Estimating the Number of Young Black Men who have Sex with Men (YBMSM) on the South Side of Chicago: Towards HIV Elimination within US Urban Communities

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ABSTRACT *The rate of HIV infection among young Black men who have sex with men (YBMSM) aged 16–29 is increasing significantly in the United States. Prevention in this population would considerably impact future health-care resources given the need for lifelong antiretrovirals. A YBMSM population estimate is needed to assist HIV prevention program planning. This analysis estimates the number of YBMSM aged 16–29 living on the south side of Chicago (SSC), the Chicago HIV epicenter, as the first step in eliminating HIV in this population. Three methods were utilized to estimate the number of YBMSM in the SSC. First, an indirect approach following the formula a=k/b; where a = the estimated number of YBMSM, k = the average YBMSM HIV prevalence estimate, and b=the YBMSM population-based HIV seropositivity rate. Second, data from the most recent National Survey of Family Growth (NSFG) was used to estimate the proportion of Black men who report having sex with a man. Third, a modified Delphi approach was used, which averaged community expert estimates. The indirect approach yielded an average estimate of 11.7 % YBMSM, the NSFG yielded a 4.2 % (95 % CI 2.28–6.21) estimate, and the modified Delphi approach yielded estimates of 3.0 % (2.3–3.6), 16.8 % (14.5–19.1), and 25 % (22.0–27.0); an average of 14.9 %. The crude average of the three methods was 10.2 %. Applied to SSC, this results to 5,578 YBMSM. The estimate of 5,578 YBMSM represents a group that can be feasibly reached with HIV prevention efforts. Population estimates of those most at risk for HIV will help public health officials allocate resources, offering potential for elimination of new HIV cases.*

KEYWORDS *HIV/AIDS, Men who have sex with men, Black/African-American, Youth, Population estimates*

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BACKGROUND

Young Black men who have sex with men (YBMSM) aged 13–29 are more heavily impacted by the HIV epidemic in the United States than any other group that is at risk for HIV.[1] The rate of new HIV infections increased by 48 % among YBMSM aged 13–29 between 2006–2009, distinguishing the group as the only risk group to experience a statistically significant increase in new infections during the time period.[1] Recent estimates show the rate of new HIV infections among YBMSM aged 13–24 increasing by 17 % between 2009–2010; although this increase was not statistically significant.[2] The state of the HIV epidemic is similar in the city of Chicago. In 2009, 39 % of new HIV infection diagnoses occurred among individuals under 30 years of age, with men who have sex with men (MSM) contact accounting for the majority of transmissions within this age group.[3] The rate of new HIV diagnoses among YBMSM aged 13–29 in Chicago increased from 13.2 % in 2006 to 18.5 % in 2009.[3] HIV prevention in this young population would have considerable impact on future health-care resources given the need for lifelong antiretrovirals. Yet, adequate allocation of HIV prevention resources to at-risk populations, such as YBMSM, has been difficult due to insufficient knowledge about the size of the population.[4] This analysis aims to estimate the number of YBMSM aged 16–29 living on the south side of Chicago (SSC)—the Chicago HIV epicenter—as the first step in eliminating HIV in this population. The estimate will enable state and local agencies to determine the magnitude of HIV prevention resources needed to reach this population.

HIV prevention in this young population is instrumental in efforts toward HIV elimination because it has the potential to reduce the duration of infectiousness among individuals infected at a young age. There has been some debate as to the possibility of HIV elimination in the United States in the foreseeable future.[5,6] What remains clear is that by moving the basic reproductive rate (R_0) to less than one infection per individual living with HIV, overall HIV elimination is possible. R_0 is defined as the product of the annual transmission rate per 100 people $T(x)$ and the duration of infectiousness (D). It has been estimated that if $T(x)$ can be reduced to 2.5 (for a D of 40 years) then R_0 would drop below 1, and this is achievable in the USA with current resource allocation and sufficient investment in evidence-based interventions.[7]

Optimistic projections of HIV reduction have been forwarded, largely in the context of novel biomedical projection such as test and treat models.[8] Recent interventions such as pre-exposure prophylaxis and treatment as prevention may augment future HIV reduction as they have been found to be efficacious in clinical trials.[9,10] However, many operational difficulties will need to be overcome.[11]

By providing a population estimate of the number of YBMSM on the SSC, we will aid HIV prevention program planning efforts by establishing a denominator for a measurable objective. Three methods were used to estimate the population: an indirect approach,[12] a representative population survey,[13] and a modified Delphi technique.[14–16] The utility of each method is discussed and the estimates are triangulated to provide a single estimate of YBMSM living on the SSC.

METHODOLOGY

Population Definition

The population of interest for this estimation is YBMSM aged 16–29 years living on the SSC. Early work from the University of Chicago's Department of Sociology

developed a map of 77 community areas in Chicago, which is now widely used as the reference for the organization of the city.[17] We selected 34 community areas in south Chicago that are a part of the University of Chicago Medicine's encatchment area to be our boundary for the estimation (Fig. 1). This area represents the epicenter of the HIV epidemic in Chicago. According to data from the Chicago Department of Public Health, the SSC has disproportionate rates of HIV infection compared to other parts of the city. In fact, of 20 communities with high annual HIV diagnosis rates, 13 of them form an 8-mile[2] area of which the University of Chicago is embedded: this area includes four of the six communities with the highest annual HIV diagnosis rates in the city (Washington Park, West Englewood, Greater Grand Crossing, and South Shore).[3]
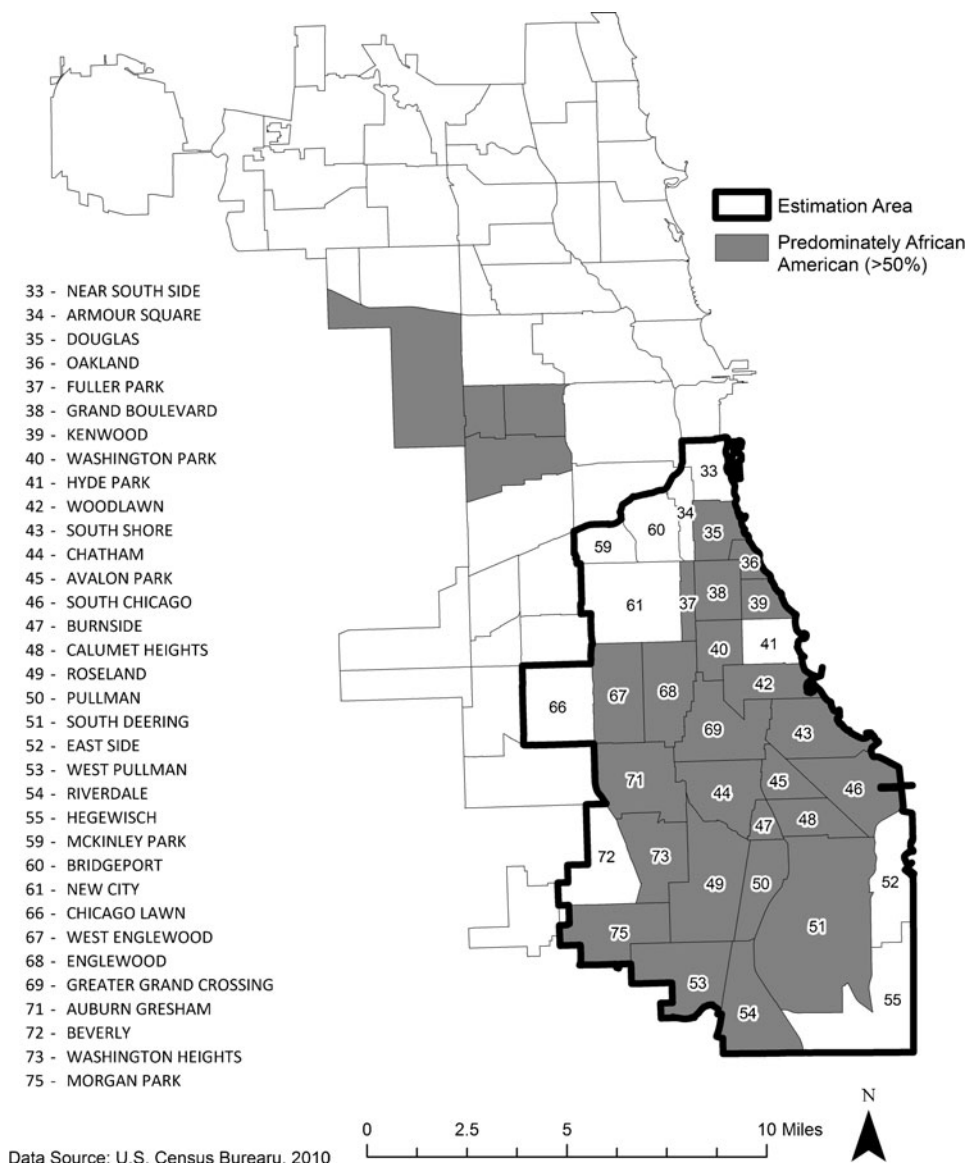

33 - NEAR SOUTH SIDE
34 - ARMOUR SQUARE
35 - DOUGLAS
36 - OAKLAND
37 - FULLER PARK
38 - GRAND BOULEVARD
39 - KENWOOD
40 - WASHINGTON PARK
41 - HYDE PARK
42 - WOODLAWN
43 - SOUTH SHORE
44 - CHATHAM
45 - AVALON PARK
46 - SOUTH CHICAGO
47 - BURNSIDE
48 - CALUMET HEIGHTS
49 - ROSELAND
50 - PULLMAN
51 - SOUTH DEERING
52 - EAST SIDE
53 - WEST PULLMAN
54 - RIVERDALE
55 - HEGEWISCH
59 - MCKINLEY PARK
60 - BRIDGEPORT
61 - NEW CITY
66 - CHICAGO LAWN
67 - WEST ENGLEWOOD
68 - ENGLEWOOD
69 - GREATER GRAND CROSSING
71 - AUBURN GRESHAM
72 - BEVERLY
73 - WASHINGTON HEIGHTS
75 - MORGAN PARK

Data Source: U.S. Census Bureau, 2010

FIGURE 1. Percentage of black residents by Chicago community area.

The SSC is a 95-mile^2 region and is one of the largest contiguous Black urban communities in the USA. Approximately 71 % of the 869,000 people residing in the SSC identify as Black, and 68 % of Chicago's entire Black population resides on the south side.[18] MSM were defined in this analysis as men who have had male–male sexual contact. Black race/ethnicity was defined as self-report of Black or African-American race/ethnicity.

Triangulation

We used a mixed-method triangulation strategy to obtain an estimate of the number of YBMSM living on the SSC. Triangulation strategies incorporate the results of various quantitative and qualitative methods with the purpose of increasing estimate validity. Triangulation presumes that each study design has unique, inherent biases that will be minimized by consolidating results from heterogeneous study designs.[19] We used the triangulation strategy in this analysis to examine estimates from three common, yet diverse, population estimation methods: the indirect approach, a representative population survey, and the modified Delphi technique. Estimates from each method are presented, and the variance between the estimates is discussed.

Indirect Approach

The indirect approach utilizes population-based HIV prevalence rates, average HIV seroprevalence rates, and US census data to estimate the number of MSM in a designated geographic area.[12] Following the methodology developed by Lieb et al., the average YBMSM HIV prevalence estimate among Black men aged 16–29 residing on the SSC is designated as (k), the number of YBMSM residing on the SSC is designated as (a), and the population-based HIV seropositivity rate among YBMSM residing on the SSC is designated as (b). The goal is to derive an estimate of the unknown quantity a from k and b via the function $a = k/b$.

Sources of b: Population-Based Seroprevalence Rate among YBMSM HIV seroprevalence estimates for YBMSM were obtained from two sources: the National HIV Behavioral Surveillance system (NHBS) and the Social Risk and Network Assessment (SRN), both conducted in Chicago during 2008 and 2010, respectively. NHBS is an ongoing CDC-funded surveillance system that collects cross-sectional data on HIV/Sexually Transmitted Infection-risk behaviors, HIV-testing behaviors, and exposure to HIV prevention in populations that are at risk for HIV infection. Further details on NHBS methodology has been published elsewhere.[20]

The NHBS population-based seroprevalence estimates utilized in this paper come from YBMSM who were recruited for NHBS in Chicago. A total of 94 YBMSM aged 18–29 residing in the SSC were recruited and tested for HIV. Twenty-two of the 94 YBMSM tested positive for HIV, resulting in a 23.4 % population-based seroprevalence rate.

The SRN is a social network study that uses respondent-driven sampling to generate a sample of YBMSM in Chicago.[21–23] A total of 97 YBMSM aged 17–29 residing in the SSC were recruited. Twenty-seven of the 97 YBMSM tested positive for HIV, resulting in a 27.8 % population-based seroprevalence rate.

Sources of k: Average HIV Seroprevalence Rate for YBMSM Our estimate of k was obtained from the Chicago Department of Public Health (CDPH) case surveillance data and 2010 US census data. In 2009, a total of 719 YBMSM aged 16–29 were

living with HIV infection in Chicago. We adjusted this number by accounting for an estimated 18 % of YBMSM who are HIV positive but unaware of their infection, yielding 876.8 (719/0.82) YBMSM aged 16–29 living with HIV infection in Chicago. The 18 % HIV positive unaware rate was obtained from the Social Risk and Network Assessment. According to the 2010 US census, there were 54,420 Black males aged 15–29 living in the SSC. Thus, we estimate k to be an average seroprevalence rate of 1,611 YBMSM cases per 100,000 Black males on the SSC (876.8/54,420)×100,000.

Representative Population Survey

The second population estimate uses an estimate of the proportion of Black Men 16–29 in central cities of metropolitan areas from the National Survey of Family Growth (NSFG). The NSFG is a continuous nationally representative multi-stage area probability sample survey that collects data on males and females between the ages of 15–44 from households in the USA. The data presented here are from the most recent NSFG from 2006–2010.[24] Respondents were defined as MSM if they answered yes to any of the following survey questions: "Have you ever performed oral sex on another male, that is, stimulated his penis with your mouth?" "Has another male ever performed oral sex on you, that is, stimulated your penis with his mouth?" "Has another male ever put his penis in your rectum or butt (anal sex)?" and "Have you ever put your penis in his rectum or butt (anal sex)?"

Modified Delphi

The third estimation was derived from a modified Delphi approach.[15] We asked three community experts to independently estimate the number of YBMSM aged 16–29 on the SSC. Community experts selected were BMSM community leaders on the South Side of Chicago who were engaged in HIV prevention and treatment programs in South Chicago since the 1990s.

Community experts were asked to give an approximate percentage (and range) of Black men on the South Side of Chicago ages 16–29 who were MSM. The three community experts provided independent estimations based upon long-term experiences working with MSM in the SSC.

RESULTS

Indirect Approach

YBMSM Estimate (a = k/b) The Chicago NHBS yielded an estimate of 6,885 YBMSM in the SSC, which corresponds to 12.7 % of the 54,420 young Black males in the SSC. Likewise, the SRN yielded an estimate of 5,795 young YBMSM in the SSC, which corresponds to 10.6 % of the 54,420 young Black males in the SSC. The average of the two estimates results in a total of 6,340 YBMSM in the SSC and 11.7 % of the total young Black male population in the SSC (Table 1).

Representative Population Survey

A total of 10,403 men were interviewed as a part of the NSFG and 33 % were from central cities of US metropolitan areas. There were 628 Black males between the ages of 16 and 29 who lived in urban centers. Of the 628 young Black men living in big cities, 4.2 % (95 % CI 2.28–6.21) responded yes to at least one of the aforementioned MSM

TABLE 1   Indirect approach: estimate of the number of YBMSM age 16–29 on the south side of Chicago, 2010

k Average YBMSM HIV prevalence estimate[a,b]	*b* YBMSM HIV population-based seropositivity rate	*a = k/b* Estimated number of YBMSM	Average *a*[c]
1,611	23.4 % (Chicago HIV Behavioral Surveillance)	6,885	6,340
	27.8 % (Social Risk and Network Assessment)	5,795	

[a]Number of HIV + YBMSM adjusted for an estimated 18 % who are unaware of their HIV positive status
[b]*k* = Number of HIV + YBMSM/number of young black males
[c]Average of NHBS estimated number of YBMSM and the SRN estimated number of YBMSM (6685 + 5795/2)

survey questions; thus, when applied to the 54,420 young Black males in the SSC, the NSFG yields an estimate of 2,286 (1,241–3,379) YBMSM aged 16–29 living on the South Side of Chicago.[24]

Modified Delphi

The three estimates generated by the community experts were the following: 3 % (2.3–3.6), 16.8 % (14.5–19.1), and 25 % (22.0–27.0). We standardized these three estimates by taking the average. This resulted in an estimated 8,109 YBMSM aged 16–29 in the SSC, or 14.9 % of the total 54,420 young Black males in the SSC.
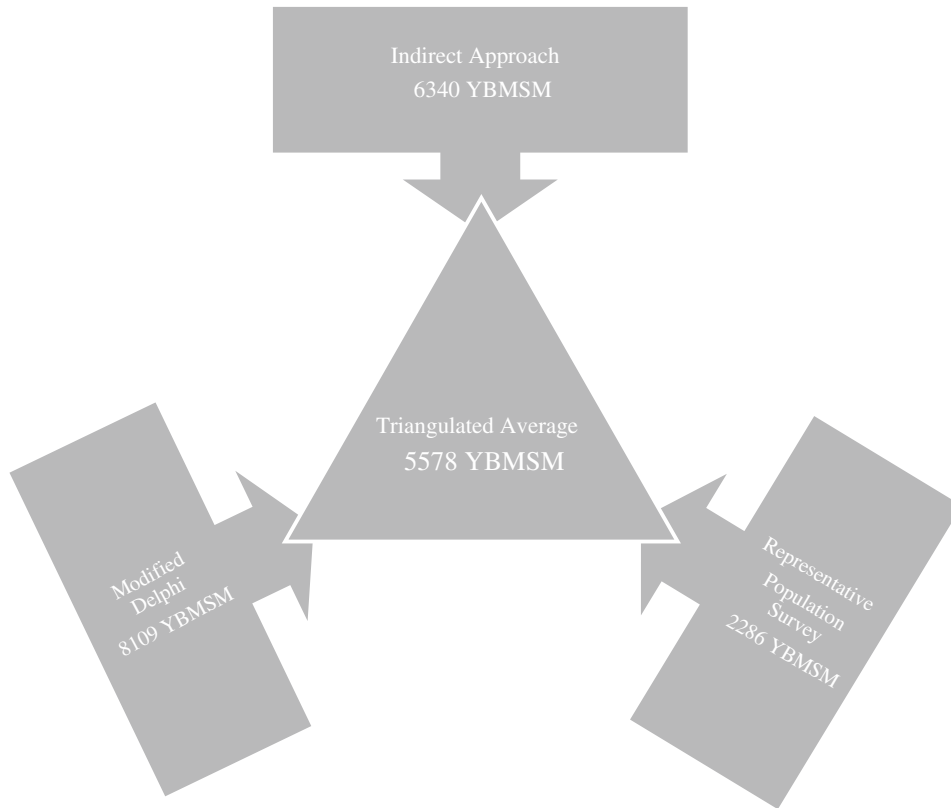
Triangulated Estimate

The results and specifications of each method can be seen in Table 2. To obtain one overall population estimate, we took a crude average of the three methods, which yields a YBMSM population estimate of 10.2 % of Black males age 16–29 on the SSC, with a range of 4.2–14.9 %. Applied to SSC, the combined estimates result in 5,578 YBMSM (Fig. 2).

TABLE 2   Results by method: estimate of the number of YBMSM Age 16–29 on the SSC, 2010

Method	Data source	Age range	YMSM estimate *n* (%)[b]
Total Black Males in SSC[a]	2010 US Census	15–29	
Indirect Approach			6,340 (11.7)
	NHBS	18–29	
	SRN	17–29	
	CDPH Case Surveillance	16–29	
Representative Population Survey			2,286 (4.2)
	NSFG	16–29	
Modified delphi			8,109 (14.9)
	Community experts	16–29	
Triangulated estimate			5,578 (10.2)

[a]Total Black males in SSC = 54,420
[b] Percentage of total Black males in SSC

FIGURE 2.   Triangulated population estimate.

DISCUSSION

Our method suggests that approximately 10.2 % (4.2–14.9 %) of Black males aged 16–29 on the SSC are MSM. Estimates of this particular population have not been published previously. Previous MSM population estimates have only been calculated for MSM over the age of 18 years in other large urban areas.[25–27]

A standard method for estimating at-risk populations has not been developed.[4] We chose three approaches, each with their own set of limitations. The modified Delphi method may have produced an overestimate due to the community experts being members of the estimated population. We note that one of the community expert estimates was significantly higher than the other community expert estimates (25 %). When this estimate is excluded, the triangulated estimate changes by 1.6 % to 8.6 % (4,671) of Black males aged 16–29 on the SSC being MSM. Likewise, the representative population survey may have produced an underestimate due to self-report of sensitive behaviors. The parameters used for the indirect method are subject to the limitations of NHBS and SRN, and the HIV case surveillance data is subject to limitations due to incomplete reporting of diagnoses and risk categories. The lower limit of the age range used in the indirect calculation also varied between 15 to 18 years of age in the different data sources. Despite these limitations, the indirect method has been effectively implemented in previous analyses,[26] and our application of a triangulated average helps to mitigate the limitations of each

method individually. The application of these three methods offers a pragmatic alternative to more costly population estimation methods.

The estimate of YBMSM on the SSC derived from this analysis will help substantially with HIV prevention planning efforts among this population. The estimate of approximately 5,578 YBMSM represents a group that can be feasibly reached with HIV prevention efforts. In 2012, the CDPH allocated $218,643 for HIV prevention among young MSM on the South Side of Chicago. The $218,643 represents 4 % of the total HIV prevention funding from CDPH, and 21 % of CDPH HIV prevention funding for the SSC.[28] Using our population estimate, this relates to approximately $40 per YBMSM. While our study population may be difficult to reach, efforts targeted at this group will have a large impact in terms of both cost and HIV reduction. Farnham et al. estimate the lifetime cost of HIV infection, exclusive of costs due to loss of productivity, to be $367,134 (2009 US dollars).[29] This cost would likely be higher for those in our target population due to their young age. Increasing HIV prevention in this population would have a substantial impact in terms of both cost and reduction of disease. Estimating the size of populations most at risk for HIV will help public health officials allocate resources appropriately as we begin the process of moving R_0 below 1 in domestic urban HIV epicenters.

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