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## Background

HIV has become a manageable disease with near normal life-expectancy. Keys to improved HIV outcomes include early diagnosis, linkage to care (LTC), retention in care (RIC) and HIV viral load (VL) suppression-called Continuum of HIV Care. Disparity in HIV care and outcomes exist in the United States. Black or African-Americans (thereafter referred to as black) share a higher burden of disease with poor outcomes. These disparities are particularly prominent in the South and in young men who have sex with men (MSM). Social determinants of health (SDH) are factors in the places where people live, work and play that are responsible for most health inequities. These include poverty level, income, education, and employment. Past studies have shown SDH to be one of the main drivers of disparity in HIV prevalence. There are few published studies examining the interaction of SDH and racial disparities in the HIV care continuum.

## Objectives

- Evaluate the effect of SDH on time of LTC for newly diagnosed HIV-infected individuals in South Carolina (SC)
- Identify the influence of SDH on the racial disparities and LTC

## Methods

- Linked HIV surveillance data from the South Carolina's Department of Health and Environmental Services (DHEC) Enhanced HIV/AIDS Reporting System (eHARS) to census tract (CT) data
- SDH were derived from CT data (as a proxy for individual level data) based on their residence at the time of HIV diagnosis and the included 4 variables- education, income, unemployment and poverty level.
- All newly diagnosed HIV positive individuals in SC from 01/01/2009 until 12/31/2011 who were ≥18 years of age were included in the analysis
- Time to LTC: Time in days from HIV diagnosis to first CD4 or VL with a washout period of 7 days, to eliminate laboratory records potentially associated with HIV diagnosis rather than an indicator of LTC
  - Early LTC: ≤30 days
  - Late LTC: >30 days but within 365 days
  - Never LTC (NLTC): >365 days
- CT variables were dichotomized as below:
  - Low education: CT where ≤18% individual had high school education
  - Low-income: CT with median income ≤\$36,000
  - High poverty: CT with >20% of the population lived below the poverty level
  - High unemployment: CT with unemployment rate >6%
  - Rural/Urban residence was based on zip code or county of residence at time of HIV diagnosis
  - OMB\_MSA rural/urban definition was based on county level
  - RUCA rural/urban definition was based on zip code

## Analysis

- Factors investigated -Age, race, HIV risk exposure group, rural/urban residence at time of HIV diagnosis and SDH based on CT of residence at time of HIV diagnosis
- Univariate assessment and multivariable analysis was performed between LTC and age, race, gender, HIV risk exposure group, rural/urban residence and initial CD4 and SDH
- Two-way interactions between race and demographics and SDH variables
- Analysis stratified by age <35 and ≥35 years

**Table 1: Characteristics of Newly Diagnosed HIV-Infected Individuals in SC in 2009-2011 by LTC**

	Total (%)	Early LTC	Late LTC	NLTC	p-value
<b>Total</b>	<b>2151(100)</b>	<b>1636(76.1)</b>	<b>285(13.2)</b>	<b>230(10.7)</b>	<b>&lt;0.01</b>
<b>Gender</b>					<b>&lt;0.01</b>
Male	1640(76.2)	1233(75.2)	213(13.0)	194(11.8)	
Female	511(23.8)	403(78.9)	72(14.1)	36(7.0)	
<b>Age, years (mean±SD)</b>	<b>35.60(12.9)</b>	<b>35.70(13.0)</b>	<b>35.57(12.4)</b>	<b>34.89(12.5)</b>	<b>0.67</b>
<b>Race</b>					<b>0.02</b>
White	430(20.0)	332(77.2)	64(14.9)	34(7.9)	
Black	1584(73.6)	1211(76.4)	201(12.7)	172(10.9)	
Other	137(6.3)	93(67.9)	20(14.6)	24(17.6)	
<b>HIV Exposure</b>					<b>&lt;0.01</b>
MSM	1124(52.2)	864(76.9)	154(13.7)	106(9.4)	
IDU	113(5.2)	90(79.6)	12(10.6)	11(9.7)	
Heterosexual	403(18.7)	320(79.4)	54(13.4)	29(7.2)	
Unspecified	511(23.8)	362(70.8)	65(12.7)	84(16.4)	
<b>Initial Median CD4, cells/mm<sup>3</sup> (Min,Max)</b>	<b>324.5(1.0, 4795.0)</b>	<b>318(1, 4795)</b>	<b>395(9,2770)</b>	<b>241(1,1148)</b>	<b>&lt;0.01</b>
<b>Initial CD4 group, cells/mm<sup>3</sup></b>					<b>&lt;0.01</b>
≤200	670(32.2)	532(79.4)	65(9.7)	73(10.9)	
201-350	441(21.2)	348(78.9)	55(12.5)	38(8.6)	
351-500	410(19.7)	316(77.1)	63(15.4)	31(7.6)	
>500	559(26.9)	427(76.4)	101(18.1)	31(5.5)	
<b>Initial Median HIV Viral Load (VL), copies/ml (Min,Max)</b>	<b>17144(0, 7154380)</b>	<b>19129(0, 7154380)</b>	<b>3775(20, 3169528)</b>	<b>28200(19, 2868033)</b>	<b>0.07</b>
<b>Initial VL Group, copies/ml</b>					<b>&lt;0.01</b>
≤200	248(12.0)	134(54.0)	77(31.0)	37(14.9)	
201-10000	627(30.4)	513(81.82)	90(14.3)	24(3.8)	
10,001-100000	716(34.7)	594(83.0)	75(10.5)	47(6.6)	
>100,000	471(22.8)	388(82.4)	38(8.1)	45(9.5)	
<b>OMB MSA</b>					<b>.53</b>
Urban	1683(78.2)	1271(75.5)	227(13.5)	185(11.0)	
Rural	468(21.8)	365(78.0)	58(12.4)	45(9.6)	
<b>RUCA</b>					<b>0.74</b>
Rural	516(24.7)	396(76.7)	70(13.6)	50(9.7)	
Urban	1573(75.3)	1196(76.0)	206(13.1)	171(10.9)	
<b>Disease Stage</b>					<b>&lt;0.01</b>
HIV only	1069(49.7)	782(73.1)	166(15.5)	121(11.3)	
HIV and later AIDS	378(17.6)	247(65.3)	56(14.8)	75(19.8)	
Simultaneous	702(32.7)	607(86.5)	63(9.0)	32(4.6)	
<b>SDH</b>					
Lower Education	1730(81.9)	1326(76.6)	221(12.8)	183(10.6)	0.22
Lower Income	636(30.1)	487(76.6)	74(11.6)	75(11.8)	0.22
Higher Poverty	547(25.9)	410(74.9)	77(14.1)	60(11.0)	0.80
High Unemploymt	824(39.0)	612(74.3)	110(13.3)	102(12.4)	0.13

**Table 3: Predictors of Late LTC and NLTC versus Early LTC: Univariate Analysis**

	Late LTC OR (CI)	NLTC OR (CI)
<b>Education</b>		
Higher Education	Reference	Reference
Lower Education	<b>0.76 (0.54-1.04)</b>	<b>0.90 (0.63-1.28)</b>
<b>Income</b>		
Higher Income	Reference	Reference
Lower Income	<b>0.82 (0.61-1.09)</b>	<b>1.14 (0.85-1.53)</b>
<b>Poverty</b>		
Lower poverty	Reference	Reference
Higher Poverty	<b>1.10 (0.82-1.46)</b>	<b>1.05 (0.77-1.45)</b>
<b>Unemployment</b>		
Higher	Reference	Reference
Lower	<b>1.04 (0.80-1.35)</b>	<b>1.34 (1.01-1.77)</b>

**Table 4: Predictors of NLTC versus Early LTC: Multivariate Analysis**

	aOR
<b>Gender</b>	
Female	Reference
Male	<b>2.44 (1.50-3.97)</b>
<b>HIV Exposure</b>	
Heterosexual	Reference
MSM	<b>0.89 (0.51-1.58)</b>
IDU	<b>1.23 (0.54-2.78)</b>
Unspecified	<b>1.76 (1.05-2.94)</b>
<b>Initial CD4 Category</b>	
>500	Reference
≤200	<b>1.89 (1.19-2.99)</b>
201-350	<b>1.47 (0.88-2.45)</b>
351-500	<b>1.31 (0.78-2.20)</b>
<b>Unemployment</b>	
Lower unemployment	Reference
Higher unemployment	<b>1.48(1.04-2.10)</b>

**Table 5: Predictors of Late LTC versus Early LTC : Multivariate Analysis**

	aOR
<b>Initial CD4 Category</b>	
>500	Reference
≤200	<b>0.47 (0.33-0.68)</b>
201-350	<b>0.69 (0.48-0.99)</b>
351-500	<b>0.85 (0.60-1.21)</b>
<b>Income</b>	
Higher Income	Reference
Lower Income	<b>0.63 (0.42-0.95)</b>
<b>Poverty</b>	
Lower Poverty	Reference
Higher Poverty	<b>1.59 (1.05-2.39)</b>

## Results

- From 2009-2011, 2151 new HIV cases were diagnosed in SC.
- Table 1 shows the characteristics of the study population
  - 1636 (76.1%) were LTC early, 285 (13.2%) were LTC late, 230 (10.7%) were NLTC
  - 76% were male
  - Mean age 35.6 years
  - 73.6% Black, 20% White
  - 52.2% MSM, 18.7% heterosexual, 5.2% IDU, 23.8% no identified risk group
  - 24.7% rural
  - Median initial CD4 was 324 cells/mm<sup>3</sup>
  - 81.9% lived in CT with low education level
  - 30.1% lived in CT with medium income <\$ 36,000
  - 25.9% lived in CT with high poverty levels
  - 39% lived in CT with high unemployment rate
- Tables 2 and 3 show the univariate analysis for predictors of late LTC and NLTC
- Tables 4 and 5 show the multivariate analysis for predictors of NLTC versus Early LTC and Late LTC versus Early LTC
- Results stratified by race; Black compared with Whites
  - Black males more likely NLTC [OR 1.77 (1.17-2.69)]
  - Blacks with initial CD4 <200 more likely to NLTC [OR 1.84 (1.13-2.99)]
  - Whites in lower income CT were more likely NLTC [OR 3.4 (1.65-7.01)]
- Results stratified by race (Black/White) and age (<35 or ≥35 years)
  - Amongst those ≥35 years of age there was no difference between Blacks and Whites in time to LTC
  - Among those <35 years Blacks had longer time to LTC compared to Whites
    - Black MSM (14 days longer)
    - Black males (15 days longer)
    - Blacks from higher education CT (25 days longer)
    - Black from higher income CT (15 days longer)
    - Black from lower poverty rates CT(14 days longer)

## Discussion

- Of the 2151 new diagnosis almost ¼ were LTC late or NLTC
- Males were more likely NLTC (5% difference)
- Unspecified HIV risk group were more likely to be NLTC
- In un-stratified analysis, SDH were not associated with timing of LTC
- When stratified by race and age
  - Younger Blacks had longer time to LTC
  - This was true even in CT with higher income, higher education and less poverty
  - Compared with Whites, young Black MSM had longer times to LTC

## Limitations

- Dataset is limited to individuals diagnosed in South Carolina and obtaining care within South Carolina
  - Unable to account for individuals moving in and out of the state
  - Results may not be generalizable to other areas
- CT may not be best proxy for individual level data

## Conclusion

- In SC, almost ¼ of newly diagnosed HIV infected individuals from 2009-2011 were LTC late or NLTC
- SDH were not the major driver of timing to LTC
- Black-White disparities in LTC were seen mostly in the younger age group

## References

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