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RESEARCH ARTICLE

An Examination of Geographic Differences in Social Determinants of Health Among Women with Diagnosed HIV in the United States and Puerto Rico, 2017

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Abstract:

Objective:

To examine differences, at the census tract level, in the distribution of human immunodeficiency virus (HIV) diagnoses and social determinants of health (SDH) among women with diagnosed HIV in 2017 in the United States and Puerto Rico.

Background:

In the United States, HIV continues to disproportionately affect women, especially minority women and women in the South.

Methods:

Data reported in the National HIV Surveillance System (NHSS) of the Centers for Disease Control and Prevention were used to determine census tract-level HIV diagnosis rates and percentages among adult women (aged ≥18 years) in 2017. Data from the American Community Survey were combined with NHSS data to examine regional differences in federal poverty status, education level, income level, employment status, and health insurance coverage among adult women with diagnosed HIV infection in the United States and Puerto Rico.

Results:

In the United States and Puerto Rico, among 6,054 women who received an HIV diagnosis in 2017, the highest rates of HIV diagnoses generally were among those who lived in census tracts where the median household income was less than $40,000; at least 19% lived below the federal poverty level, at least 18% had less than a high school diploma, and at least 16% were without health insurance.

Conclusion:

This study is the first of its kind and gives insight into how subpopulations of women are affected differently by the likelihood of an HIV diagnosis. The findings show that rates of HIV diagnosis were highest among women who lived in census tracts having the lowest income and least health coverage.

Keywords: HIV, Census tract, Healthcare, Poverty, Social determinants of health, Women.

1. INTRODUCTION

Although the rates of new Human Immunodeficiency Virus (HIV) infections in the United States have declined greatly, women are still affected heavily, especially Black/African American (here inafter referred to as Black) women and women living in the South [1]. HIV among Black women has decreased [1], but the rate among Black women is on ave-

rage 5 times the rate among White women [2, 3]. In the United States, HIV diagnosis rates vary across the states and regions. Although only 37% of the United States population lives in the South, that region accounted for 53% (19,968 of 37,377) of HIV diagnoses in 2017 [1, 4]. More specifically, women who lived in the southern region had the highest rates of diagnosis of HIV infection in 2017 (4,010/6,986), with the highest rates being among Blacks (26.2), followed by Hispanics/Latinos (5.8), and Whites (2.4) [1].

Several factors, commonly referred to as social determinants of health (SDH), contribute to these disparities.

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The World Health Organization (WHO) defines SDH as the conditions in which people are born, grow, live, work, and age [5]. Economic and social stressors, such as lack of transportation, lack of childcare, and transient housing are additional factors that can cause disparities among women, particularly minority women [2 - 7]. A report from the Centers for Disease Control and Prevention (CDC) identified several factors common among women who had the highest HIV diagnosis rates [2]. In general, those women had less than a high school diploma, had incomes below the federal poverty level, had the lowest median household income, were unemployed, did not have health insurance or a health coverage plan, and lived in areas with the highest percentage of vacant housing units [2].

Much research has been conducted to better understand and highlight how HIV affects women [8 - 11]. Disparities in HIV infection, access to care, and subsequent viral suppression differ among women of color. Therefore, a federal initiative, *Ending the HIV Epidemic: A Plan for America (EHE),* and CDC's HIV/AIDS Strategic Plan [12, 13], are addressing the need to reduce health disparities among certain populations, such as women. Additionally, the CDC HIV/AIDS prevention goals target specific populations, including Black women (reducing the rate of diagnoses by at least 15%) and people in the South (reducing the rate of new diagnoses by 15%) [13]. To achieve the goals set forth by these federal initiatives, an improved understanding of the social determinants that affect the health of women, particularly minority women, is important. Therefore, this analysis examined the differences, at the census tract level, in the distribution of HIV diagnosis and SDH among women with diagnosed HIV infection in 2017, by region, as specified in the U.S. Census Bureau's division of the 50 states [14].

2. METHODS

Data from CDC's National HIV Surveillance System (NHSS) and the U.S. Census Bureau's American Community Survey (ACS) were used for this analysis.

2.1. NHSS

Numbers, rates, and percentages of diagnoses of HIV infection for 2017 were based on cases reported to NHSS from 2017 to December 2018. Those include cases among women aged 18 years and older whose HIV infection was diagnosed during 2017, regardless of the stage of disease at diagnosis. HIV surveillance data were geocoded to the census tract level for addresses of residence at the time of diagnosis and linked at the census tract level to the SDH indicator variable data from the ACS.

The NHSS is a population-based database of all persons in the United States and Puerto Rico with diagnosed HIV infection, based on standard, robust statistical methodology. Annual evaluation of NHSS data show that as of December 2017, the completeness of reporting of HIV infection was estimated to be at least 85% [1]. Because NHSS is a comprehensive national surveillance system that contains data on nearly all people with diagnosed HIV in the United States, no statistical tests of significance were applied to the data.

2.2. ACS

Census tract level SDH data on federal poverty status, education level, median household income, employment status, and health insurance coverage were obtained from the ACS 2013–2017, with 5-year estimates [15]. Those five SDH indicator variables are generally recognized as key determinants that affect women in the United States [16 - 18]. The selected SDH variables were categorized by using empirically derived quartiles, determined based on data from all census tracts in the United States and Puerto Rico.

2.3. Analysis

This ecological analysis used NHSS data from the 50 states, the District of Columbia, and Puerto Rico to examine distributions of HIV diagnoses by age group, race/ethnicity, transmission category, residence at time of diagnosis, and SDH indicators among women with a diagnosis of HIV infection in 2017. Because a substantial proportion of cases of HIV infection are reported to CDC without an identified risk factor, multiple imputation was used to assign a transmission category [19].

Percentages and rates of HIV diagnoses per 100,000 population were calculated by region for adult women (aged ≥18 years). Distributions were assessed by age group, race/ethnicity, transmission category, residence at the time of diagnosis (urban, suburban, rural, or unknown), and SDH indicator variables in each census tract. The denominators used for calculating age and race/ethnicity-specific rates were computed by applying the 5-year (2013–2017) estimates for age, sex, and race/ethnicity for these areas [20].

The denominator population from the ACS was based on all women aged 18 years and older. ACS uses predetermined age categories and varying criteria for SDH variables, so the denominators differ for some SDH variables. The numerator population was limited to women aged 18 years and older whose HIV infection had been diagnosed and reported with complete residential address information that could be geocoded to the census tract level. Cases or census tracts were excluded if 1) the address was nonresidential (*e.g.*, military base, corrections facility, *etc*.), 2) no census tract was associated with the case, 3) no SDH information was available for the census tract, or 4) the census tract from the surveillance data could not be matched to a census tract provided by ACS. Regions were based on the U.S. Census Bureau's division of the 50 states [15] and one U.S. territory: Puerto Rico. Area of residence was defined as urban (metropolitan area ≥500,000 population), suburban (metropolitan area of 50,000–499,999 population), or rural (nonmetropolitan population) [14]. SAS version 9.4 (SAS Institute, Inc., Cary, NC) was used to conduct all analyses.

3. RESULTS

This analysis used data on 6,054 adult women with HIV infection diagnosed in 2017 that included sufficient residential address information for geocoding to census tracts for 5,972 women in the United States and 82 women in Puerto Rico. The overall rate (per 100,000 population) of diagnoses of HIV infection among women in the United States and Puerto Rico

was 2.4. Because of the small cell sizes, results stratified by demographic and SDH characteristics for women in Puerto Rico are not discussed.

In terms of the U.S. region, the overall rate of diagnosis was highest in the South (2.4), followed by the Northeast (1.5), the Midwest (1.0) and the West (0.9) (Table **1**). By age, the highest rates were among women aged 35–44 years for the Northeast (3.5), and West (1.9) and among women aged 25–34 years in the Midwest (2.8) and the South (5.7). By race/ethnicity, Black women had the highest HIV diagnosis rates in every region: Northeast (22.5), Midwest (17.7), South (24.4), and West (18.2). By transmission category, in every region, the largest percentages of HIV diagnoses were among women with HIV infection attributed to heterosexual contact: Northeast (83.3%), Midwest (83.3%), South (90.1%), and West (80.9%). By residence area, in every region, the largest percentages were in urban areas: Northeast (92.3%), Midwest (79.5%), South (76.2%), and West (88.3%) (Table **1**).

Table 1. Diagnoses of HIV infection among adult women, by U.S. Census region[a] and selected characteristics, 2017─United States, the District of Columbia and Puerto Rico.

-	Northeast			Midwest			South			West			Subtotal			Puerto Rico			Total		
-	No.	%	Rate	No.	%	Rate	No.	%	Rate	No.	%	Rate	No.	%	Rate	No.	%	Rate	No.	%	Rate
Age group at diagnosis (yrs.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18–24	101	9.5	1.9	123	15.9	1.9	469	13.9	4.1	100	13.3	1.4	793	13.3	2.6	*	*	*	797	13.2	5.2
25–34	253	23.8	3.3	245	31.6	2.8	943	27.9	5.7	200	26.5	1.8	1,641	27.5	3.7	17	20.7	3.5	1,658	27.4	7.5
35–44	245	23.0	3.5	178	23.0	2.2	775	23.0	4.9	186	24.6	1.9	1,384	23.2	3.4	17	20.7	3.4	1,401	23.1	6.8
45–54	250	23.5	3.0	124	16.0	1.4	647	19.2	3.9	148	19.6	1.5	1,169	19.6	2.7	25	30.5	4.8	1,194	19.7	5.4
55–64	166	15.6	2.1	86	11.1	0.9	407	12.1	2.6	102	13.5	1.1	761	12.7	1.8	14	17.1	2.8	775	12.8	3.6
65+	50	4.7	0.5	19	2.5	0.2	136	4.0	0.7	19	2.5	0.2	224	3.8	0.4	*	*	*	229	3.8	0.9
Race	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
American Indian/Alaska Native	*	*	*	*	*	*	*	*	*	12	1.6	2.6	27	0.5	2.8	*	*	*	27	0.5	—
Asian	14	1.3	0.9	16	2.1	1.9	30	0.9	1.8	44	5.8	1.3	104	1.7	1.4	*	*	*	104	1.7	—
Black/African American	617	57.9	22.5	483	62.3	17.7	2,273	67.3	24.4	241	31.9	18.2	3,614	60.5	22.4	*	*	*	3,614	59.7	—
Hispanic/Latino[b]	246	23.1	8.7	54	7.0	3.4	415	12.3	5.9	229	30.3	3.0	944	15.8	5.0	81	98.8	5.6	1,025	16.9	—
Native Hawaiian/Other Pacific Islander	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
White	148	13.9	0.9	195	25.2	0.9	584	17.3	2.0	200	26.5	1.3	1,127	18.9	1.4	*	*	*	1,128	18.6	—
Multiple races	38	3.6	8.7	23	3.0	5.3	61	1.8	7.0	25	3.3	2.4	147	2.5	5.3	*	*	*	147	2.4	—
Transmission category[c]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Injection drug use	173	16.3	—	122	15.7	—	326	9.6	—	139	18.4	—	760	12.7	—	*	*	—	769	12.7	—
Hetrosexual contact[d]	887	83.3	—	645	83.3	—	3,042	90.1	—	611	80.9	—	5,184	86.8	—	75	91.6	—	5,263	86.9	—
Other[e]	*	*	—	*	*	—	*	*	—	*	*	—	28	0.5	—	*	*	—	33	0.6	—
Residence area at diagnosis[f]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Urban	983	92.3	—	616	79.5	—	2,574	76.2	—	667	88.3	—	4,840	81.0	—	56	68.3	—	4,896	80.9	—
Suburban	68	6.4	—	108	13.9	—	524	15.5	—	67	8.9	—	767	12.8	—	25	30.5	—	792	13.1	—
Rural	14	1.3	—	51	6.6	—	239	7.1	—	21	2.8	—	325	5.4	—	*	*	—	326	5.4	—
Unknown	*	*	—	*	*	—	40	1.2	—	*	*	—	40	0.7	—	*	*	—	40	0.7	—
Social Determinants of Health	-	-		-	-		-	-		-	-		-	-		-	-		-	-	
Below federal poverty level (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<7	169	15.9	0.6	87	11.2	0.3	385	11.4	1.1	111	14.7	0.4	752	12.6	0.7	*	*	*	752	12.4	1.0
7.00–10.99	131	12.3	0.9	93	12.0	0.5	492	14.6	1.7	140	18.5	0.7	856	14.3	1.0	*	*	*	856	14.1	1.5
11.00–18.99	245	23.0	1.8	215	27.7	1.1	987	29.2	2.3	213	28.2	0.9	1,660	27.8	1.6	*	*	*	1,662	27.5	2.4
≥19	520	48.8	4.2	380	49.0	2.6	1,513	44.8	4.4	291	38.5	1.6	2,704	45.3	3.4	80	97.6	1.9	2,784	46.0	5.0
Less than high school diploma (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<6	85	8.0	0.4	107	13.8	0.4	325	9.6	1.1	98	13.0	0.4	615	10.3	0.6	*	*	*	617	10.2	0.9
6.00–10.99	169	15.9	0.8	178	23.0	0.6	615	18.2	1.8	146	19.3	0.7	1,108	18.6	1.1	*	*	*	1,110	18.3	1.6
11.00–17.99	275	25.8	2.0	224	28.9	1.3	913	27.0	2.3	145	19.2	0.8	1,557	26.1	1.8	14	17.1	1.4	1,571	26.0	2.7
≥18	536	50.3	4.3	266	34.3	2.6	1,524	45.1	3.8	366	48.5	1.6	2,692	45.1	3.1	64	78.1	2.0	2,756	45.5	4.7
Median household income (U.S. $)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(Table 1) contd.....

<40,000	440	41.3	4.3	388	50.1	2.6	1,549	45.9	4.2	222	29.4	1.7	2,599	43.5	3.5	81	98.8	1.9	2,680	44.3	5.1
40,000–53,999	234	22.0	1.8	197	25.4	0.9	861	25.5	2.2	187	24.8	1.0	1,479	24.8	1.6	*	*	*	1,480	24.5	2.4
54,000–74,999	218	20.5	1.1	132	17.0	0.5	629	18.6	1.8	191	25.3	0.8	1,170	19.6	1.1	*	*	*	1,170	19.3	1.7
≥75,000	173	16.2	0.6	58	7.5	0.3	337	10.0	1.1	155	20.5	0.5	723	12.1	0.7	*	*	*	723	11.9	1.0
Unemployed (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<2	45	4.2	0.5	80	10.3	0.5	252	7.5	1.1	50	6.6	0.5	427	7.2	0.7	*	*	*	430	7.1	1.0
2.00–3.99	238	22.4	0.8	173	22.3	0.5	862	25.5	1.5	214	28.3	0.6	1,487	24.9	1.0	*	*	*	1,493	24.7	1.5
4.00–5.99	258	24.2	1.4	169	21.8	1.1	1,022	30.3	2.7	260	34.4	1.0	1,709	28.6	1.8	14	17.1	1.5	1,723	28.5	2.7
≥6	524	49.2	4.2	353	45.6	2.8	1,241	36.8	4.9	231	30.6	1.2	2,349	39.3	3.4	59	72.0	2.0	2,408	39.8	5.1
Without health insurance (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<6	223	20.9	0.7	101	13.0	0.3	195	5.8	1.0	83	11.0	0.4	602	10.1	0.6	20	24.4	1.0	622	10.3	0.9
6.00–9.99	214	20.1	1.2	176	22.7	0.8	361	10.7	1.4	155	20.5	0.7	906	15.2	1.0	34	41.5	1.8	940	15.5	1.6
10.00–15.99	309	29.0	2.8	229	29.6	1.4	710	21.0	1.8	165	21.9	0.7	1,413	23.7	1.6	21	25.6	3.0	1,434	23.7	2.4
≥16	319	30.0	4.1	269	34.7	2.7	2,111	62.5	3.7	352	46.6	1.6	3,051	51.1	3.2	*	*	*	3,058	50.5	4.8
Total[g]	1,065	100	1.5	775	100	1.0	3,377	100	2.4	755	100	0.9	5,972	100	1.6	82	100	1.8	6,054	100	2.4

Abbreviation: Asterisk (*) indicates cell too small (<12 diagnoses during the year) and data has been suppressed. Dash (—) indicates absence of denominator data and rate is not calculated.

Note: Rates are per 100,000 population. Rates are not calculated by transmission category because of the lack of denominator data. The American Community Survey does not provide age- and sex-specific social determinants of health variables stratified by race and ethnicity for racial groups except Whites (i.e., White, not-Hispanic/Latino). Therefore, the denominators used for computing race-specific rates may include Hispanics/Latinos and should be interpreted with caution.

[a] Northeast: Connecticut, Maine, New Hampshire, New Jersey, New York, Pennsylvania, and Rhode Island; Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; South: Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; West: Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

[b] Hispanics/Latinos can be of any race.

[c] Data have been statistically adjusted to account for the missing transmission category.

[d] Heterosexual contact with a person known to have, or to be at high risk for, HIV infection.

[e] Includes hemophilia, blood transfusion, perinatal exposure, and risk factor not reported or not identified.

[f] Urban: population of ≥500,000. Suburban: population of 50,000– 499,999. Rural: nonmetropolitan area (<50,000)

[g] Totals do not represent all adults whose HIV infection was diagnosed during 2017 in these areas.

By race/ethnicity and age, among white women, those aged 25–34 years had the highest rates of HIV diagnoses (in every region) (Table **2**). Among Black women, those aged 25–34 years in the Midwest and South and those aged 35–44 years in the Northeast and West had the highest rates. Among Hispanic/Latino women, those aged 45–54 years had the highest rates in all regions except for the South, where those aged 25–34 years had the highest rate (Table **2**). By race/ethnicity and transmission category, the largest percentages of HIV diagnoses were among women with HIV infection attributed to heterosexual contact, regardless of region or race/ethnicity. By race/ethnicity and residence area, the largest percentages were among women who lived in urban areas.

Table 2. Percentages and rates of diagnoses of HIV infection among women, by U.S. Census region[a], race/ethnicity and selected characteristics, 2017─United States, the District of Columbia and Puerto Rico.

-	White									
-	**Northeast**		**Midwest**		**South**		**West**		**Puerto Rico**	
-	**%**	**Rate**	**%**	**Rate**	**%**	**Rate**	**%**	**Rate**	**%**	**Rate**
Age group at diagnosis (yrs.)	-	-	-	-	-	-	-	-	-	-
18–24	10.1	0.9	15.4	1.3	12.7	2.6	8.5	1.1	0.0	0.0
25–34	26.4	1.7	30.3	1.9	28.8	3.9	32.0	2.6	0.0	0.0
35–44	16.9	1.2	22.1	1.4	24.3	3.4	23.0	2.0	0.0	0.0
45–54	29.1	1.5	15.9	0.9	19.5	2.3	20.5	1.6	100.0	43.1
55–64	14.9	0.8	15.4	0.8	12.0	1.3	13.5	0.9	0.0	0.0
65+	2.7	0.1	1.0	0.0	2.7	0.2	2.5	0.1	0.0	0.0
Transmission category[c]	-	-	-	-	-	-	-	-	-	-
Injection drug use	40.1	-	33.1	-	26.4	-	32.5	-	0.0	-
Heterosexual contact[d]	59.6	-	66.5	-	73.5	-	66.7	-	100	-
Other[e]	0.3	-	0.5	-	0.2	-	0.8	-	0.0	-
Residence area at diagnosis[f]	-	-	-	-	-	-	-	-	-	-
Urban	79.1	-	70.8	-	65.2	-	82.5	-	100	-
Suburban	15.5	-	18.5	-	22.6	-	12.0	-	0.0	-

(Table 2) contd.....

	%	Rate	%	Rate	%	Rate	%	Rate	%	Rate
Rural	5.4	-	10.8	-	11.3	-	5.5	-	0.0	-
Unknown	0.0	-	0.0	-	0.9	-	0.0	-	0.0	-
Social Determinants of Health	-	-	-	-	-	-	-	-	-	-
Below the federal poverty level (%)	-	-	-	-	-	-	-	-	-	-
<7	32.4	0.6	15.4	0.4	17.8	1.3	20.5	0.8	0.0	0.0
7.00–10.99	14.2	0.6	16.9	0.6	20.4	1.8	25.5	1.2	0.0	0.0
11.00–18.99	26.4	1.4	30.8	1.2	31.5	2.1	22.5	1.1	0.0	0.0
≥19	27.0	2.8	36.9	2.8	30.3	3.5	31.5	3.0	100	10.7
Less than high school diploma (%)	-	-	-	-	-	-	-	-	-	-
<6	19.6	0.5	19.0	0.5	12.7	1.0	22.0	0.7	0.0	0.0
6.00–10.99	32.4	0.8	26.7	0.7	25.3	2.0	26.0	1.1	0.0	0.0
11.00–17.99	22.3	1.1	26.7	1.2	31.3	2.3	18.0	1.2	100	48.7
≥18	25.7	3.4	27.7	3.3	30.7	3.0	34.0	3.6	0.0	0.0
Median household income (U.S. $)	-	-	-	-	-	-	-	-	-	-
<40,000	18.9	2.3	38.5	2.7	31.2	3.2	24.5	3.0	100	10.9
40,000–53,999	25.0	1.4	28.2	0.9	30.5	2.1	19.5	1.2	0.0	0.0
54,000–74,999	26.4	0.8	24.6	0.7	24.8	1.9	30.0	1.3	0.0	0.0
≥75,000	29.7	0.6	8.7	0.3	13.5	1.1	26.0	0.8	0.0	0.0
Unemployed (%)	-	-	-	-	-	-	-	-	-	-
<2	8.1	0.5	18.0	0.7	12.2	1.2	9.5	0.7	0.0	0.0
2.00–3.99	39.9	0.8	28.2	0.6	38.0	1.8	33.0	1.0	0.0	0.0
4.00–5.99	29.7	1.1	23.1	1.1	28.9	2.4	31.5	1.5	0.0	0.0
≥6	22.3	2.1	30.8	3.0	20.9	3.7	26.0	2.3	100	17.9
Without health insurance (%)	-	-	-	-	-	-	-	-	-	-
<6	46.0	0.8	19.5	0.4	10.5	1.2	19.0	0.8	0.0	0.0
6.00–9.99	23.7	0.9	28.7	0.9	16.8	1.5	29.0	1.3	100	25.0
10.00–15.99	19.6	1.5	26.7	1.3	27.9	1.8	19.0	0.9	0.0	0.0
≥16	10.8	2.3	25.1	3.0	44.9	3.1	33.0	2.9	0.0	0.0
Total[g]	**100**	**0.9**	**100**	**0.9**	**100**	**2.0**	**100**	**1.3**	**100**	**9.3**
-					**Black**					
-	**Northeast**		**Midwest**		**South**		**West**		**Pureto Rico**	
-	**%**	**Rate**	**%**	**Rate**	**%**	**Rate**	**%**	**Rate**	**%**	**Rate**
Age group at diagnosis (yrs.)	-	-	-	-	-	-	-	-	-	-
18–24	9.9	16.0	16.4	19.3	14.0	24.0	12.9	16.4	0.0	0.0
25–34	22.5	27.1	33.8	31.4	28.0	35.6	20.8	19.0	0.0	0.0
35–44	24.3	32.6	22.8	23.6	22.6	31.4	25.3	27.4	0.0	0.0
45–54	21.6	26.8	13.5	14.0	18.7	25.8	19.5	19.9	0.0	0.0
55–64	16.1	23.4	11.0	12.4	12.4	19.1	17.8	20.8	0.0	0.0
65+	5.7	7.5	2.7	3.0	4.3	6.9	3.7	4.3	0.0	0.0
Transmission category[c]	-	-	-	-	-	-	-	-	-	-
Injection drug use	11.4	-	9.5	-	5.5	-	10.7	-	0.0	-
Heterosexual contact[d]	88.2	-	89.1	-	94.1	-	87.9	-	0.0	-
Other [e]	0.4	-	1.4	-	0.4	-	1.4	-	0.0	-
Residence area at diagnosis [f]	-	-	-	-	-	-	-	-	-	-
Urban	95.0	-	85.1	-	77.3	-	95.0	-	0.0	-
Suburban	5.0	-	11.4	-	14.9	-	3.7	-	0.0	-
Rural	0.0	-	3.5	-	6.4	-	1.2	-	0.0	-
Unknown	0.0	-	0.0	-	1.4	-	0.0	-	0.0	-
Social Determinants of Health	-	-	-	-	-	-	-	-	-	-
Below federal poverty level (%)	-	-	-	-	-	-	-	-	-	-
<7	13.6	17.7	8.7	13.4	9.6	15.7	10.8	10.9	0.0	0.0
7.00–10.99	11.7	17.8	9.1	13.5	12.6	20.4	19.1	17.6	0.0	0.0
11.00–18.99	23.0	21.1	24.6	18.8	28.0	23.3	29.5	18.1	0.0	0.0
≥19	51.7	26.8	57.6	19.1	49.9	30.0	40.7	22.7	0.0	0.0
Less than high school diploma (%)	-	-	-	-	-	-	-	-	-	-

(Table 2) contd.....

	%	Rate	%	Rate	%	Rate	%	Rate	%	Rate
<6	6.0	13.4	10.6	12.6	8.6	16.9	8.3	9.7	0.0	0.0
6.00–10.99	14.3	16.2	20.5	16.3	16.5	18.9	21.6	19.0	0.0	0.0
11.00–17.99	29.7	21.9	31.3	18.0	26.7	22.3	25.7	20.6	0.0	0.0
≥18	50.1	28.3	37.7	20.8	48.2	31.8	44.4	19.6	0.0	0.0
Median household income (U.S. $)	-	-	-	-	-	-	-	-	-	-
<40,000	45.9	27.3	58.2	19.0	51.6	29.5	30.7	24.2	0.0	0.0
40,000–53,999	21.4	21.9	22.4	17.8	22.8	22.3	27.0	20.1	0.0	0.0
54,000–74,999	18.5	19.3	13.9	16.1	16.9	21.3	22.8	14.8	0.0	0.0
≥75,000	14.3	17.4	5.6	12.4	8.6	16.7	19.5	14.6	0.0	0.0
Unemployed (%)	-	-	-	-	-	-	-	-	-	-
<2	2.8	13.4	6.4	16.9	5.7	17.6	5.4	16.6	0.0	0.0
2.00–3.99	17.8	18.1	16.8	15.7	20.6	18.7	27.0	19.3	0.0	0.0
4.00–5.99	23.3	20.1	21.1	19.1	29.6	25.3	38.6	22.6	0.0	0.0
≥6	56.1	26.7	55.7	18.0	44.1	29.5	29.1	14.0	0.0	0.0
Without health insurance (%)	-	-	-	-	-	-	-	-	-	-
<6	17.8	19.8	9.7	11.4	5.0	15.8	6.6	8.2	0.0	0.0
6.00–9.99	18.5	16.4	20.1	15.7	9.8	17.5	19.1	17.5	0.0	0.0
10.00–15.99	31.9	23.0	31.3	17.2	20.1	18.2	25.3	16.5	0.0	0.0
≥16	31.8	30.8	38.9	22.9	65.2	30.8	49.0	23.7	0.0	0.0
Total[g]	**100**	**22.5**	**100**	**17.7**	**100**	**24.4**	**100**	**18.2**	**0.0**	**0.0**
-	**Hispanic/Latino[b]**									
-	**Northeast**		**Midwest**		**South**		**West**		**Pureto Rico**	
-	**%**	**Rate**	**%**	**Rate**	**%**	**Rate**	**%**	**Rate**	**%**	**Rate**
Age group at diagnosis (yrs.)	-	-	-	-	-	-	-	-	-	-
18–24	8.1	4.5	14.8	2.7	15.7	5.8	18.8	3.2	4.9	2.4
25–34	24.4	9.6	27.8	3.9	27.0	7.2	27.1	3.6	21.0	7.7
35–44	23.6	10.2	16.7	2.5	23.1	6.4	23.1	3.4	21.0	7.5
45–54	25.6	12.8	29.6	6.3	18.8	6.5	20.5	3.7	29.6	10.0
55–64	14.6	10.4	3.7	1.2	10.8	5.5	8.7	2.3	17.3	6.0
65+	3.7	2.6	7.4	3.0	4.6	2.2	1.8	0.5	6.2	1.4
Transmission category[c]	-	-	-	-	-	-	-	-	-	-
Injection drug use	13.9	-	12.2	-	7.3	-	16.2	-	8.5	-
Heterosexual contact[d]	85.4	-	87.6	-	92.7	-	83.7	-	91.5	-
Other[e]	0.7	-	0.2	-	0.1	-	0.1	-	0.0	-
Residence area at diagnosis[f]	-	-	-	-	-	-	-	-	-	-
Urban	93.5	-	68.5	-	85.8	-	86.9	-	67.9	-
Suburban	4.1	-	14.8	-	8.7	-	11.4	-	30.9	-
Rural	2.4	-	16.7	-	4.8	-	1.8	-	1.2	-
Unknown	0.0	-	0.0	-	0.7	-	0.0	-	0.0	-
Social Determinants of Health	-	-	-	-	-	-	-	-	-	-
Below the federal poverty level (%)	-	-	-	-	-	-	-	-	-	-
<7	8.9	4.0	14.8	2.4	11.6	3.8	11.4	2.2	0.0	0.0
7.00–10.99	13.0	7.3	16.7	2.8	16.1	5.3	12.7	2.1	0.0	0.0
11.00–18.99	19.9	7.1	38.9	4.1	30.4	5.7	32.3	3.0	2.5	2.5
≥19	58.1	12.4	29.6	3.8	41.9	7.5	43.7	4.0	97.5	5.9
Less than high school diploma (%)	-	-	-	-	-	-	-	-	-	-
<6	6.5	4.9	14.8	3.0	9.4	4.3	8.7	2.4	2.5	4.7
6.00–10.99	8.5	4.5	24.1	3.7	17.4	5.9	11.4	2.3	2.5	2.2
11.00–17.99	16.3	7.1	22.2	3.6	22.7	6.0	12.7	2.1	16.1	4.3
≥18	68.7	11.5	38.9	3.3	50.6	6.3	67.3	3.6	79.0	6.4
Median household income (U.S. $)	-	-	-	-	-	-	-	-	-	-
<40,000	46.8	12.6	33.3	4.5	38.3	7.1	34.1	4.3	98.8	5.9
40,000–53,999	21.1	8.5	40.7	4.2	32.5	6.8	28.8	3.2	1.2	1.4
54,000–74,999	21.5	8.0	14.8	1.9	16.6	4.3	23.1	2.6	0.0	0.0
≥75,000	10.6	4.1	11.1	2.5	12.5	4.4	14.0	2.0	0.0	0.0

(Table 2) contd.....

Unemployed (%)	-	-	-	-	-	-	-	-	-	-
<2	4.5	5.7	13.0	3.6	10.6	4.7	4.4	2.0	3.7	6.6
2.00–3.99	21.5	6.5	38.9	4.0	32.3	5.0	25.8	2.8	7.4	2.9
4.00–5.99	23.6	7.3	22.2	2.8	35.9	7.1	32.3	3.1	17.3	4.8
≥6	50.4	12.1	25.9	3.2	21.2	6.7	37.6	3.4	71.6	6.4
Without health insurance (%)	-	-	-	-	-	-	-	-	-	-
<6	13.4	5.3	13.0	2.4	4.1	4.4	5.7	1.6	24.7	3.3
6.00–9.99	18.3	8.2	20.4	3.6	6.3	4.2	14.0	2.7	40.7	5.7
10.00–15.99	28.5	10.5	25.9	3.9	15.7	5.3	21.0	2.5	25.9	9.6
≥16	39.8	9.9	40.7	3.5	74.0	6.4	59.4	3.7	8.6	19.5
Total[g]	**100**	**8.7**	**100**	**8.7**	**100**	**5.9**	**100**	**3.0**	**100**	**5.6**

Abbreviation: Dash (-) indicates absence of denominator data and rate is not calculated.

Note: Rates are per 100,000 population. Rates are not calculated by transmission category because of the lack of denominator data. The American Community Survey does not provide age- and sex-specific social determinants of health variables stratified by race and ethnicity for racial groups except Whites (i.e., White, not-Hispanic/Latino). Therefore, the denominators used for computing race-specific rates may include Hispanics/Latinos and should be interpreted with caution.

[a] Northeast: Connecticut, Maine, New Hampshire, New Jersey, New York, Pennsylvania, and Rhode Island; Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; South: Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; West: Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

[b] Hispanics/Latinos can be of any race.

[c] Data have been statistically adjusted to account for the missing transmission category.

[d] Heterosexual contact with a person known to have, or to be at high risk for, HIV infection.

[e] Includes hemophilia, blood transfusion, perinatal exposure, and risk factor not reported or not identified.

[f] Urban: population of ≥500,000. Suburban: population of 50,000– 499,999. Rural: nonmetropolitan area, (<50,000)

[g] Totals do not represent all adults whose HIV infection was diagnosed during 2017 in these areas.

By SDH for each race/ethnicity group and across all regions, the highest rates of HIV diagnoses were among women who lived in census tracts where at least 19% of residents had incomes below the federal poverty level. The one exception was Hispanic/Latino women in the Midwest, for whom the highest rate was among those women who lived in census tracts where at least 11% but fewer than 19% of the residents had incomes below the federal poverty level. Women with the highest HIV rates lived in census tracts where at least 18% of residents had less than a high school diploma. An exception was Black women in the West, for whom the highest rates were among women living in census tracts where at least 11% but fewer than 18% of the residents had less than a high school diploma. Another exception was Hispanic/Latino women in the Midwest, for whom the highest rates were among women living in census tracts where at least 6% but fewer than 11% of the residents had less than a high school diploma. Women with the highest HIV diagnosis rates also lived in census tracts where the median household income was less than $40,000, and at least 16% were without health insurance. The exception was Hispanic/Latino women in the Northeast and Midwest, among whom the highest diagnosis rates were in census tracts where at least 10% but fewer than

16% of the residents were uninsured. Among White women, those who lived in census tracts where at least 6% of the residents were unemployed accounted for the highest HIV diagnosis rates in every region; no clear pattern was observed for Black and Hispanic/Latino women (Table **2**).

By residence area and race/ethnicity, the largest number of HIV diagnoses (2,984) was among Black women in urban areas (Table **3**). By age and residence area, the largest percentages of HIV diagnoses were among women aged 25–34 years, regardless of race/ethnicity (except for Hispanic/Latinos in rural areas). By residence area and transmission category, the largest percentage was among women with HIV infection attributed to heterosexual contact, regardless of race/ethnicity. By residence area and SDH, regardless of race/ethnicity, the highest percentages were among those who lived in census tracts where at least 19% of the residents lived below the federal poverty level (except White women in rural areas), at least 18% of the residents had less than high school diploma (except White women in suburban areas), the median household income was less than $40,000 a year (except White women in urban areas) and 16% or more of the residents did not have health insurance or a health coverage plan (Table **3**).

Table 3. Count and percentages of diagnoses of HIV infection among women, by race/ethnicity, area of residence and selected characteristics, 2017─United States, the District of Columbia and Puerto Rico.

-	White						Black						Hispanic/Latino[a]					
-	Urban		Suburban		Rural		Urban		Suburban		Rural		Urban		Suburban		Rural	
-	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Age group at diagnosis (yr)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18-24	102	12.7	21	9.8	12	11.3	380	12.7	76	17.5	28	17.0	120	13.7	8	7.6	10	25.0
25-34	232	28.9	64	29.8	33	31.1	794	26.6	128	29.5	56	33.9	225	25.7	30	28.6	10	25.0
35-44	175	21.8	59	27.4	22	20.8	700	23.5	99	22.8	32	19.4	208	23.7	19	18.1	6	15.0
45-54	165	20.6	40	18.6	24	22.6	564	18.9	73	16.8	27	16.4	189	21.6	28	26.7	11	27.5

(Table 3) contd.....

55-64	111	13.8	25	11.6	11	10.4	415	13.9	41	9.5	16	9.7	100	11.4	15	14.3	2	5.0
65+	17	2.1	6	2.8	4	3.8	131	4.4	17	3.9	6	3.6	35	4.0	5	4.8	1	2.5
Transmission category[b]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Injection drug use	251	31.3	59	27.4	32	30.5	229	7.7	28	6.5	10	6.0	99	11.3	15	14.0	1	3.3
Heterosexual contact[c]	547	68.3	156	72.6	73	69.3	2,737	91.7	404	93.1	155	93.9	777	88.6	89	85.1	39	96.5
Other[d]	3	0.4	0	0.1	0	0.3	19	0.6	1	0.3	0	0.1	1	0.1	1	1.0	0	0.3
Social Determinants of Health	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Below federal poverty level (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<7	185	23.1	35	16.3	*	*	338	11.3	27	6.2	*	*	90	10.3	*	*	*	*
7.00–10.99	154	19.2	51	23.7	18	17.0	394	13.2	36	8.3	14	8.5	119	13.6	*	*	*	*
11.00–18.99	224	27.9	56	26.1	45	42.5	801	26.8	106	24.4	52	31.5	230	26.2	27	25.7	15	37.5
≥19	239	29.8	73	34.0	41	38.7	1,451	48.6	265	61.1	95	57.6	438	49.9	58	55.2	15	37.5
Less than high school diploma (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<6	146	18.2	34	15.8	*	*	255	8.6	40	9.2	*	*	75	8.6	*	*	*	*
6.00–10.99	217	27.1	63	29.3	18	17.0	536	18.0	61	14.1	14	8.5	108	12.3	17	16.2	*	*
11.00–17.99	201	25.1	64	29.8	38	35.9	815	27.3	128	29.5	51	30.9	154	17.6	22	21.0	*	*
≥18	238	29.7	54	25.1	46	43.4	1,378	46.2	205	47.2	94	57.0	540	61.6	58	55.2	20	50.0
Median household income (U.S. $)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<40,000	212	26.4	77	35.8	46	43.4	1,412	47.3	267	61.5	113	68.5	381	43.4	51	48.6	17	42.5
40,000–53,999	202	25.2	59	27.4	45	42.5	678	22.7	103	23.7	36	21.8	228	26.0	33	31.4	15	37.5
54,000–74,999	213	26.6	63	29.3	14	13.2	552	18.5	52	12.0	12	7.3	159	18.1	16	15.2	*	*
≥75,000	175	21.8	16	7.4	*	*	341	11.4	12	2.8	*	*	109	12.4	*	*	*	*
Unemployed (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<2	83	10.4	39	18.1	15	14.2	138	4.6	31	7.1	21	12.7	56	6.4	14	13.3	*	*
2.00–3.99	277	34.5	71	33.0	53	50.0	572	19.2	97	22.4	46	27.9	236	26.9	21	20.0	16	40.0
4.00–5.99	238	29.7	57	26.5	24	22.6	839	28.1	118	27.2	46	27.9	269	30.7	26	24.8	*	*
≥6	204	25.4	48	22.3	14	13.2	1,435	48.1	188	43.3	52	31.5	316	36.0	44	41.9	*	*
Without health insurance (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<6	162	20.2	36	16.7	*	*	259	8.7	23	5.3	*	*	70	8.0	18	17.1	*	*
6.00–9.99	175	21.8	49	22.8	23	21.7	407	13.6	54	12.4	17	10.3	113	12.9	23	21.9	*	*
10.00–15.99	190	23.7	55	25.6	36	34.0	715	24.0	94	21.7	52	31.5	189	21.6	20	19.1	*	*
≥16	275	34.3	75	34.9	41	38.7	1,603	53.7	263	60.6	92	55.8	505	57.6	44	41.9	20	50.0
Total[f]	802	100	215	100	106	100	2,984	100	434	100	165	100	877	100.0	105	100	40	100

Abbreviation: Asterisk (*) indicates cell too small (<12 diagnoses during the year) and data has been suppressed.

Rates are per 100,000 population. Rates are not calculated by transmission category because of the lack of denominator data.

[a] Hispanics/Latinos can be of any race.

[b] Data have been statistically adjusted to account for the missing transmission category.

[d] Heterosexual contact with a person known to have, or to be at high risk for, HIV infection.

[e] Includes hemophilia, blood transfusion, perinatal exposure, and risk factor not reported or not identified.

[c] Urban: population of ≥500,000. Suburban: population of 50,000– 499,999. Rural: nonmetropolitan area (<50,000).

[f] Totals do not represent all adults whose HIV infection was diagnosed during 2017 in these areas..

4. DISCUSSION

The results of this study are supported by findings in the previous research [21 - 24]. Overall, women who lived in areas with the highest poverty, highest unemployment, lowest incomes, and those without health insurance coverage were more likely to have higher rates of HIV infection than did women who lived in the higher favorable quartiles. The South followed the national trends in having the highest number of HIV diagnoses and the highest rates of HIV infection among women in the SDH examined. Overall, women in the least favorable quartiles in every region, regardless of race/ethnicity, tended to have the highest diagnosis rates. However, patterns in the SDH categories varied among Hispanic/Latino women in the Midwest. Across regions, higher rates of diagnoses were seen among White women aged 25–34 years. Among Blacks and Hispanics/Latinos, higher rates were seen in women aged

35 years and older for certain regions. Additionally, Black women in every area of residence had the highest percentages of HIV diagnoses in the least favorable SDH quartiles. Overall, across all races/ethnicities and regions, rates of HIV diagnoses were highest among women residing in the census tracts with the lowest median household income and lacking health insurance coverage.

The results of this study showed that women who receive an HIV diagnosis, regardless of race/ethnicity and region, are generally in the least favorable quartiles of each SDH analyzed (barring a few exceptions). Research has shown an association between poor health and living in areas with high poverty levels, having low income, lacking health insurance coverage, lacking education, and lacking employment [25 - 27]. This is more pronounced among women, who often put their health needs aside to meet other priorities to survive and take care of

their families [28, 29]. When race is considered, we find that there are more pervasive disparities in access to health insurance coverage among minority women [30, 31]. The Coverage and Access to Care Under the Affordable Care Act reports that overall, 86% of Black women (ages 18–64 years) had health insurance in 2017, compared with nearly 92% of white women [32]. Moreover, Black women are more likely to hold low-wage jobs that might not provide adequate health benefits [33].

The results of this study also showed that the highest rates of HIV diagnoses among white women were seen in a younger age group (25–34 years). In contrast, Black and Hispanic/Latino women mostly had the highest rates of HIV diagnoses in older age groups. This might be a result of Black and Hispanic/Latinos receiving a late HIV diagnosis. Previous studies show that Black and Hispanic/Latino women tend to present at later stages in their HIV diagnosis [34 - 36]. This could be attributed to varying attitudes towards sexual and reproductive health among younger women of certain racial/ethnic origins. Among Black and Hispanic/Latino women, stigma might restrain young unmarried women from going for an HIV test [37, 38]. The fear of being HIV positive and fear of the social consequences, such as rejection by loved ones, loss of employment or housing, and the fear of discrimination and violence, can lead to delays in testing for HIV [37 - 39]. This concurs with a study involving Black and Latino women at risk for HIV, which showed that stigma and the perception that these women were engaging in risky behaviors influenced their decision to visit a clinic to receive an HIV vaccine in a vaccine trial study [39]. Through the decades, Black and Hispanic/Latino women also have had less access to treatment and prevention services [40 - 42].

The results of this study showed that Black women in every type of residence area had the highest HIV diagnosis percentages in the least favorable quartile of each SDH. However, this does not hold the same for White and Hispanic/Latino women. This might be because Black women often experience multiple SDH that might negatively affect their health. For instance, Black women experience poverty at higher rates than do Black men and women from all other racial/ethnic groups [42, 43]. One study reported that non Hispanic Black women were most likely to be single heads of households with family members present (27.5%), and non Hispanic Asian and non-Hispanic White women were least likely (7.5% and 9.4%, respectively) [43]. More than 30% of female single heads of households with family members had household incomes below the poverty level, contributing further to worse health outcomes [43]. However, White women had the highest percentages of HIV diagnoses in the second most favorable unemployment level, regardless of region. This suggests that being unemployed for White women is not necessarily a factor for poor health. It is possible that White women are more likely to be employed than women of other races [2, 26], but we cannot explain why they had higher rates of HIV diagnosis in the more favorable unemployment census tracts.

The results of this study showed that regardless of race/ethnicity, women who lived in a census tract with the lowest median household income and the highest percentage of uninsured residents (except for Hispanic/Latino women in the Northeast and Midwest) generally had the highest HIV diagnosis rates. Several studies have shown that women with low incomes might have poorer health outcomes and are unable to afford health insurance coverage might have poorer health outcomes [44 - 46]. Previous research has given important insights into how health care coverage affects health care use, disease treatment and outcomes, self-reported health, and mortality [47]. Women in worse health and those with low incomes, or those uninsured, are more likely than others to delay or forgo health services because of the costs associated with health coverage. Women in low-income households tend to decline needed health care screenings to keep income within the household [27, 28]. There is also strong evidence that health insurance coverage increases access to preventive services, such as pre-exposure prophylaxis, which can directly maintain or improve health and reduce the chances of being infected with HIV [47, 48].

This analysis is subject to at least four limitations. First, diagnoses of HIV do not represent incidence of HIV or new infections. The time from infection to diagnosis will differ with each woman and the residence at HIV diagnosis might not be the same as when HIV was acquired. Second, data were limited to women with a complete residential address that could be geocoded; therefore, the results might not be representative of all women receiving an HIV diagnosis in the United States in 2017. Third, because SDH information is not available at the individual level, census tract-level data were used as a snapshot of the environment in which women lived at the time of HIV diagnosis. Conclusions and findings should be interpreted with caution and not inferred at the individual level. Fourth, some SDH indicators (*e.g.*, lack of health coverage) are associated with low income and poverty in the United States [27, 49, 50], but correlations between SDH indicators were not analyzed for this report.

CONCLUSION

This publication is the first of its kind to examine the distribution of census tract-level SDH among women receiving an HIV diagnosis in the 50 states, DC, and Puerto Rico. The results show that the burden of HIV among women by region is affected by race/ethnicity and SDH. By identifying the SDH that are strong indicators for a diagnosis of HIV among select populations of women, and the distribution of HIV by geography, targeted interventions can be tailored to those specific populations, which might yield better health outcomes. Future interventions should take into consideration SDH, such as income and health insurance coverage, among women with respect to race/ethnicity, region and area of residence. Examining these will allow appropriate allocation of resources to the geographic areas where they are needed the most, thereby meeting the objectives outlined in the federal initiatives.

AUTHORS' CONTRIBUTIONS

All authors contributed to the design of the study, analysis, interpretation, and write up of the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

Not applicable.

CONSENT FOR PUBLICATION.

Not applicable.

AVAILABILITY OF DATA AND MATERIALS

The authors confirm that the data supporting the findings of this study are available within the article.

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CONFLICT OF INTEREST

The authors herein declare that, in the conception, ethics, data collection, and the drafting of this paper, they have no conflicts of interest in any form.

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