Foreign Born Status and HIV/AIDS: A Comparative Analysis of HIV/AIDS Characteristics Among Foreign and U.S. Born Individuals

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Published online: 17 February 2011
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Abstract The purpose of this study was to observe differences in HIV characteristics between the foreign and U.S. born HIV population. The study sample consisted of individuals, ≥ 13 years of age, who have been diagnosed with HIV and are patients of the Lexington Bluegrass Care Clinic. For the comparison analysis, the sample was divided into two groups ($n = 1070$), foreign born and U.S. born. Compared to U.S. born patients, foreign born patients were younger at the time of their HIV diagnosis (31 years vs. 36 years, $P = 0.005$), of Hispanic origin (63.1% vs. 1.1%, $P < 0.001$), and reported heterosexual contact as their mode of transmission (67.7% vs. 33.9% $P < 0.001$). Foreign born patients enrolled into care at a much lower CD4+ count and compared to the U.S. born, they were more likely to be classified as late testers (53.9% vs. 32.8%, $P = 0.006$). There were many differences found between foreign born and U.S. born HIV patients. Upon enrolling into care, foreign born individuals were more likely to have multiple OI's and have an AIDS diagnosis. In regards to testing, foreign born individuals were more likely to have tested late for HIV compared to their U.S. born counterparts.

Keywords Foreign born · HIV/AIDS · Opportunistic infections · CD4+ count · Late testing

Introduction

Human Immunodeficiency Virus (HIV) has spread quickly to every corner of the U.S. [1, 2]. What is not clear is the distribution of HIV and Acquired Immune Deficiency Syndrome (AIDS) among the foreign born population in the United States (U.S.). Efforts to describe the distribution of the U.S. HIV/AIDS epidemic have largely ignored differences among the foreign born population [3, 4].

An estimated 12.6% of the U.S. population consists of foreign born individuals [5], and it is suggested that the migration of persons to resource-rich countries from resource-poor countries presents several public health related challenges [6]. A major challenge facing the increase in the foreign born population is detecting and managing the introduction of infectious diseases like HIV/AIDS [6]. Foreign born individuals have been considered more likely to adopt high risk sexual practices due to separation from family, dramatic changes in their cultural environment, social isolation, and a greater sense of anonymity [3].

Rates for several infectious diseases in addition to HIV suggest they are higher among the foreign born and the frequency of HIV-associated Opportunistic Infections (OI) vary by geography [7]. Bouckennooghe anticipates that HIV and its associated OIs will be higher among the foreign born populations and is a unique spectrum of OIs present among the foreign born population [7].

Kentucky (KY), like many other states, has seen an increase in the number of foreign born persons. In the current study, we wish to assess the epidemiology of opportunistic infections and AIDS among HIV infected

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foreign born individuals living in Lexington, KY. Between 2005 and 2007, there have been a total of 1,012 HIV infections in Kentucky. Of these, 248 (25%) were concurrently diagnosed with AIDS during the same calendar month as the initial HIV diagnosis [8]. In 2007, there were 201 new AIDS cases diagnosed and reported to the KY-HIV/AIDS Surveillance Program [8]. There has been a total of 4,764 AIDS cases reported in KY, with 2,802 cases still presumed to be living [8].

The purpose of this study is to observe differences in HIV characteristics between the foreign and U.S. born HIV population.

Materials and Methods

Study Design

A comparative analysis was conducted with a case being defined as an individual diagnosed with HIV. The study consisted of data collected from the Blue Grass Care Clinic (BCC) in Lexington, KY. Patient data were collected from two sources, the Medical Chart Review and Lab tracker™ patient records database.

The BCC, a multi-disciplinary HIV care clinic, is the largest of five providers in a 63 county area, serving people living with HIV/AIDS in Central and Eastern Kentucky since 1990. Data obtained from the Lab Tracker™ Patient Records Database included demographic characteristics such as age, country of origin, race/ethnicity, sex, and education level. Data from chart reviews included relevant HIV/AIDS measures like dates of HIV and AIDS diagnoses, CD4+ lymphocyte and viral load results, types of OIs, antiretroviral therapy, and HIV transmission category. Data was abstracted by the principal investigator, a research assistant from the University of Kentucky. The director of the BCC (Co-PI) provided assistance in the abstraction of data when warranted.

Study Sample

The study sample consisted of individuals, ≥ 13 years of age, who have been diagnosed with HIV and are patients of the BCC. For the comparison analysis, the sample was divided into two groups, foreign born and U.S. born. Patients who were enrolled into care from June 1, 2003 (initiation of the electronic database) to June 1, 2008 were eligible for inclusion into the study. Patients' data, once collected, were de-identified for the privacy and security of each patient. This study was approved by the University of Kentucky Institutional Review Board (2008).

Individuals with their country of origin and HIV diagnosis date recorded were included in the study. If an individual did not have a diagnosis date or country of origin recorded in the chart or the Lab Tracker Database, then they were excluded from the study. Individuals that were diagnosed with HIV < 13 years of age were excluded from the study. To control for individuals who were diagnosed before the initiation of Highly Active Antiretroviral Therapy (HAART) into the BCC, individuals who were diagnosed prior to 1998 were excluded.

During the study period, there were a total of 1070 eligible patients. Of these, 83 were defined as foreign born. U.S. born individuals were randomly selected based on a 3 to 1 comparison; there were 327 randomly selected U.S. born individuals. Due to the inclusion/exclusion criteria, 144 U.S. born individuals and 18 foreign born individuals did not meet the criteria standards. Hence, there were a total of 248 (65 foreign born and 183 U.S. born) individuals that met the inclusion criteria.

Study Definitions

According to the U.S. Census Bureau, a foreign-born person is defined as either a U.S. citizen by naturalization or they were not a citizen of the U.S. [5].

HIV transmission categories include the following risk factors: heterosexual contact, Men Who Have Sex with Men (MSM), Injecting Drug Use (IDU), MSM + IDU, blood transfusion/hemophiliac, and unidentified risk.

The U.S. defines a late tester as an individual who at the time of their HIV diagnosis presents with a CD4 cell count of < 200 cells/ μ l or an AIDS defining illness, or an individual who presents with AIDS within 12 months of their HIV diagnosis [9]. An early tester was defined as an individual who presented with AIDS 5 years or greater than their HIV diagnosis.

Statistical Analysis

Data were analyzed using the Statistical Analysis Software, SAS version 9.2.; SAS Institute; Cary North Carolina. Means, medians, standard deviations, and ranges were calculated to describe all continuous variables. Frequencies and percentages were used to describe all categorical variables. Independent two-sample *t* tests and Mann–Whitney tests were used to describe differences between means and medians, respectively. Chi Square tests of independence were used to compare categorical variables. *P* values less than 0.05 were considered statistically significant for all statistical tests.

Results

Demographic Characteristics

For the entire sample ($n = 248$), the mean age was 35 (9.8) years, 79.4% were men, and 17.3% were originally from Central and South America. MSM (46.0%) and heterosexual contact (42.7%) were the two most frequent modes of transmission. Over half (52.1%) of the sample had no prior insurance upon enrollment in the BCC (Table 1). Compared to U.S. born patients, foreign born patients were younger at the time of their HIV diagnosis (31 years vs. 36 years, $P = 0.005$), of Hispanic origin (63.1% vs. 1.1%, $P < 0.001$), and reported heterosexual contact as their mode of transmission (67.7% vs. 33.9% $P < 0.001$) (Table 2). Foreign born patients were also

Table 1 Demographic characteristics of the study sample enrolled at the BCC between June 1st, 2003 and June 1st, 2008

Characteristics	Sample (N = 248)	
	n	%
Age at diagnosis		
N	248	
Mean (SD)	35.1 (9.8)	
Median (min, max)	33.8 (16.0, 68.6)	
(Q1, Q3)	(28.2, 41.2)	
Sex		
Male	197	79.4
Female	51	20.6
Country of origin		
U.S.	183	73.8
Central and South America	43	17.3
Africa	15	6.1
Other	7	2.8
Race		
White-non-hispanic	151	60.9
Black-non-hispanic	51	20.6
Hispanic	43	17.3
Other	3	1.2
Mode of transmission		
Heterosexual contact	106	42.7
MSM	114	46.0
IDU	8	3.2
Receipt of blood	9	3.6
Unidentified	11	4.4
Insurance status		
No	112	52.1
Medicaid/medicare	40	18.6
Yes	63	29.2

more often uninsured compared to their U.S. born counterparts (67.9% vs. 46.5%, $P = 0.001$).

Clinical Characteristics

Upon enrolling into care at the BCC, foreign born patients presented with CD4+ cells of <200 cells/ μ l compared to U.S. born patients (50.8% vs. 32.5%, $P = 0.011$) (Table 3). The majority of patients, regardless of foreign born status, were on HIV therapy (81.2%) (Data not shown), but foreign born patients were more likely to start therapy with a CD4+ count of <200 cells/ μ l compared to U.S. born patients (47.5% vs. 23.9%, $P = 0.007$) (Table 3).

Opportunistic Infections

A total of 114 patients (46.7%) were diagnosed with at least one OI. Of these, 34 (54%) were foreign born patients and 80 (44.2%) were U.S. born patients (Table 4). When observing individuals with multiple OIs, foreign born patients were more likely to have two or more OIs compared to U.S. born patients (31.2% vs. 18.2%, $P = 0.03$). The three most common OIs among the foreign born patients were thrush (35.2%), herpes simplex virus (HSV) (26.5%), and Cryptococcus meningitis (14.7%). For U.S. born patients, the three most common OIs were Thrush (37.5%), pneumocystis carinii pneumonia (PCP) (27.5%), and HSV (18.8%). U.S. born patients were more likely to be diagnosed with PCP compared to foreign born patients (27.5% vs. 5.9%, $P = 0.01$) (Table 5).

AIDS Diagnosis and Late Testing

During the course of their HIV infections, 124 patients (50%) were diagnosed with AIDS (Table 6). Compared to U.S. born patients, foreign born patients were more likely to have acquired an AIDS diagnosis (66.2% vs. 44.3%, $P = 0.02$). Of these, a concurrent HIV/AIDS diagnosis was found to be more likely in foreign born patients compared to U.S. born patients (36.9% vs. 22.4%, $P = 0.02$).

When defining testing, there were 95 patients (38.3%) who were considered late testers and 133 patients (53.6%) were considered early testers (Table 6). Compared to U.S. born patients, foreign born patients were more likely to be considered a late tester (53.9% vs. 32.8%, $P = 0.006$).

Discussion

The entire sample from the BCC is consistent with the reported HIV population in KY [8]. The findings indicate many differences in HIV characteristics between the foreign born and U.S. born patients. Foreign born individuals

Table 2 Demographic characteristics of the foreign born and U.S. born HIV individuals enrolled at the BCC between June 1st, 2003 and June 1st, 2008

Characteristics	Foreign born		U.S. born		<i>P</i> value
	n	%	n	%	
Age at diagnosis					
N	65		183		0.005
Mean (SD)	31.41 (7.48)		36.39 (10.21)		
Median (min, max)	30.59 (21.511, 59.85)		35.9 (16.02, 68.64)		
(Q1, Q3)	(26.23, 35.19)		(29.36, 42.67)		
Sex					
Male	43	66.2	154	84.2	0.003
Female	22	33.9	29	15.9	
Race					
White-non-hispanic	3	4.6	148	80.9	<0.001
Black-non-hispanic	18	27.7	33	18.0	
Hispanic	41	63.2	2	1.1	
Other	3	4.6	0		
Mode of transmission					
Heterosexual contact	44	67.7	62	33.9	<0.001
MSM	12	18.5	102	55.7	
IDU	4	6.2	4	2.2	
Receipt of blood	4	6.2	5	2.7	
Unidentified	1	1.5	10	5.5	
Insurance status					
No	38	67.9	74	46.5	0.001
Medicaid/medicare	1	1.8	39	24.5	
Yes	17	30.4	46	28.9	

P values obtained using two group independent pooled *t* tests and chi-square tests of independence to make comparisons of means and percentages between both groups

were younger at time of their HIV diagnosis, Hispanic, and reported heterosexual contact as their mode of transmission. The reported mode of transmission is consistent with another study that showed that foreign born individuals were more likely to report a heterosexual mode of transmission [7].

The clinical characteristics between the foreign born and U.S. born patients were quite different. An important finding was that foreign born patients were more likely to present with a CD4+ count of <200 cells/μl upon enrollment into care compared to U.S. born patients. This is a disconcerting finding because an impediment to proper HIV care is enrolling too late, thus missing a chance to delay progression to AIDS. The late enrollment could be due to many factors that were not ascertained in this study. It is important to understand these factors that prevent early enrollment. One study reported similar results, which suggest that foreign born patients were more likely to enroll in a study or care with a much lower CD4+ count than their U.S. counterparts [10]. There was a higher percentage of foreign born patients who were receiving

therapy, but at a much later stage in their HIV infection. This could be due to having a late diagnosis, or not entering into care until they developed an infection, which in turn could explain the low CD4+ count at enrollment into care. The study did not measure the time that HIV therapy was initiated in comparison to the time that they were enrolled into care, possibly leading to differences between the groups in time to treatment, but that was not assessed due to lack of information.

Bouckennooghe and Shandera suggested that foreign born individuals have a distinct profile of HIV and their OIs [7]. Compared to other studies, the three most common OIs for U.S. born patients are PCP, Candida esophagitis, and Mycobacterium Avium Complex (MAC) [4, 11]. For foreign born patients, the three most common OIs were PCP, Toxoplasmosis, and tuberculosis (TB) [7]. In our study, there were no differences in OI diagnoses or the type of OIs acquired by either foreign born or U.S. born patients.

There appears to be inconsistent findings in regards to acquiring an OI and foreign born status. Levy et al. [10]

Table 3 Clinical characteristics of the foreign born and U.S. born HIV individuals enrolled at the BCC between June 1st, 2003 and June 1st, 2008

Characteristics	Foreign born		U.S. born		<i>P</i> value
	n	%	n	%	
CD4+ count on enrollment					
<200	32	50.8	53	32.5	0.01
>200	31	49.2	110	67.5	
Viral load on enrollment					
Detectable (>400)	43	81.1	26	25.2	0.26
Undetectable (<400)	10	18.9	77	74.8	
HIV therapy					
Yes	56	87.5	143	79.0	0.13
No	8	12.5	38	21.0	
CD4+ count on initiation of therapy					
≤50	9	15.3	19	12.0	0.01
51–100	5	8.5	6	3.8	
101–200	14	23.7	13	8.2	
201–350	11	18.6	32	20.1	
≥351	13	22.0	52	32.7	

P values obtained using two group independent pooled *t* tests and chi-square tests of independence to make comparisons of means and percentages between both groups

suggested that foreign born individuals were more likely to have an OI at HIV diagnosis compared to U.S. born individuals. In our study, there were no differences in those regards. It also did not appear that foreign born patients enrolled at the BCC are more susceptible to acquiring an

OI once diagnosed with HIV. But, foreign born individuals were more likely to acquire two or more OIs compared to U.S. born patients which suggest the burden of HIV infection for foreign born patients is much greater than U.S. born patients. There were even some patients that acquired four or more OIs during the course of HIV infection. This is an important observation, in that this difference could be due to issues like therapy (are they adhering to their medication), insurance (can they pay for medication), knowledge of HIV/AIDS after infection, and late testing. Acquiring multiple OIs can lead to increases in hospital days, costs of care, and reduced survival.

Half of the sample had acquired an AIDS diagnosis during the course of their HIV infection. The results of the study demonstrated that foreign born patients were more likely to have an AIDS diagnosis compared to U.S. born patients. Not only were foreign born patients more likely to acquire AIDS, but they were more likely to be diagnosed with AIDS concurrent with their HIV diagnosis. Foreign born individuals need to be tested early and not only tested early, but treated early once their status is known.

Many complications due to HIV infection can be related to late testing. In our study, late testing was more prevalent in the foreign born patients. The authors suggested differences between foreign born and U.S. born HIV patients for late testing. Foreign born individuals were more likely to have tested late compared to U.S. born individuals. It is known that having a late diagnosis prevents an individual from seeking treatment and increases their risk of transmission, acquiring multiple OIs, and early progression to AIDS [10, 12–15].

Table 4 Status of opportunistic infections among foreign born compared to U.S. born

	Foreign born		U.S. born		Total		<i>P</i> value
	n	%	n	%	n	%	
Opportunistic infections							
Yes	34	54.0	80	44.2	114	46.7	0.18
No	29	46.0	101	55.8	130	53.3	
OI at HIV diagnosis							
Yes	9	14.3	26	14.4	35	14.3	0.99
No	54	85.7	155	85.6	209	85.7	
Multiple OIs							
0–1	44	68.8	148	81.8	192	78.4	0.03
2+	20	31.2	33	18.2	53	21.6	
Days to OI diagnosis							
N	34		80		114		0.65
Mean (SD)	413.88 (722.93)		488.61 (849.31)		465.44 (810.77)		
Median (min, max)	104 (0, 2751)		40.5 (0, 3180)		43 (0, 3180)		
(Q1, Q3)	(0, 546)		(0, 534)		(0, 546)		

P values obtained using two group independent *t* tests and chi-square test of independence to make comparisons of means and percentages between both groups, respectively

Table 5 Opportunistic infections and other diagnosis during the course of HIV infection among foreign born and U.S. born

	Foreign born		U.S. born	
	n	%	n	%
Candida esophagitis	3	8.8	3	3.8
Cervical cancer	2	5.9	0	0
Cryptococcus meningitis	5	14.7	4	5.0
Cryptosporidiosis	1	2.9	0	0
Cytomegalovirus (CMV)	2	5.9	2	2.5
Hepatitis A	1	2.9	1	1.3
Hepatitis B	5	14.7	12	15.0
Hepatitis C	3	8.8	8	10.0
Herpes simplex virus (HSV)	9	26.5	15	18.8
Histoplasmosis	3	8.8	4	5.0
HSE	0	0	1	1.3
Kaposi's sarcoma (KS)	2	5.9	2	2.5
Lymphoma	1	2.9	0	0
Mycobacterium avium complex (MAC)	4	11.8	4	5.0
PCP	2	5.9	22	27.5
Thrush	12	35.3	32	40.0
Toxoplasmosis	4	11.8	4	5.0
Tuberculosis	4	11.8	2	2.5
Varicella (shingles)	1	2.9	10	12.5
Wasting syndrome	1	2.9	3	3.8
Total	65		137	

Some individuals acquired more than one OI

In the U.S. there are so few intervention or prevention strategies that target the high risk foreign born population. This discerning result shows that there needs to be interventions implemented to get foreign born individuals tested and tested early and reduce their risk of acquiring AIDS.

Limitations

The sample analyzed in this paper cannot be generalized to any other foreign born population in the U.S. The sample was abstracted from a database in a clinic in Lexington, KY and the study sample does not resemble study samples from other published studies [3, 5, 6].

A limitation of the study is that of using medical charts to ascertain data. Medical charts are usually not completed for the purposes of research which mean that some information that is important to the research may be missing. The sample size did not include all eligible patients because the date of HIV diagnosis and country of origin was missing for some patients. Having all the information available would have allowed for a larger sample size. In order to adjust for income level, the authors used health insurance status as a marker because the income of the patients was not recorded. It was also difficult to ascertain the education of each patient. This information was missing for 90% of the patients and therefore was not included in the analysis. These are very important limitations when considering medical chart review for research purposes.

Table 6 Status of AIDS and late diagnosis among foreign born compared to U.S. born HIV patients

	Foreign born		U.S. born		Total		P value
	n	%	n	%	n	%	
AIDS diagnosis							
Yes	43	66.2	81	44.3	124	50.0	0.002
No	22	33.9	102	55.7	124	50.0	
Concurrent HIV/AIDS Diagnosis							
Yes	24	36.9	41	22.4	65	26.2	0.02
No	41	63.1	142	77.6	183	73.8	
Testers							
Late	35	53.9	60	32.8	95	38.3	0.01
Middle	6	9.2	14	7.7	20	8.1	
Early	24	36.9	109	59.6	133	53.6	
Days to AIDS diagnosis							
N	43		81		124		0.36
Mean (SD)	265.55 (550.50)		378.69 (712.19)		339.46 (660.52)		
Median (min, max)	0 (0, 1927)		0 (0, 2661)		0 (0, 2661)		
(Q1, Q3)	(0, 96)		(0, 366)		(0, 307)		

P values obtained using two group independent *t* tests and chi-square test of independence to make comparisons of means and percentages between both groups

Conclusions

There were many differences found between foreign born and U.S. born HIV patients. Upon enrolling into care, foreign born individuals were more likely to have multiple OI's and have an AIDS diagnosis. In regards to testing, foreign born individuals were more likely to have tested late for HIV compared to their U.S. born counterparts. It is important to acknowledge and understand this population and to work on improving prevention strategies.

References

1. Abdool Karim SS, Abdool Karim Q, Gouws E, Baxter C. Global epidemiology of HIV-AIDS. *Infect Dis Clin North Am*. 2007;21(1): 1–17.
2. Fauci AS. Twenty-five years of HIV/AIDS. *Science*. 2006; 313(5786):409.
3. Harawa NT, Bingham TA, Cochran SD, Greenland S, Cunningham WE. HIV prevalence among foreign- and US -born clients of public STD clinics. *Am J Public Health*. 2002;92(12):1958–63.
4. Wohl AR, Lu S, Turner J, Kovacs A, Witt M, Squires K, et al. Risk of opportunistic infection in the HAART era among HIV-infected Latinos born in the United States compared to Latinos born in Mexico and Central America. *AIDS Patient Care STDs*. 2003;17(6):267–75.
5. American Community Survey. 2009. Available from www.census.bureau.gov. Cited 18 March 2009.
6. Cartwright CP. The changing epidemiology of HIV/AIDS at a Minnesota hospital: impact of demographic change and viral diversity. *J Med Virol*. 2006;78(Suppl 1):S19–21.
7. Bouckennooghe AR, Shandera WX. The epidemiology of HIV and AIDS among Central American, South American, and Caribbean immigrants to Houston, Texas. *J Immigr Health*. 2002;4(2):81–6.
8. Bosch K. HIV/AIDS semi-annual report. 2007. Dec 2007.
9. Vital signs: HIV testing and diagnosis among adults—United States, 2001–2009. *MMWR Morb Mortal Wkly Rep*. 2010; 59(47):1550–1555.
10. Levy V, Prentiss D, Balmas G, Chen S, Israelski D, Katzenstein D, et al. Factors in the delayed HIV presentation of immigrants in Northern California: implications for voluntary counseling and testing programs. *J Immigr Minor Health*. 2007;9(1):49–54.
11. Kaplan JE, Hanson D, Dworkin MS, Frederick T, Bertolli J, Lindegren ML, et al. Epidemiology of human immunodeficiency virus-associated opportunistic infections in the United States in the era of highly active antiretroviral therapy. *Clin Infect Dis*. 2000;30(Suppl 1):S5–14.
12. Castilla J, Sobrino P, De La Fuente L, Noguer I, Guerra L, Parras F. Late diagnosis of HIV infection in the era of highly active antiretroviral therapy: consequences for AIDS incidence. *AIDS*. 2002;16(14):1945–51.
13. Girardi E, Sabin CA, Monforte AD. Late diagnosis of HIV infection: epidemiological features, consequences and strategies to encourage earlier testing. *J Acquir Immune Defic Syndr*. 2007;46(Suppl 1):S3–8.
14. Schwarcz S, Hsu L, Dilley JW, Loeb L, Nelson K, Boyd S. Late diagnosis of HIV infection: trends, prevalence, and characteristics of persons whose HIV diagnosis occurred within 12 months of developing AIDS. *J Acquir Immune Defic Syndr*. 2006;43(4): 491–4.
15. Girardi E, Aloisi MS, Arici C, Pezzotti P, Serraino D, Balzano R, et al. Delayed presentation and late testing for HIV: demographic and behavioral risk factors in a multicenter study in Italy. *J Acquir Immune Defic Syndr*. 2004;36(4):951–9.