



Social Determinants of Late Presentation to HIV Care

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Connie Leeper , *University of Alabama at Birmingham and Ventura County Family Medicine Residency*,
connie.leeper@ventura.org

Michael Mugavero , *University of Alabama at Birmingham*, mmugavero@uab.edu

James Willig , *University of Alabama at Birmingham*, jwillig@uab.edu

See next page for additional authors

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Abstract

Background: In recent years, increased attention has shifted toward evaluating social determinants of health, and understanding how community, environment, and system factors affect health outcomes. HIV policies and guidelines emphasize the importance of earlier HIV diagnosis and presentation for care. This study evaluated the role of individual and community-level factors in late presentation to HIV care.

Methods: HIV-infected patients newly initiating outpatient HIV medical care at an academic medical center between 2005-2010 were included. Patients' self-reported addresses at their first clinic visit were geocoded using geographic information systems software to the appropriate United States census block group. Using data from the U.S. Census Bureau's 2005-2009 American Community Survey, community-level data was recorded for each patient's census block group. Poisson regression was used to evaluate associations between individual- and community-level factors with late presentation for HIV care, defined as an initial CD4 count /mm³.

Results: Among 609 patients, 341 patients (56%) had an initial CD4 count /mm³. At a community level, late presentation was significantly associated with the proportion of African Americans in a census block group (RR=1.47; 95%CI=1.19-1.81); with proportion living in poverty, lack of fuel, and lack of vehicle demonstrating borderline statistical significance. At an individual level, older patients were more likely (1.12; 1.06-1.19), while white females were less likely (0.45; 0.24-0.84) to present with a CD4 count /mm³.

Conclusion: Both individual and community-level characteristics were associated with late presentation for HIV medical care. Research and interventions to promote earlier HIV diagnosis and care entry should include geographical information and social determinants of health to define priority populations.

Keywords

HIV; Social Determinants; Late presentation

Authors

Connie Leeper, Michael Mugavero, James Willig, Eric Chamot, Shatomi Kerbawy, and Anne Zinski



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School of Community Health Sciences
University of Nevada, Las Vegas

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Connie Leeper, MD, MPH, University of Alabama at Birmingham and
Ventura County Family Medicine Residency
Michael Mugavero, MD, MHSc University of Alabama at Birmingham
James Willig, MD, University of Alabama at Birmingham
Eric Chamot, MD, PhD, University of Alabama at Birmingham
Shatomi Kerbawy, MPH, MEd, University of Alabama at Birmingham
Anne Zinski, PhD, University of Alabama at Birmingham

ABSTRACT

Background: In recent years, increased attention has shifted toward evaluating social determinants of health, and understanding how community, environment, and system factors affect health outcomes. HIV policies and guidelines emphasize the importance of earlier HIV diagnosis and presentation for care. This study evaluated the role of individual and community-level factors in late presentation to HIV care.

Methods: HIV-infected patients newly initiating outpatient HIV medical care at an academic medical center between 2005-2010 were included. Patients' self-reported addresses at their first clinic visit were geocoded using geographic information systems software to the appropriate United States census block group. Using data from the U.S. Census Bureau's 2005-2009 American Community Survey, community-level data was recorded for each patient's census block group. Poisson regression was used to evaluate associations between individual- and community-level factors with late presentation for HIV care, defined as an initial CD4 count <350 cells/mm³.

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Keywords: HIV; Social determinants; late presentation

INTRODUCTION

In recent years, additional focus has been placed on investigating social determinants of health and understanding how socio-economic status, community, environment, and the health care system affect health outcomes [26]. According to the World Health Organization, social determinants of health are the conditions in which a person is born, grows up, lives, works, and the health care systems in place around them [25]. These conditions are influenced by broader forces of politics, economics, and social policy [25]. The U.S. Centers for Disease Control and Prevention (CDC) highlights the importance of understanding the social determinants of health and their influence on HIV [21].

A principal tenet of the U.S. National HIV/AIDS Strategy and treatment as prevention initiatives is earlier HIV diagnosis and prompt establishment of care; hence there is interest in identifying populations at risk of presenting late for HIV care [3]. The concept of late presentation to HIV care involves entering outpatient HIV treatment with an advanced stage of disease, as indicated by a low CD4 cell count or AIDS-defining condition [2]. From 1997 to 2007, the median CD4 count at presentation to outpatient HIV care increased only modestly, but remained below 350 cells/mm³, indicating that most HIV-positive persons continue to present late to care [1]. Patients have higher rates of morbidity and mortality if they present to care in an advanced stage of disease. From a public health perspective, patients who present late for HIV care are more likely to transmit the virus to others. This is due to increased likelihood of engaging in risk transmission behavior during the time period from HIV acquisition to diagnosis [16] and unsuppressed viral loads that increase the likelihood of transmission during the time period from HIV acquisition to diagnosis and care entry [18].

Many studies that characterize persons who may be at risk of presenting late for HIV care are limited to analysis of individual demographic factors [1,5,19,23]. Interest in the influence of social determinants on HIV health care behaviors and outcomes has been increasing, with recent literature examining the influence of homelessness on CD4 counts and adherence to medication [14], and examining the effect of literacy rates on adherence to antiretroviral therapy (ART) [17]. In this study, we examine the influence of community-level factors according to participants' reported residences at HIV care entry as they relate to late presentation among individuals establishing initial outpatient HIV care. Specifically, this study explores the role of community factors (community capital, access to resources, and living conditions) in predicting whether or not a patient residing in that community presents to HIV care with a CD4 count < 350 cells/mm³. By improving our understanding of the systemic factors that affect the health of individuals who are diagnosed with HIV, we are able to characterize communities within which individuals may have an increased risk for presenting late to HIV primary care, while also identifying environmental and societal factors that could be targeted by policymakers to decrease rates of late presentation to HIV care.

METHODS

Study sample and setting

This retrospective cohort study sampled all HIV-infected patients over the age of 19 who were newly initiating outpatient HIV medical care between the years of 2005 and 2010 at the University of Alabama at Birmingham (UAB) 1917 HIV/AIDS Clinic in

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Birmingham, Alabama. Patients were excluded from the sample if they had received care at an outpatient HIV clinic in the past, if they had ever taken ART, if they did not have confirmed HIV, if the address they reported was a P.O. box, or if they did not have either an available CD4 count value or an opportunistic infection diagnosed within a required window. Patients were included only if they had a CD4 count available within 180 days before to 14 days after their first arrived clinic visit, or if they had an opportunistic infection diagnosed within 360 days before to 90 days after their first clinic visit, reflecting that it was present at the time of medical care initiation.

Individual factors (gender, race, age, insurance, marital status, education, and living situation), clinical information (CD4 count, history of opportunistic infections, and reported HIV risk factors), and patient's reported residence at presentation to care were collected from a review of administrative and clinical records data from the UAB 1917 Clinic Cohort. These variables are often utilized to describe patient populations in HIV literature. Late presentation to care was defined as having a CD4 count below 350 cells/mm³, or being diagnosed with an opportunistic infection within 360 days before to 90 days after the first arrived clinic visit. This definition of late presentation was utilized in accordance with the parameters of the European Late Presenter Consensus working group [2].

Community Data

U.S. Census Bureau data was used to characterize the communities where patients resided. The Census Bureau periodically collects and analyzes survey data to describe the population of the United States and the communities in which people live. Variables were obtained and calculated from the Census Bureau's American Community Survey (ACS) data from 2005-2009. Data was reported at the level of the smallest Census-defined geographic unit for which detailed information exists, the *Census block group* (CBG), a geographic unit that contains approximately 700 residents. The community-level variables of interest included gender ratios, median age, racial milieu, percentage of female-headed households, educational attainment, linguistic isolation, poverty, median household income, social security income or receipt of public assistance, housing vacancies, rental units, crowding, power sources, phone service, and access to personal vehicles. These community factors were employed to examine which social determinants, if any, may be associated with presentation to HIV care. Geographic information systems were used to link individual patient residence information to the data from the community. The patients' self-reported addresses of residence were standardized using ZP4 software (October 2011 version) [20], then geocoded using ArcGIS Software (version 10.0) [6]. The geocoding linked each patient's address of residence to the corresponding Census block group. The clinic data was then merged with the reported community data from the ACS for analysis.

Statistical Analysis

We used Poisson regression with robust error variance to estimate relative risks [28]. This approach was chosen over logistic regression because the rare outcome assumption needed to interpret odds ratios as approximate relative risks was violated [8]. As an exploratory study with modest sample size, we conducted unadjusted analyses to evaluate

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the association of community and individual level factors on late presentation to HIV care.

A sampling error is associated with each estimate of community factors derived from the ACS survey [24]. The magnitude of this error depends both on the factor considered and the size of the community population; failing to account for this sampling error in regression analyses would yield biased estimates of the associations between community factors and outcomes of interest. In this study we used published margins of errors and the simulation-extrapolation method (SIMEX as implemented in Stata software version 12 [11,12]) to correct relative risk estimates obtained from regression models including covariates measured with sampling error. SIMEX is a robust three-step procedure that (1) uses a form of re-sampling to simulate datasets that incorporate the effect of the measurement error; (2) fits the desired regression model to each simulated dataset; and (3) extrapolates regression coefficients back to the case of no measurement error [9].

RESULTS

The study cohort included 639 patients with mean age 36 ± 11 years, 77% male, 61% African-American (AA) (Table 1). Among the 639 patients included in the study, 609 patients (95%) provided an address that was successfully geocoded. Of the 30 addresses that were not geocoded, 20 addresses were excluded because they were homeless shelters, HIV housing assistance programs, rehabilitation centers, or university housing. These 20 addresses were excluded as the locations of these facilities may not accurately reflect the available resources to these individuals prior to living in these facilities and the surrounding communities may not be reflective of people living in the facilities. Among the 609 geocoded patients, 341 patients (56%) had an initial CD4 count <350 cells/mm³ and an additional 5 had an opportunistic infection diagnosed just prior to their first visit. Therefore, 346 patients (57%) were considered late presenters to HIV care.

Table 1. Characteristics of Patients & Census Block Groups in Which Patients Live

Variable	N (%) or mean \pm SD	N (%) with late presentation	Univariate analysis RR (95%CI)
Individual			
Total patients	639 (100%)	360 (56%)	
Age at first clinic visit	36 ± 10.8		1.12 (1.06-1.19)* ^a
Race x Sex			
Caucasian male	189 (30%)	100 (53%)	Reference
African-American male	284 (44%)	173 (61%)	1.16 (0.98-1.37)
Caucasian female	36 (6%)	11 (31%)	0.45 (0.24-0.84)*
African-American female	107 (17%)	58 (54%)	1.04 (0.83-1.30)

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HIV Risk Factor			
Heterosexual	257 (40%)	149 (58%)	Reference
Intravenous drug use (IDU)	38 (6%)	17 (45%)	0.67 (0.43-1.06)*
Men who have sex with men (MSM)	336 (53%)	190 (57%)	0.97 (0.84-1.12)
Insurance			
Uninsured	285 (45%)	154 (54%)	Reference
Public	110 (17%)	69 (63%)	1.10 (0.90-1.33)
Private	243 (38%)	136 (56%)	1.01 (0.86-1.18)
CD4 closest to first clinic visit	335 ± 264		
Community^b		Predictive Community Factors	
Total CBG in which patients lived	413		
Percentage of males	48% ± 7.0%	Percent of males in CBG > 50%	1.14 (0.93-1.40)
Percentage of African-Americans	47% ± 36.3%	Percent of African-Americans between 33-67%	1.47 (1.19-1.81)*
Percentage of households in poverty	21% ± 17.1%	Percent of households in poverty	1.23 (0.97-1.56)
Median household income	\$40,744 ± \$20,102	Median household income > \$40,000	0.88 (0.74-1.05)
Percentage of households with no source or fuel	0.2% ± 0.8%	Percentage of households with no fuel available >0%	1.55 (0.98-2.39)
Percentage of households with no vehicle available	10% ± 11.5%	Percent of households with no vehicle available >5%	1.22 (0.96-1.57)

* p < 0.05

^a Age at first clinic visit (RR in 10-year increments)

^b Each patient's block group data counted once even if multiple patients lived within same block group.

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At a community level, presenting late to HIV care was associated with living in a census block group with 33% to 67% African-Americans (RR 1.47, p 0.002) in unadjusted analyses (Table 1). Block groups with more than 15% of households living in poverty (RR 1.23, p 0.10), more than 5% of households without access to a vehicle (RR 1.22, p 0.11), any households having no access to fuel (RR 1.55, p 0.05), or with over 50% males (RR 1.14, p 0.22) demonstrated trends toward being associated with late presentation for HIV care. Block groups with median household incomes over \$40,000 trended toward being protective against late presentation (RR 0.88, p 0.15).

At an individual level, older patients were more likely (RR 1.12, p <0.001), while Caucasian females (RR 0.45, p 0.009) and persons with reported IDU (RR 0.67, p 0.002) were less likely to present late to care. African American males showed a trend towards late presentation (RR 1.16, 95% CI 0.98-1.37).

DISCUSSION

Timely HIV diagnosis and presentation for care are imperative for achieving the vision and goals set forth by the National HIV/AIDS Strategy and the promise of HIV treatment as prevention success. Accordingly, an improved understanding of factors associated with late diagnosis and presentation for HIV care beyond individual-level demographics is essential to inform policy and practice. This study helps to characterize individual and community factors that may be associated with an increased risk of presenting late to HIV care. Uniquely, we identify the importance of several community-level factors as social determinants that are associated with late HIV care entry, and may serve as targets for health policy and practice.

Block groups with higher rates of poverty, more citizens without access to a motor vehicle, and more households without access to fuel showed a trend toward housing HIV-positive patients with higher rates of late presentation to HIV care. Additionally, block groups with average median household income above \$40,000 trended toward lower rates of late presentation. Poverty, income, access to personal vehicles, and access to fuel are all markers of socioeconomic status that may also be indicative of individual-level barriers to presentation for HIV care.

HIV positive persons who reside in areas with less access to monetary, healthcare, and transportation resources may not have access to regular medical or primary care services, and therefore may be less likely to seek HIV testing. Alternatively, persons may delay seeking treatment for HIV after diagnosis if they are unable to pay for care, unable to afford transportation, or unable to seek care due to competing life demands.

Community markers of lower socioeconomic status may also reflect unmeasured indicators of poorer health, including stress, domestic safety, or food and shelter insecurity, which may compete with health-seeking behaviors. As these markers indicate community-level characteristics, it is possible that patients residing in block groups with lower socioeconomic status are more likely to present late to HIV care regardless of personal socioeconomic status.

Late presentation to HIV care was also associated with communities with 33-67% African-Americans, but not associated with communities with less than 33% or more than 67% African-Americans. The curvilinear correlation between percentages of

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African-Americans in a block group and late presentation to HIV care may represent disparities in access to or quality of care in racially mixed communities. In communities that are racially mixed, there may be more evident disparities between the races than in communities that are more homogeneous. These disparities may be more pronounced in racially mixed communities due to stress related to racism or discrimination [13].

Disparities in health outcomes between African-Americans and Caucasians have been shown to diminish or disappear in racially mixed neighborhoods where location is held constant [15], suggesting that health disparities between African-Americans and Caucasians are related more to the association between low socioeconomic status and African-American race, than to race itself. As noted in previous studies, race and socioeconomic status are confounded by each other, making it difficult to clarify the specific source of observed disparities [7]. Further research is needed to understand why patients living in a racially mixed block group may have higher rates of late presentation for HIV care.

At an individual level, Caucasian females were at lower risk of presenting late to HIV care. While females may be more likely overall to be diagnosed and treated due to increased testing during pregnancy, a disparity between Caucasian and African-American females remains evident in this study. This may reflect better access for Caucasian women to general medical and prenatal care [4,22], or less perceived stigma for HIV screening and treatment amongst Caucasian women [27].

Consistent with previous findings, older patients were more likely to present late for HIV care. As older persons are likely under-diagnosed due to lower rates of perceived risk and screening by health care providers [10], this population may experience disease progression and lower CD4 counts at eventual presentation to care.

Persons with reported IDU were less likely to present late for care. This finding is somewhat paradoxical, as intra-venous drug use is often associated with deleterious HIV health behaviors and outcomes. This finding may be due to persons with IDU interfacing more frequently with the health care system or an increased emphasis on expanding HIV testing to higher risk populations in recent years, including testing in substance abuse treatment centers, emergency departments, jails, and prisons.

CONCLUSION

In conclusion, this study may indicate a more complex interaction between individual and community factors in late presentation to HIV care. Beyond individual characteristics, this study incorporated census block group data that may be useful for identifying priority communities for HIV education, as well as screening endeavors and early treatment services. These findings posit that, in addition to considering individual factors and reported resource access, gaining an understanding of that individual's community resources may be valuable toward evaluating health risk. To further characterize the association of individual and community-level factors with late presentation for HIV care, subsequent investigations are necessary to evaluate best practices for incorporating geographical information systems community data and social determinants of health into HIV policy and public health program planning.

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