

**ORIGINAL RESEARCH**

Infectious Disease

# Racial and sex disparities in HIV screening outcomes within emergency departments of Harris County, Texas

Mandy J. Hill DrPH, MPH<sup>1</sup>  | Marylou Cardenas-Turanzas MD, DrPH<sup>2</sup> | Samuel Prater MD<sup>3</sup> | Jeffrey W. Campbell BBA<sup>4</sup> | Marlene McNeese BS<sup>5</sup>

<sup>1</sup>Department of Emergency Medicine, Division of Population Health, McGovern Medical School, University of Texas Health Science Center at Houston (UTHealth), Houston, Texas

<sup>2</sup>Department of Emergency Medicine, School of Biomedical Informatics, University of Texas Health Science Center at Houston (UTHealth), Houston, Texas

<sup>3</sup>Department of Emergency Medicine, McGovern Medical School, University of Texas Health Science Center at Houston (UTHealth), Houston, Texas

<sup>4</sup>AIDS Foundation Houston, Houston, Texas

<sup>5</sup>Houston Health Department, Division of Disease Prevention and Control, Houston, Texas

**Correspondence**

Mandy J. Hill, DrPH, MPH, Department of Emergency Medicine, Division of Population Health, McGovern Medical School, University of Texas Health Science Center at Houston (UTHealth), Houston, TX, USA.  
Email: mandy.j.hill@uth.tmc.edu

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**Abstract**

**Objectives:** The emergency department provides opportunities for identifying undiagnosed HIV cases. We sought to describe the racial and sex epidemiology of HIV through ED screening in Harris County, Texas, one of the most diverse and populous metropolitan cities in the Southern United States.

**Methods:** We used a descriptive secondary analysis of a universal HIV screening program (2010–2017) to quantify demographic differences in HIV incidence. We applied a validated codebook to a dataset by the local health department containing 894,387 records of ED visits with 62 variables to assess race/ethnicity and sex differences.

**Results:** Of 885,199 (98.9%) patients screened for HIV during an ED visit, 1795 tested positive (incidence rate = 0.2%). Of those tested for HIV, most were White (66.3%), followed by racial minorities (African Americans (29.9%), Asians (3.6%), and American Indian, Alaska Native, Native Hawaiian or Pacific Islanders (natives) (0.1%). Half of those tested were Hispanic. Conversely, of patients testing positive ( $n = 1782$ , 99.3% of positive cases), most were African American (52.6%) followed by Whites (46.6%), Asians (0.7%), and natives (0.1%). Less than half (35.5%) of positives were Hispanic. A racial disparity in HIV incidence was discovered among African American females. This group represented 16.8% of the tested population; yet accounted for 65.8% of females who tested positive for HIV and 20.3% of all HIV-positive test results.

**Conclusion:** Descriptive findings of the racial and sex epidemiology of HIV revealed that African American females had the largest disparity between the population tested and those who tested positive for HIV.

**KEYWORDS**

African Americans, disparities, emergency department, HIV, HIV screening, race, sex

## 1 | INTRODUCTION

### 1.1 | Background

New HIV cases persist as a major public health problem. The consistent practice of universal HIV screening in emergency departments is a key component of the nation's End the HIV epidemic plan. HIV screening of eligible ED patients is paramount to achieving goals of re-engaging HIV-positive persons into care, identifying new HIV cases, and linking new positives to HIV care. The ED provides care to the most diverse patient population of any clinical setting, making it a key venue for initiatives capable of advancing population health in the United States. Concerted and consistent HIV prevention efforts in highly populated Southern cities have not been successful at decreasing HIV transmission rates, unlike referent other US metropolitan cities like New York City, NY and San Francisco, CA.<sup>1</sup>

The HIV epidemic is different in the South. Although HIV rates are declining overall nationally, the disproportionate burden of new HIV diagnoses to vulnerable segments of the population remain alarming. Demographic disparities in HIV incidence persist at the national level in the United States.<sup>2</sup> The imminent threat of HIV to the public health of our nation is most experienced by racial and sex minorities in South.<sup>1,3-6</sup> African Americans account for more HIV incident and prevalent rates than others. Although race is not a risk factor for HIV, it is possibly a stronger predictor of vulnerability to a new HIV diagnosis above other demographic factors, including age, sex, income, and sexual orientation.<sup>7-9</sup>

Houston, Texas, is one of the most populous and most diverse metropolitan cities in the Southern US.<sup>10,11</sup> It is also one of the nation's hotspots for HIV. African Americans and Hispanics comprise 60% of the racial/ethnic groups in Harris County, the largest county in Houston.<sup>10</sup>

Racial trends in HIV incidence in Houston between 2007 and 2013 had little variance. Over a 6-year period, African Americans bore the most disproportionate burden of HIV compared to other race/ethnic groups. African American men in Harris County were more likely to become HIV-positive relative to White men (4.6 to 1, respectively) and Hispanic men; African American females were more likely to become HIV-positive compared to White females (21 to 1, respectively) and Hispanic (5.8 to 1) females.<sup>12</sup>

### 1.2 | Importance

Although demographic disparities in HIV incidence have been quantified in Houston, it is unknown if HIV incidence rates in our EDs are similar. ED-level HIV incidence data is needed to guide implementation plans for effective HIV prevention approaches in the ED. The importance here has national implications for EDs located in national HIV hotspots.

#### The Bottom Line

This descriptive analysis of patients screened for HIV in an emergency department in Harris County, Texas shows racial and gender disparities in HIV incidence among ED patients, particularly African American females, tested for HIV in this population. These results suggest the ongoing need for focusing HIV prevention, testing, and treatment efforts on vulnerable populations.

### 1.3 | Goals of the investigation

The analyses presented here was of an ED patient cohort in Houston's Harris County who were tested for HIV. The study aims were to quantify and describe demographic differences in the ED subpopulation with HIV-positive results. The study hypothesis was that differences in HIV incidence among a population tested in local EDs would reveal differences by race and sex.

## 2 | METHODS

### 2.1 | Study design

This was a secondary analysis of a universal HIV screening program funded by the Centers for Disease Control and Prevention (CDC) located in Houston, Texas (2007–present). This was deemed a quality improvement project by UTHealth (Committee for the Protection of Human Subjects); thus, this secondary analysis did not require institutional review board (IRB) approval. The overall project was implemented in non-traditional venues across the United States, including EDs, to address the HIV epidemic at a population level. Routine HIV testing in the ED affords clinicians and public health practitioners access to a network of individuals who often times have significant HIV and sexually transmitted infections risk nationally and locally.<sup>12-14</sup> The expansion of HIV testing to the ED was integrated with linkage to care offered by our partners at the Houston Health Department. Standard nomenclature was used to describe processes.<sup>15</sup> Further details on the methods used for our ED-based universal HIV screening program are provided in earlier publications.<sup>13</sup>

### 2.2 | Setting

Universal HIV screening was implemented in two local EDs of a private and public hospital. The Memorial Hermann-Texas Medical Center location is a nationally ranked private hospital and is the largest level 1 trauma center in the nation. Memorial Hermann-Texas Medical Center is the primary teaching hospital for UTHealth and

is the flagship location to 13 hospitals in the Memorial Hermann Healthcare System located throughout the Houston metropolitan area. Memorial Hermann-Texas Medical Center is one of two certified level I trauma centers in the greater Houston area. Equipped with a Life Flight service that provides ambulance emergency transport within a 150-mile radius of Houston, the Memorial Hermann-Texas Medical Center ED offers emergency care to a patient volume of 72,000 visits each year. Lyndon B. Johnson Hospital is a 328 licensed-bed acute care public hospital offering varied medical services. The ED at this public hospital has a patient volume exceeding 70,000 visits each year, because Lyndon B. Johnson Hospital is the state's busiest level III trauma center. Testing protocols were uniform across sites.

## 2.3 | Data source

Houston Health Department is the local clearinghouse for HIV cases in Harris County and manages required reporting of HIV cases to the state health department. Their local data repository served as the data source for the analysis presented here. The eligible population for routine, opt-out HIV screening includes all individuals accessing emergency services within participating local hospital systems who were between 18 and 65 years of age. In some cases, whereby a patient was deemed at significant risk for HIV, a test was provided whether or not they fell outside of the standard age range (18–65 years). As a result, the age range of the data set was 0–113.

The Houston Health Department's dataset contained 894,387 individual records of patients who were tested for HIV during a local ED visit between 2010 and 2017 (Figure 1). Houston Health Department collected data on 62 variables per patient. However, only variables described in the data analysis section below were extracted for this secondary analysis.

## 2.4 | Selection of participants

Adult ED patients ages 18–65 were eligible for the universal HIV screening program. When emergency nurses informed the patients about the procedures that would take place during the visit, they also shared that an HIV test would be performed. At that time, patients had an opportunity to decline the test. If the patient did not decline the test, they received an HIV test. For this analysis, we reviewed Houston Health Department record of all ED patients who were screened for HIV during the designated time period.

## 2.5 | Outcome

The main outcome of this study was the HIV incidence rates in each race and sex group. HIV incidence was determined based on findings of a fourth generation HIV test that uses a small sample of blood to screen for both HIV antibodies and p24 antigens.<sup>16</sup> This test is the

most accurate and reliable routinely used diagnostic HIV test. This main outcome was the variable used to evaluate whether disparities in HIV incidence rates existed by race and/or sex group. Findings of this evaluation were used to test the study hypothesis.

## 2.6 | Data analysis

Bivariate associations were described between demographic characteristics of people who were tested for HIV and those who tested positive for HIV, including both race and sex.

### 2.6.1 | Descriptive variables

#### *Agency*

Tested patients, per Houston Health Department records, were classified by agency. The response format for agency was dichotomous, either the private (Memorial Hermann-Texas Medical Center) or public (Lyndon B. Johnson Hospital) hospital.

#### *Demographics*

The study assessed demographic factors, including location, age, sex, race, and ethnicity.

#### *Age*

Age was a continuous variable ranging from 0–113.

#### *Sex*

Sex was a dichotomous variable, either male or female. For the purpose of this study, females were described as persons born with a female sex and sex identified as a female (cissex). Males were persons who are born with a male sex and sex identified as a male (cissex male).

#### *Race*

Race had six categories: African American, White, Asian, American Indian/Alaska Native/Native Hawaiian/Pacific Islander, or unknown.

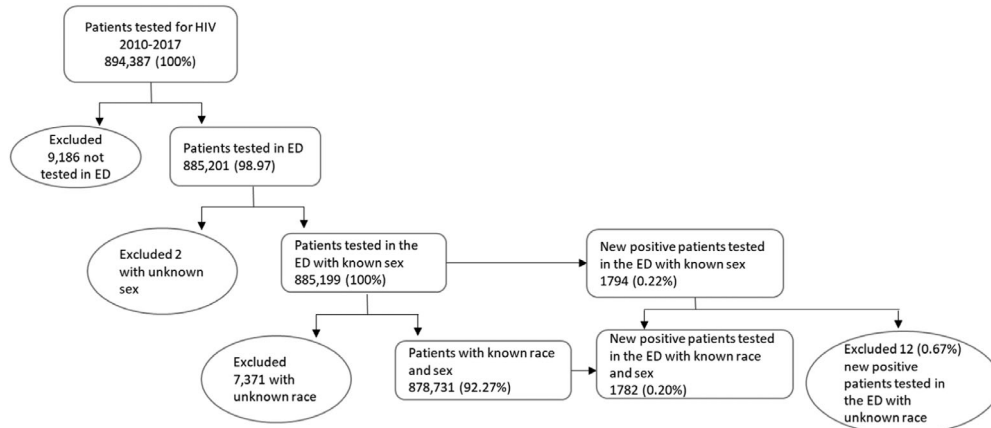
#### *Ethnicity*

Ethnicity had three categories: Hispanic, not Hispanic, or unknown.

#### *Incident HIV cases*

Incident HIV cases were cases who tested positive for HIV during an ED visit, but were not identified in the Houston Health Department database as a previous positive.

Metrics to discern statistically significant differences were frequencies, percentages, means, and *P* values. Depending on the distribution (normal or not) for continuous variables, the Student's *t* test or the Mann-Whitney *U* test and the chi-square test were used for nominal variables. A two-tailed *P* value of <0.05 was considered statistically significant for all tests. All analyses were conducted in IBM SPSS Statistics software (version 25).



**FIGURE 1** Flowchart of the emergency department patient population tested for HIV

### 3 | RESULTS

During the study period, 885,199 patients were screened for HIV in the ED; there were 1795 positive tests (producing an incidence rate of 0.2%). The race and sex was available on 878,731 of screened patients and 1782 who screened positive (Figure 1).

The average age of patients who were tested for HIV in our local EDs was 42 years old (Table 1). Men were on average 4 years older than females. Nearly two-thirds of those tested were White and less than one-third were African American. Of females tested, over two-thirds were White and <30% were African American. Nearly two-thirds of men tested were White and over 30% were African American. Half of those tested were Hispanic. Females accounted for over half of the Hispanic population tested (Table 1).

A total of 0.2% of patients who tested positive for HIV were new positives, according to Houston Health Department records ( $n = 1795$ ). Patients who tested positive at the private hospital were significantly younger than those who tested positive at the public hospital (Table 2). Males were more likely to test positive than females at both hospitals (Table 2), but sex differences were not significant by agency. However, racial differences by agency were significant. Specifically, African Americans represented over half of positive cases at both hospitals (Table 2). Most patients who tested HIV-positive were not Hispanic (Table 2). The population tested was equally distributed by ethnicity. A stratification by sex revealed that females represented the majority of the Hispanic population. Males represented the majority of the Non-Hispanic population. These findings revealed a significant difference with ethnicity by sex.

We examined the characteristics of ED patients who tested positive for HIV (Figure 1 and Table 3). The average age of persons who tested positive was 38 years old. Females were older than males. There were also significant differences by race and ethnicity. The prevalence of HIV positivity among White males was much higher than White females. Hispanic males represented more HIV-positive cases than Hispanic females. Conversely, among non-Hispanic positive cases, females represented a larger sample of positive cases than males (Table 3). Among African Americans, there were more HIV-positive cases among females

than males. Racial disparities between the local population compared to the HIV-positive population were noted. Racial and sex-based disparities worked together to compound overall health disparities driven by HIV incidence.

#### 3.1 | Limitations

Study data were collected retrospectively, limiting the ability to capture data on additional variables of interest. Demographic data on socioeconomic status (ie, household income) would have reinforced our ability to generalize the findings to similar populations. Determining whether or not first-time positives from Houston Health Department were truly first-time positives was not possible, as the data was limited to the jurisdiction of Houston Health Department. It is possible that the first-time positives in our sample had a prior positive diagnosis of HIV in another jurisdiction. Results from this convenience sample may not generalize to other ED populations. This is a vulnerable population that otherwise would be difficult to recruit outside of an ED setting.

### 4 | DISCUSSION

This is the first longitudinal analysis of an HIV screening program in the Southern region of the United States. There is a paucity of evidence highlighting the benefits of opt-out HIV testing that uses fourth generation testing technology to diagnose acute HIV among ED patients.<sup>17-19</sup> HIV screening programs in the existing literature describe the ED population as a whole with minimal attention to racial/ethnic differences. Our findings confirm demographic disparities in HIV incidence within the local ED population.

Of the 328.5 million people in the United States, there were 144,842,742 unique visits to the ED in 2016 and  $\approx 55,025,758$  (37.99%) of them were in the South.<sup>20,21</sup> The ED serves a population that is representative of local communities.<sup>22</sup> In a review article of 20 published studies (18 in the United States) on non-targeted HIV

**TABLE 1** Demographic distribution of emergency department patients tested for HIV stratified by sex

Demographic variables	Total 885,199 (100%)	Sex		P value
		Female 525,981 (59.4%)	Male 359,218 (40.6%)	
Age				
Number	884,167	525,589	358,578	≤0.001
Mean	41.94	40.49	44.06	
SD	14.88	14.91	14.58	
Race				
African American	262,845 (29.9)	148,607 (28.4)	114,238 (32.1)	≤0.001
White	582,898 (66.3)	354,367 (67.8)	228,531 (64.2)	
Asian	31,871 (3.6)	18,942 (3.6)	12,929 (3.6)	
American Indian, Alaska Native, Native Hawaiian, or Pacific Islander	1117 (0.1)	639 (0.1)	478 (0.1)	
Ethnicity				
Hispanic	439,570 (50.0)	281,520 (53.9)	158,050 (44.4)	≤0.001
Non-Hispanic	439,161 (50.0)	241,035 (46.1)	198,126 (55.6)	

Note: Categories in rows may not add up to total due to missing values

**TABLE 2** Demographic characteristic of those who tested positive for HIV stratified by emergency department

Demographic variables	Total n (%)	Public hospital n (%)	Private hospital n (%)	P value
	1795 (100)	1408 (78.4)	387 (21.6)	NA ≤0.001
Age				
Mean (SD)	38.3 (12.4)	38.8 (12.5)	36.4 (36)	
Age range (y)	0–113	0–113	0–72	
Sex				
Male	1245 (69.4)	986 (70.1)	259 (66.9)	0.23
Female	549 (30.6)	421 (29.9)	128 (33.1)	
Race				
African American	939 (52.3)	710 (50.4)	229 (59.2)	0.002
White	830 (46.2)	677 (48.1)	153 (39.5)	
Asian	13 (0.7)	9 (0.6)	4 (1.0)	
American Indian/Alaska Native/Native Hawaiian/Pacific Islander	1 (0.1)	0	1 (0.3)	
Ethnicity				
Hispanic	633 (35.3)	547 (38.8)	86 (22.2)	≤0.001
Not Hispanic	1150 (64.1)	849 (60.3)	301 (77.8)	

Note: Percentages may not add up to 100, due to rounding. Missing values: age (13), sex (1), race (12), and ethnicity (12).

screening in EDs, the testing approach, consent protocol, staff members offering the test, and testing type is described. There was no discussion on the racial/ethnic and/or sex breakdown of ED patients tested.<sup>23</sup> The absence of data on race and sex differences among ED patients tested demonstrates a gap that calls into question the accuracy of racial- and sex-based generalizations extrapolated from national data to local testing rates.

Females outnumbered males in the population at the national and county levels.<sup>24</sup> Conversely, males outnumbered females among those who tested positive for HIV in the local ED, per HHD records (Table 3). The imbalanced HIV burden to sex and racial minorities peaks

with African American females, because this racial and sex minority group was less than one-third of the population tested. African American females account for two-thirds of HIV-positive diagnoses among females tested for HIV in the ED. Females in the South have a higher HIV incidence than females in all other regions of the United States.<sup>25,26</sup> Breskin et al (2017) led a county-level analysis in the US on HIV among females and found that one in two HIV-positive cases were among females in the counties with the highest HIV prevalence and one in four cases were in lower prevalence areas. HIV rates in Houston affirm the generalizability of Breskin's (2017) findings to other areas in the Southern United States, as three out of ten in the tested population

**TABLE 3** Demographic distribution of HIV-positive cases stratified by sex

Demographic variables	Total	Sex		P value
		Female (SD)	Male (SD)	
Number	1782	549	1233	
Age				≤0.001
Mean (SD)	38.3 (12.4)	40.1 (11.7)	37.5 (12.2)	
Race				≤0.001
African American	938 (52.6)	361 (65.8)	577 (46.8)	
White	830 (46.6)	186 (33.9)	644 (52.2)	
Asian	13 (0.7)	2 (0.4)	11 (0.9)	
American Indian/Alaska Native	1 (0.1)	0	1 (0.1)	
Ethnicity				≤0.001
Hispanic	633 (35.5)	123 (22.4)	510 (41.4)	
Non-Hispanic	1149 (64.5)	426 (77.6)	723 (58.6)	

The total 1782 is missing 13 cases (of 1795 positive cases) because they were missing race and/or sex. One African American, Non-Hispanic person was missing sex. Twelve men were missing race and ethnicity.

were females; yet, six out of ten HIV cases were among females. The sex-specific disparity did not apply to males in this sample. Six out of ten people tested were males and only four out of ten HIV cases were among males. The disproportionate burden of HIV to females tested at two EDs in Houston, Texas, illustrates a comparable and more concentrated threat of the HIV epidemic to the sexual health of females.

Sex and racial disparities in HIV incidence at the national level impact males more than females. African American males are most impacted by the HIV epidemic.<sup>27</sup> This national HIV burden extends to African Americans locally, because this racial group is over-represented in those tested for HIV in the ED and even more so among those testing positive for HIV.

This is a notable change in the HIV epidemic whereby transmission in the 1980s to males was almost fifteen times the rate in females.<sup>26,28</sup> This former sex-based disparity did not apply to males in this sample. Six out of ten people tested were males, but only four out of ten HIV cases were among males. The disproportionate burden of HIV to females among those tested in this sample suggests that the former sex-based disparity in HIV incidence has reversed in the ED population.

In the study cohort, the tested population and the subgroup who tested positive had a different racial composition than the HIV-positive adult population at the national and county level. White, non-Hispanic people comprise the majority of the US population; however, they are a minority racial and ethnic population among HIV-positive persons nationally.<sup>29</sup> Females represented <20% of new HIV-positive cases nationally and roughly one-third of those tested in the ED, but they comprised nearly two-thirds of those who tested positive. African Americans are the third largest racial group in the nation, but have the highest HIV incidence cases. This racial group was more represented in both the tested portion of the ED population and the subpopulation that tested positive when compared to estimates at the national and county levels. The rationale for these differences remains uncertain. In summation, the data presented here tells us that racial and sex disparities in HIV incidence among ED patients tested for HIV in Harris County of Houston, Texas exist.

ED clinicians and public health practitioners routinely care for people who are at high risk for HIV. Study findings justify the need to offer HIV prevention interventions to this captive audience, which may be an especially vulnerable population that otherwise may be missed.

Epidemiologic studies are needed to better understand why racial and sex differences exist within HIV tested populations. The best practice in response to CDC's recommendation of expanded and integrated HIV testing is to test routinely and consistently. This approach will improve matching on race and sex between the population tested and the general population. The efficacy of non-targeted approaches is weakened when program implementers use targeted strategies instead. Epidemiologic evaluation of other HIV testing approaches in the South is needed in the literature. There is also a need for annual analyses of HIV testing data. Routine and systematic approaches to data capture will equip public health practitioners with the information needed to readily discern changes in the HIV epidemic more closely and more often.

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#### AUTHOR CONTRIBUTIONS

MJH made substantial contributions to conception and design, or acquisition of data, analysis and interpretation of data; led the drafting the manuscript and revising it critically for important intellectual content; gave approval of the version to be published; participated sufficiently in the work to take public responsibility for appropriate portions of the content; and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

MC-T made substantial contributions to the acquisition of data, analysis and interpretation of data; and was involved in drafting the

manuscript and revising it critically for important intellectual content; gave approval of the version to be published; participated sufficiently in the work to take public responsibility for appropriate portions of the content; and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

SP made substantial contributions to conception and design; He was involved in revising the manuscript critically for important intellectual content; gave final approval of the version to be published; and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

JC made substantial contributions to conception and design, and acquisition of data; involved in drafting the manuscript for critically for important intellectual content; gave final approval of the version to be published; and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

MMN made substantial contributions to conception and design and acquisition of data, involved in revising the manuscript for critically for important intellectual content; gave final approval of the version to be published; and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

## CONFLICT OF INTEREST

The authors declare no conflicts of interest.

## ORCID

Mandy J. Hill DrPH, MPH  <https://orcid.org/0000-0001-9778-358X>

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**AUTHOR BIOGRAPHY**

Mandy Hill, DrPH, MPH completed her doctoral studies in public health (disease control) at the University of TX Health, School of Public Health and her master studies in epidemiology at Tulane School of Public Health & Tropical Medicine. She directs public health research at UT Health/McGovern Medical School.

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