 1873 persons, and some were from clinical samples. Therefore, these variations limited generalizability of our findings. The majority of ecological-level studies on social capital and HIV/AIDS were conducted by the one group of researchers, and the majority of individual-level studies by another group. Both groups of researchers may hold different perspectives of social capital and so may have examined indicators that

closely relate to their view. Nevertheless, we are unable to assess any potential bias since it is also possible that those researchers may have been limited by the measures available in secondary data.

5. Conclusion

The evidence from this scoping review suggests that social capital may be an important determinant of HIV/AIDS prevention, transmission, and treatment outcomes in the US. There is an increasing trend in studies and we provided future directions for research. We recommend more qualitative and mixed-methods studies, assessing social capital nationally and in local contexts such as the Southern region, conduct stratified analysis across sociodemographic subgroups and key populations, and HIV care continuum outcomes beyond diagnosis. Household surveys should consider using other constructs such as informal social control and position and resource generator. We recommend development of econometric measures that are directly observable and for studies to investigate how mechanisms such as stigma link social capital to HIV/AIDS.

Ethical statement

None.

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