AIDS Education and Prevention, 21, Supplement B, 19–33, 2009

INCREASES IN HIV DIAGNOSES AT THE U.S.–MEXICO BORDER, 2003–2006

Lorena Espinoza, H. Irene Hall, and Xiaohong Hu

The population at the U.S.-Mexico border has experienced growth, more than double the U.S. national average. Movements of populations in this region have contributed to increased incidence of certain infectious diseases. We used information on persons diagnosed with HIV during 2003 to 2006 and aged 13 years or older (n = 4,279) reported to the Centers for Disease Control and Prevention for 45 U.S. border counties. We estimated the annual percent change and rates with Poisson regression. Overall, 47% of persons diagnosed with HIV in the border region were Hispanic; 39% nonHispanic white; and 10% nonHispanic black. During 2003 to 2006, HIV diagnoses increased 7.8% per year. Increases were observed among males, particularly among men who have sex with men. Among females, HIV diagnoses remained stable but decreased among females in nonborder regions. The number of HIV diagnoses at the border has increased. To decrease incidence of HIV disease it is necessary to develop prevention and education programs specific to this region.

The population along the U.S.–Mexico border has experienced tremendous growth, more than double the U.S. national average (United States–Mexico Border Health Commission, 2001). According to the U.S. Census Bureau (2001b), between 1990 and 2000, the region experienced a 21% increase in population. Movements of populations in this region have contributed to increased incidence of some infectious diseases, including tuberculosis, hepatitis A, botulism, brucellosis, measles, mumps, rabies, rubella, salmonellosis, and shigellosis (Doyle & Bryan, 2000; Pérez, Brown, & Restrepo, 2006; Redlinger, O'Rourke, Nickey, & Martinez, 1998). Factors such as population migration, socioeconomic status, and demographic characteristics may contribute to the risk of HIV infection, and an increase in the population affects the health care infrastructure.

Migration patterns in the border region may contribute to the risk for HIV infection because change in residence can result in homelessness, loneliness, isolation, and financial instability. In turn, these factors can result in new sex partners, drug use, and inadequate access to health care services (Hirsch, Higgins, Bentley, & Na-

Lorena Espinoza, Irene Hall, and Xiaohong Hu are with the Division of HIV/AIDS Prevention, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, Centers for Disease Control and Prevention, Atlanta, GA.

The findings and conclusions in this manuscript are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

Address correspondence to Lorena Espinoza, DDS, Division of HIV/AIDS Prevention, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, Centers for Disease Control and Prevention, 1600 Clifton Rd., Mailstop E-47, Atlanta, GA, 30333; e-mail LEspinoza@cdc.gov

thanson, 2002). For example, injection drug use has become of increasing concern because the border region encompasses major drug trafficking routes (Brouwer et al., 2006; Bucardo et al., 2005).

The U.S.–Mexico border extends 62 miles on either side of the 2,000-mile border between the United States and Mexico (U.S. Department of State, 1986). In 2000, the population living in the 48 U.S. counties bordering Mexico was 6.3 million (U.S. Census Bureau, 2001a). This region, where the rates of poverty and unemployment are high, is one of the most economically disadvantaged areas in the United States (U.S. Census Bureau, 2006a). A large number of people live in *colonias,* which are residential areas lacking basic infrastructure such as electricity, access to water, and sewer services. Most residents of colonias are Hispanics/Latinos born in the United States (Texas Secretary of State, 2008).

More than half (55%) of the Hispanics/Latinos living in the United States. reside in the four states that border Mexico (Arizona, California, New Mexico, Texas), and the proportion living in counties along the border with Mexico far exceeds the national proportion of 12.5% in 2000 (U.S. Census Bureau, 2001a). In the United States, Hispanics/Latinos are disproportionately affected by HIV infection. Although Hispanics/Latinos accounted for 15% of the U.S. population in the 2006 census estimates (U.S. Census Bureau, 2007), 19% of U.S. residents with AIDS that year were Hispanic/Latino (Centers for Disease Control and Prevention [CDC], 2008a). Although the highest HIV diagnosis rates in 2006 (in 33 states) were those for Blacks (not Hispanic/Latino), the second highest rates were for Hispanics/Latinos: 51 HIV diagnoses per 100,000 Hispanic/Latino men (three times the rate for White [not Hispanic/Latino] men) and 15 HIV diagnoses per 100,000 Hispanic/Latino women (five times the rate for White [not Hispanic/Latino] women) (CDC, 2008a).

We examined the characteristics of persons in this region with a diagnosis of HIV infection and determined (a) recent trends in HIV diagnosis in the border and nonborder region, (b) the association between diagnosis in the border region and a short interval (<12 months) between diagnoses of HIV infection and AIDS, and (c) survival after diagnosis of AIDS.

METHODS

Using the 2000 revised HIV surveillance case definition (CDC, 1999a), we analyzed cases of HIV infection that were diagnosed among adults and adolescents (aged ≥13 years) in the U.S.–Mexico border region and nonborder region during 2003 to 2006 and that were reported to the Centers for Disease Control and Prevention CDC through June 2007. Data were available from 38 areas that had been conducting name-based HIV infection reporting since at least 2003 (long enough for data collection to stabilize and for adjustment of the data in order to monitor trends). The 38 areas encompass 33 states (Alabama, Alaska, Arizona, Arkansas, Colorado, Florida, Idaho, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, West Virginia, Wisconsin, Wyoming) and five U.S. dependent areas (American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and U.S. Virgin Islands).

The U.S.–Mexico border region, hereafter referred to as "border region," consists of 48 counties in four states (Arizona, California, New Mexico, Texas), as de-

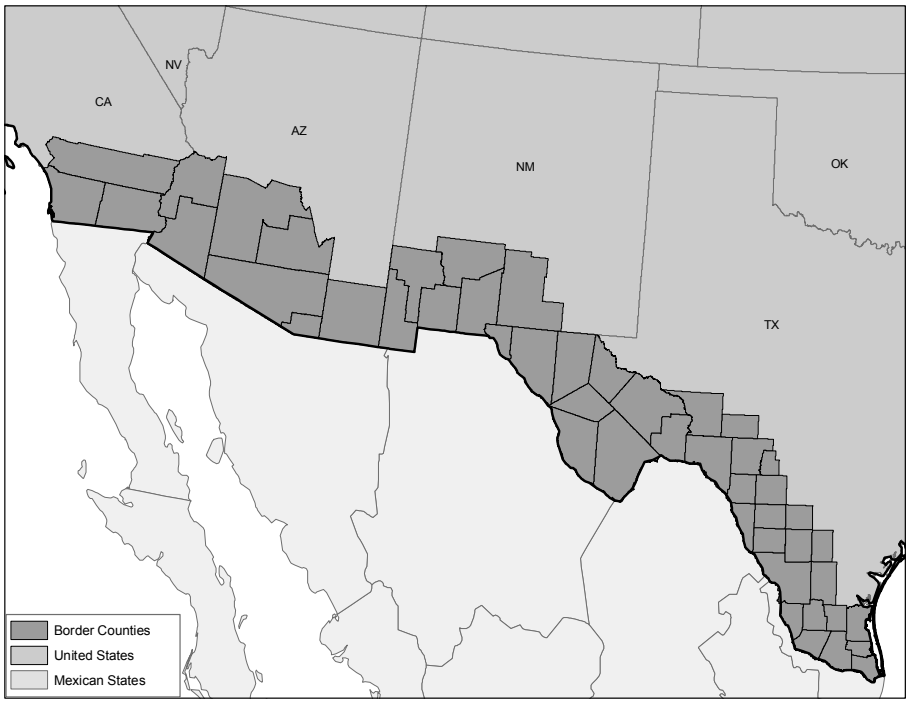

FIGURE 1. U.S.–Mexico Border Region

fined by the U.S. Department of Health and Human Services, Health Resources and Services Administration (U.S. Department of Health and Human Services, 2007) (Figure 1). We defined the nonborder region as U.S. dependent areas and the counties in the 33 states that do not border Mexico. We defined *U.S. born* as persons whose place of birth was in the continental United States; we excluded persons born in the U.S. dependent areas and persons whose place of birth was not reported.

We used the Office of Management and Budget (1997) *Revisions to the Standards for the Classification of Federal Data on Race and Ethnicity* to define race/ethnicity. The term *Hispanic* or *Latino* refers to persons who trace their origin or descent to Mexico, Puerto Rico, Cuba, Central and South America, and other Spanish cultures.

DEMOGRAPHIC CHARACTERISTICS OF PERSONS WITH HIV INFECTION

Using data from the 38 areas, we examined sex, age group, place of birth, race/ethnicity, transmission category, and year of diagnosis among HIV-infected persons in the border region (45 counties in Arizona, New Mexico, Texas) and the nonborder region. The HIV transmission categories were (a) male-to-male sexual contact (regardless of whether the men also had sex with women), (b) injection drug, (c) male-to-male sexual contact and injection drug use, (d) high-risk heterosexual contact (with a sex partner known to have, or to be at high risk for, HIV infection, e.g., a man who has sex with men or an injection drug user), (e) all other specified HIV

TABLE 1: Estimated Number, Percentage and Estimated Annual Percent Change (EAPC) of HIV Diagnosis among Adults and Adolescents, by Selected Characteristics—United States–Mexico border and Nonborder region, 2003–2006

	U.S.–Mexico Border Region								Nonborder Region							
	Year of Diagnosis								Year of Diagnosis							
	2003–2006		2003		2006				2003–2006		2003		2006			
	No.	(%)	No.	(%)	No.	(%)	EAPC	(95% CI)	No.	(%)	No.	(%)	No.	(%)	EAPC	(95% CI)
Total	4,279		949		1,189		7.8	(3.3 to 12.5)	138,447		34,931		35,491		0.1	(–0.6 to 0.8)
Sex																
Male	3,638	(85)	807	(85)	1,022	(86)	8.2	(3.3 to 13.3)	100,100	(72)	24,787	(71)	25,963	(73)	1.3	(0.4 to 2.1)
Female	640	(15)	143	(15)	167	(14)	5.2	(–5.3 to 16.9)	38,347	(28)	10,144	(29)	9,528	(27)	–2.9	(–4.2 to –1.5)
Age group (yrs)																
13–19	94	(2)	14	(1)	36	(3)	30.9	(2.6 to 66.8)	4,626	(3)	1,057	(3)	1,367	(4)	8.3	(4.4 to 12.4)
20–29	1,079	(25)	226	(24)	319	(27)	9.9	(0.9 to 19.7)	30,873	(22)	7,222	(21)	8,449	(24)	5.1	(3.6 to 6.6)
30–39	1,424	(33)	335	(35)	360	(30)	3.1	(–4.0 to 10.7)	42,521	(31)	11,632	(33)	10,008	(28)	–5.4	(–6.6 to –4.1)
40–49	1,145	(27)	256	(27)	342	(29)	10.2	(1.5 to 19.8)	38,988	(28)	9,944	(28)	9,983	(28)	–0.4	(–1.8 to 1.0)
50–59	383	(9)	79	(8)	96	(8)	9.1	(–4.6 to 24.7)	16,074	(12)	3,818	(11)	4,300	(12)	4.1	(1.8 to 6.4)
60+	154	(4)	39	(4)	36	(3)	1.5	(–17.2 to 24.4)	5,365	(4)	1,258	(4)	1,383	(4)	3.4	(–0.6 to 7.5)
Place of birth																
U.S.-born	3,087	(72)	674	(71)	855	(72)	7.6	(2.4 to 13.2)	85,853	(62)	22,039	(63)	21,846	(62)	–0.7	(–1.6 to 0.2)
Foreign-born	900	(21)	185	(19)	277	(19)	13.7	(3.7 to 24.6)	23,005	(17)	5,427	(16)	6,076	(17)	3.7	(1.7 to 5.6)
Missing	292	(7)	91	(10)	57	(9)	–5.7	(–18.8 to 9.6)	29,589	(21)	7,465	(21)	7,568	(21)	–0.2	(–1.7 to 1.5)
Race/ethnicity																
White, not Hispanic/Latino	1,657	(39)	373	(39)	456	(38)	7.4	(0.2 to 15.0)	39,769	(29)	9,631	(28)	10,286	(29)	2.3	(0.9 to 3.6)
Black, not Hispanic/Latino	447	(10)	93	(10)	158	(13)	12.5	(–1.5 to 28.6)	67,540	(49)	17,463	(50)	17,129	(48)	–1.4	(–2.4 to –0.4)
Hispanic/Latino	2,020	(47)	458	(48)	528	(44)	6.1	(–0.1 to 12.7)	28,257	(20)	7,152	(20)	7,400	(21)	0.4	(–1.3 to 2.1)

Asian/Pacific Islander	44	(1)	8	(1)	15	(1)	16.6	(–17.8 to 65.5)	1,403	(1)	328	(1)	387	(1)	5.6	(–1.8 to 13.5)
American Indian/ Alaska Native	98	(2)	15	(2)	24	(2)	17.7	(–7.7 to 50.0)	596	(< 1)	162	(< 1)	140	(< 1)	–4.0	(–13.0 to 5.9)
Missing	13	(< 1)	1	(< 1)	8	(1)	96.5	(0.7 to 283.1)	882	(1)	194	(1)	149	(< 1)	3.0	(–5.2 to 12.0)
Transmission category																
Male-to-male sexual contact	2,678	(63)	563	(59)	754	(63)	11.4	(5.4 to 17.9)	64,026	(46)	15,071	(43)	17,086	(48)	4.4	(3.0 to 5.8)
Male-to-male sexual contact and injection drug use	246	(6)	72	(8)	59	(5)	–9.1	(–25.0 to 10.0)	4,994	(4)	1,317	(4)	1,163	(3)	–3.8	(–9.3 to 1.9)
Injection drug use																
Males	445	(10)	100	(11)	129	(11)	6.0	(–8.8 to 23.3)	13,573	(10)	3,804	(11)	3,219	(9)	–5.6	(–9.1 to –2.0)
Females	158	(4)	31	(3)	52	(4)	17.8	(–5.3 to 46.5)	7,532	(5)	2,095	(6)	1,756	(5)	–6.3	(–11.0 to –1.2)
High-risk heterosexual contact[a]																
Males	260	(6)	69	(7)	80	(7)	0.7	(–19.5 to 25.8)	17,050	(12)	4,472	(13)	4,378	(12)	–1.2	(–4.5 to 2.1)
Females	474	(11)	110	(12)	112	(9)	0.7	(–11.0 to 14.0)	30,370	(22)	7,914	(23)	7,664	(22)	–1.3	(–3.3 to 0.7)
Other[b]	18	(< 1)	4	(< 1)	4	(< 1)	–10.3	(–51.4 to 140.9)	903	(1)	259	(1)	224	(1)	–5.6	(–20.2 to 11.7)

Note .All estimates have been adjusted for reporting delays and the reclassification of cases reported without a known risk factor for HIV infection. Shaded numbers are significant. EAPC = estimated annual percent change; CI = confidence interval. United States–Mexico border region (45 counties) in Arizona, New Mexico, and Texas. Nonborder region in 38 areas: Alabama, Alaska, Arizona, Arkansas, Colorado, Florida, Idaho, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, West Virginia, Wisconsin, Wyoming, American Samoa, Guam, the Commonwealth of the Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands. [a]Heterosexual contact with a sex partner known to have, or to be at high-risk for, HIV infection. [b]Includes receipt of transfusion of blood, blood components, or blood products, and risk factor not reported or not identified.

risk factors (e.g., receipt of HIV-contaminated blood transfusion, blood product, or tissue), and (f) no HIV risk factor identified.

We adjusted the number of diagnoses for expected reporting delay (time between diagnosis and report) (Green, 1998; Karon, Devine, & Morgan, 1990). We also adjusted the distribution of diagnoses by transmission category for missing risk factor information, based on historical patterns of cases originally reported with no risk factor but that were later found to have risk factors and were reclassified into the corresponding transmission categories (Green, Karon, & Nwanyanwu, 1992; Neal, Fleming, Green, & Ward, 1997).

TRENDS IN HIV INFECTION DIAGNOSES

We analyzed trends in the diagnosis of HIV infection among persons whose diagnosis was made during 2003–2006 and who resided in the border region (45 counties in Arizona, New Mexico, and Texas) and the nonborder region. We used Poisson regression to calculate the estimated annual percentage change (EAPC) in the annual number of diagnoses, by sex, age group, place of birth, race/ethnicity, and transmission category, from 2003 through 2006 (Kleinbaum, Kupper, & Muller, 1988). The significance of a trend was determined by whether the 95% confidence interval for the EAPC included .

Annual rates of HIV diagnosis per 100,000 population were calculated by sex, age group, and race/ethnicity for the border region and compared with rates in the 33 states. The population denominators used to compute the rates for the 33 states were based on official postcensus estimates for 2003 to 2006 from the U.S. Census Bureau (2006b) and bridged-race estimates from the National Center for Health Statistics (CDC, 2006). The U.S. dependent areas were excluded from the calculation of rates because postcensus estimates by race and Hispanic/Latino origin are not available for the U.S. dependent areas.

DETERMINANTS OF A SHORT HIV-TO-AIDS INTERVAL

We defined a short HIV-to-AIDS interval as the diagnosis of AIDS less than 12 months after the diagnosis of HIV infection. We performed logistic regression analysis to examine associations between a short HIV-to-AIDS interval and characteristics (sex, age group, place of birth, race/ethnicity, and transmission category) of persons in the border region whose diagnosis of HIV infection was made during 2003 to 2005. Differences between groups in the proportion of cases with a short interval were considered significant if the 95% confidence interval for the adjusted odds ratio did not include 1. Formal tests of interaction indicated that sex modified the effect of place of birth ($p = .002$) and race ($p = .03$) on the probability of concurrent AIDS and HIV diagnoses. Therefore, we conducted logistic regression analysis stratified by sex. Cases in persons whose month of diagnosis of HIV infection was unknown ($n = 3$) were excluded from this analysis.

SURVIVAL TIME AFTER AIDS DIAGNOSIS

We analyzed survival time after a diagnosis of AIDS among persons whose diagnosis of AIDS was made during 1996 to 2004 in 48 counties in four U.S.-Mexico border states (Arizona, California, New Mexico, and Texas) and who were reported to CDC through June 2007. We used data on deaths that occurred during 1996 to 2005 and were reported by June 2007. Cases in persons whose AIDS diagnosis and death occurred in the same month were assigned a follow-up time of 15 days. We used the Kaplan-Meier method to estimate the proportions of persons who survived

TABLE 2. Percentage of Persons Diagnosed with AIDS less than 12 Months after Diagnosis of HIV Infection among Adults and Adolescents, by Selected Characteristics—United States–Mexico border, 2003–2005.

	AIDS < 12 Months after HIV diagnosis		Males		Females	
	No.	(%)	AOR	(95% CI)	AOR	(95% CI)
Age group (yrs)						
13–19	58	(23)	Referent		Referent	
20–29	760	(26)	1.4	(0.6– 3.2)	0.7	(0.3– 2.1)
30–39	1,064	(43)	3.1	(1.4– 7.2)	1.6	(0.6– 4.5)
40–49	802	(48)	4.1	(1.8– 9.3)	2.3	(0.8– 6.4)
50–59	287	(54)	4.8	(2.0– 11.3)	4.9	(1.5– 16.3)
≥ 60	118	(61)	6.8	(2.7– 17.1)	2.7	(0.7– 9.9)
Place of birth						
U.S.-born	2,232	(39)	Referent		Referent	
Foreign-born	623	(51)	1.7	(1.4– 2.2)	0.9	(0.6– 1.5)
Missing	235	(42)	1.1	(0.8– 1.5)	0.5	(0.2– 1.2)
Race/ethnicity						
White, not Hispanic/Latino	1,201	(37)	Referent		Referent	
Black, not Hispanic/Latino	289	(37)	1.0	(0.7– 1.4)	1.3	(0.7– 2.5)
Hispanic/Latino	1,491	(46)	1.4	(1.2– 1.7)	2.2	(1.2– 3.8)
Asian/Pacific Islander	29	(42)	0.9	(0.4– 2.1)	15.1	(1.4– 162.5)
American Indian/Alaska Native	74	(41)	1.7	(0.9– 3.1)	1.1	(0.4– 3.0)
Missing	5	(19)	0.5	(0.1– 4.9)	—	—
Transmission category						
Male-to-male sexual contact	1,924	(40.3)	Referent		—	—
Injection drug use	422	(47.0)	1.4	(1.1– 1.8)	Referent	
Male-to-male sexual contact and injection drug use	187	(41.0)	1.1	(0.8– 1.5)	—	—
High-risk heterosexual contact[a]	542	(42.0)	1.4	(1.0– 1.9)	1.0	(0.6– 1.6)
Other[b]	14	(61.0)	1.4	(0.3– 6.3)	3.2	(0.5– 21.5)
Total[c]	3,090	(41.8)				

Note. No.= total number of HIV diagnoses; AOR = adjusted odds ratio (adjusted by sex, age group, place of birth, race/ethnicity, and transmission category) All estimates have been adjusted for reporting delays and the reclassification of cases reported without a known risk factor for HIV infection. Shaded numbers are significant. CI = confidence interval. Data from 45 counties in Arizona, New Mexico, and Texas. [a]Heterosexual contact with a sex partner known to have, or to be at high-risk for, HIV infection. [b]Includes receipt of transfusion of blood, blood components, or blood products, and risk factor not reported or not identified. [c]Includes 3 persons whose month of diagnosis of HIV infection is unknown. Because column totals were calculated independently of the values for the subpopulations, the values in each column may not sum to the column total.

TABLE 3. Standardized estimates of survival after AIDS diagnosis—United States–Mexico border, 1996–2004

		1 Year after AIDS diagnosis		3 Years after AIDS diagnosis	
	Total %	%	95% CI	%	95% CI
Sex					
Male	88.5	87.7	87.5– 87.8	86.3	86.3– 86.3
Female	11.4	82.1	81.8– 82.2	79.4	79.3– 79.4
Age group (yrs)					
13–29	13.7	93.1	93.0– 93.1	89.6	89.6– 89.7
30–49	72.1	88.8	88.6– 89.0	83.4	83.2– 83.6
≥ 50	13.1	79.7	79.3– 80.1	71.6	71.2– 72.0
Place of birth					
United States	77.2	88.0	87.8– 88.2	82.4	82.2– 82.6
Foreign-born	19.5	88.2	88.1– 88.4	84.3	84.2– 84.3
Other/missing[a]	3.2	92.2	92.1– 92.3	91.1	91.0– 91.1
Race/ethnicity					
White, not Hispanic/Latino	48.6	89.3	89.1– 89.5	84.0	83.7– 84.2
Black, not Hispanic/Latino	11.4	88.7	88.6– 88.9	81.7	81.7– 81.8
Hispanic/Latino	36.8	86.9	86.7– 87.1	81.7	81.4– 82.0
Asian/Pacific Islander	1.2	91.7	91.6– 91.7	86.1	85.1– 87.0
American Indian/Alaska Native	1.6	80.6	80.3– 81.0	75.5	75.0– 75.9
Transmission category					
Male-to-male sexual contact	62.8	89.0	88.8– 89.2	84.5	84.3– 84.7
Injection drug use	13.1	83.5	83.2– 83.8	75.0	74.6– 75.4
Male-to-male sexual contact and injection drug use	9.4	89.4	89.1– 89.7	78.9	78.7– 79.1
High-risk heterosexual contact[b]	9.2	90.1	90.1– 90.1	81.9	81.8– 81.9
Other[c]	4.4	76.4	76.2– 76.6	69.0	68.8– 69.1

Diagnosis year					
1996	14.6	85.6	85.0– 86.1	77.5	76.8– 78.1
1997	12.5	88.9	88.4– 89.4	81.9	81.4– 82.5
1998	11.5	86.7	86.3– 87.2	81.0	80.3– 81.6
1999	10.1	88.8	88.4– 89.1	83.2	82.7– 83.7
2000	9.9	90.0	89.8– 90.3	85.6	85.3– 85.8
2001	10.2	88.4	87.9– 88.9	83.8	83.3– 84.4
2002	10.8	87.6	86.9– 88.3	83.7	83.7– 83.7
2003	10.5	88.8	88.3– 89.2	85.2	84.9– 85.5
2004	10.0	88.9	88.3– 89.5	86.4	86.3– 86.5
CD4 count[d]					
<50	26.4	80.0	79.6– 80.5	72.6	72.1– 73.1
50-99	14.9	88.8	88.4– 89.3	83.0	82.5– 83.5
100-199	34.9	94.4	94.2– 94.7	88.8	88.5– 89.2
≥200	11.1	97.2	96.9– 97.4	94.3	94.1– 94.5
Unknown	12.7	77.2	76.8– 77.6	72.7	72.7– 72.8
Total	100	87.8	87.6– 88.0	82.2	82.0– 82.3

Note. Data from 48 counties in Arizona, California, New Mexico, and Texas. Total (12,204) includes 41 persons for whom race/ethnicity is missing and excludes 41 persons for whom the month of diagnosis was missing. CI = confidence interval. [a]Persons whose place of birth is not among those listed or missing. [b]Heterosexual contact with a sex partner known to have, or to be at high-risk for, HIV infection. [c]Includes receipt of transfusion of blood, blood components, or blood products, and risk factor not reported or not identified. [d]Within 6 months after diagnosis.

more than 12 months and the proportions who survived more than 36 months after diagnosis (Amato, 1988). We adjusted the data for sex, age group, place of birth, race/ethnicity, transmission category, year of diagnosis, and CD4 count at the time of diagnosis. We did not adjust for reporting delays or for unknown risk factors.

RESULTS

DEMOGRAPHIC CHARACTERISTICS OF PERSONS WITH HIV INFECTION

An estimated 4,279 cases of HIV infection were diagnosed among adults and adolescents in the border region during 2003 to 2006, accounting for 3% of all cases during this period in the 38 areas with name-based HIV infection reporting. Nearly half (47%) of HIV infections were diagnosed among Hispanics/Latinos, followed by 39% among Whites (not Hispanic/Latino) and 10% among Blacks (not Hispanic/Latino) (Table 1). However, outside the border region, a larger proportion of cases (49%) were among Blacks (not Hispanic/Latino), followed by 29% among Whites (not Hispanic/Latino), and 20% among Hispanics/Latinos (20%). The transmission categories for HIV infection in the border region are distributed as follows: male-to-male sexual contact (63%), followed by high-risk heterosexual contact (17%), injection drug use (14%), and male-to-male sexual contact and injections drug use (6%).

TRENDS IN HIV INFECTION DIAGNOSES

During 2003 to 2006, the annual number of diagnoses of HIV infection in the border region increased significantly (7.8% per year; 95% confidence interval [CI] = 3.3 to 12.5) (see Table 1). Increases were observed among males (8.2%, CI = 3.3 to 13.3), particularly among men who have sex with men (MSM), (11.4%, CI = 5.4 to 17.9). Among females in the border region, HIV diagnoses remained stable (5.2%, CI = –5.3 to 16.9); among females in the nonborder region, the number of diagnoses decreased (–2.9%, CI = –4.2 to –1.5). Significant changes occurred in some age groups: the EAPCs increased among those aged 13 to 29 years and among those aged 40 to 49 years. The annual number of diagnoses increased significantly among Whites (not Hispanic/Latino) in the border region (7.4%; 95% CI = 0.2 to 15.0) and nonborder region (2.3%; 95% CI = 0.9 to 3.6). Among Hispanics/Latinos in the border region there was a nonsignificant increase (6.1%; 95% CI = –0.1 to 12.7); the number of diagnosis remained stable in the nonborder region (0.4%; 95% CI = –1.3 to 2.1). However the numbers decreased only among Blacks (not Hispanic/Latino) in the nonborder region (–1.4%; 95% CI = –2.4 to –0.4). The annual number of diagnoses of HIV infection among foreign-born persons increased significantly in the border and nonborder regions. By transmission category, the number of diagnoses attributable to injection drug use decreased significantly among males (–5.6%; 95% CI = –9.1 to –2.0) and females (–6.3%; 95% CI = –11.0 to –1.2) in the nonborder region, but diagnoses attributable to IDU in the border region remained stable.

During 2003 to 2006, in the border region, the annual rate of HIV infection diagnoses per 100 000 population increased (not significantly) from 16.2 in 2003 to 18.6 in 2006 (4.6%; 95% CI = –0.2 to 9.5). Overall, the annual EAPC in the nonborder region remained stable (–0.7%; 95% CI = –2.6 to 1.2), but it decreased significantly for Blacks (not Hispanic/Latino) (–2.3%; 95% CI = –4.3 to –0.3) and

Hispanics/Latinos (–3.6%; 95% CI = –6.1 to –1.1); in the border region, the annual rate of infections remained stable (data not shown).

DETERMINANTS OF A SHORT HIV-TO-AIDS INTERVAL

During 2003 to 2005, a total of 3,090 cases of HIV infection were diagnosed among adults and adolescents in the border region: of these, 42% progressed to AIDS in less than 12 months. After adjustment for covariates, a short interval was significantly more common among foreign-born males than among U.S.-born males (Table 2). Likewise, a short interval was more common among male and female Hispanics/Latinos than among male and female Whites (not Hispanic/Latino). Among males, a short interval was more common in the injection drug use and high-risk heterosexual categories than in the male-to-male sexual contact category.

SURVIVAL TIME AFTER AIDS DIAGNOSIS

During 1996 to 2004, a total of 12,377 cases of AIDS were diagnosed among adults and adolescents in the border region—3.2% of all AIDS cases diagnosed during this period in the United States and dependent areas. Of the persons who survived more than 36 months, a larger proportion were males (Table 3). The proportion who survived more than 36 months decreased with increasing age at the time of diagnosis. After 36 months, the smallest proportion of surviving persons were American Indians/Alaska Natives, followed by Hispanics/Latinos and Blacks (not Hispanic/Latino). The smallest proportion of survivors after 36 months were injection drug users.

DISCUSSION

Almost half of HIV infections in the border region were diagnosed among Hispanics/Latinos. Previous studies found that HIV-positive Hispanics/Latinos in the border region reported fear of stigma and fear of disclosure of HIV serostatus (Center for Applied Social Research, 2005; Zúñiga, Brennan, Scolari, & Strathdee, 2008). In 2006, the highest rates of being uninsured were among Hispanics/Latinos (34.1%), followed by Blacks (not Hispanic/Latino) (20.5%) and Whites (not Hispanic/Latino) (10.8%) (U.S. Census Bureau, 2008). Although lack of health insurance and access to care may account for some of the health disparities in the border region, other reasons include inadequate community infrastructure, socioeconomic conditions, and lack of awareness of health issues (Guo & Phillips, 2006).

The highest proportion of HIV diagnoses were among MSM. The increase in the number of diagnoses of HIV infection among MSM is consistent with other reported increases (Hall et al., 2008) and suggests a resurgent epidemic among MSM (CDC, 2008; Wolitski, Valdiserri, Denning, & Levine, 2001). Improved treatments for HIV disease may have led to changes in belief patterns regarding disease severity (Fleming, Wortley, Karon, De Cock, & Janssen, 2000) and consequently to increases in the frequency of high-risk sexual behavior among MSM (CDC, 1999b; Ekstrand, Stall, Paul, Osmond, & Coates, 1999).

In the nonborder region, the number of cases of HIV infection attributed to injection drug use among males and females decreased significantly; in the border region, the number did not change. Injection drug use in the border region has become of increasing concern because the region encompasses major drug trafficking routes (Brouwer et al., 2006; Bucardo et al., 2005) and mobile populations. Shar-

ing syringes and other equipment for drug injection is a well-known route of HIV transmission, as is the increased risk of HIV through sexual transmission (sex with an injection drug user). Studies of IDU along the border are limited; however, several studies (Deiss et al., 2008; Patterson et al., 2005) have been conducted in Tijuana, Mexico (adjacent to San Diego, California) and Ciudad Juárez, Mexico (adjacent to El Paso, Texas). Among male injection drug users, high-risk behaviors such as needle sharing, shooting gallery use, and exchange for sex were more likely among males who engaged in male-to-male sexual contact and injection drug use than among males who did not (Deiss et al., 2008). In a study of female sex workers, three quarters of those in Ciudad Juárez and one quarter of those in Tijuana had injected illegal drugs (Patterson et al., 2005).

The results of our analysis confirm reports of increases in HIV diagnosis in the border region (Strathdee & Magis-Rodriquez, 2008). The increase in the rate of diagnosis may be due to an increased incidence of HIV infection or to an increase in HIV testing. However, according to a recent report, HIV testing rates among adults during 2001 to 2006 remained flat: in 2006, the proportion who had ever been tested was 40.4% (CDC, 2008b). However, data specific to HIV testing in the border region are not available.

Mobility of populations provides the potential for cross-border transmission of HIV. In a study of young Latino MSM at the San Diego–Tijuana border, 75% of MSM in San Diego and 46% of MSM in Tijuana reported having had male sex partners from across the border (California Department of Health Services, 2006). Of the young Latino MSM in this study, 35.2% in San Diego and 20.1% in Tijuana were HIV infected; of these, 75% of HIV-infected males from San Diego and more than 50% from Tijuana had been unaware that they were HIV-positive.

A short HIV-to-AIDS interval may indicate that testing was delayed until late in the course of HIV disease, when symptoms are likely to have developed. It also may reflect inadequate care and treatment. Our results show that the proportion of persons with a short interval is larger in the border region than elsewhere in the United States (CDC, 2008a). Among males, the number with a short interval increased with age, which may be explained by the fact that HIV disease tends to progress more rapidly among older persons (Pezzotti et al., 1996). Another possible explanation is that older persons are assumed not to be at risk and therefore are not the focus of testing programs. A short interval varied by place of birth and was more common among Hispanics/Latinos than among Whites (not Hispanic/Latino), consistent with other studies (CDC, 2008a; Espinoza, Hall, Selik, & Hu, 2008). This racial/ethnic difference may reflect differing testing behaviors among Hispanics/Latinos compared with persons of other race/ethnicities. Historically, Hispanics/Latinos, compared with Whites (not Hispanic/Latino), have had less access to general medical treatment and prevention services (U.S. Department of Health and Human Services, 2000). The barriers of language and lack of health insurance, both of which affect care, may be more prevalent among Hispanics/Latinos living at the border.

Our findings, consistent with those of other studies, were that survival after a diagnosis of AIDS was shorter for Hispanics/Latinos than for Whites (not Hispanic/Latino) (Hall, McDavid, Ling, & Sloggett, 2006). Hispanics/Latinos are more likely to be uninsured; in turn, those who are uninsured are more likely to delay or not receive medical care because of cost (Inungu, 2002; Turner et al., 2000). However, other studies have reported that the survival of Hispanics/Latinos is similar to that of Whites (not Hispanic/Latino) (Lee, Karon, Selik, Neal, & Fleming, 2001).

Our data are subject to at least three limitations. First, HIV diagnoses from some states are not included in the data. Although our data are from the largest set of population-based data on persons with HIV infection, the 33 states and dependent areas used in this analysis may not be representative, as they reported only 65% of all AIDS cases diagnosed among adults and adolescents in the United States and dependent areas during 2003 to 2006. The lack of data from California, an important border state with high AIDS morbidity, results in an underrepresentation of cases among persons living in the border region. However, the U.S. border population of Arizona, New Mexico, and Texas in 2006 constituted 60.6% of the total border population and 67.7% of the Hispanic/Latino border population. Second, the assumptions on which we based the reclassification of the transmission category of cases reported without risk factors may no longer be valid: these assumptions are being reevaluated. However, limited studies have indicated an underestimation of the number of cases attributed to high-risk heterosexual contact (McDavid et al., 2006). Lastly, detailed information about the HIV-related behavioral risk factors of sex partners of HIV-infected persons is limited, reducing the usefulness of the surveillance data in evaluating the effect of sexual behavior on HIV transmission.

In summary, the number of HIV diagnoses in the border region has increased, adding to the burden of disease in a poor and medically underserved region. Prevention programs should include increased access to HIV testing and effective linkages to care and treatment services for those with a positive HIV test. Hispanics/Latinos are disproportionately affected by HIV infection, which underscores the importance of tailoring HIV prevention efforts to address the important cultural and behavioral characteristics of Hispanics/Latinos in this region. To decrease the incidence of HIV disease it will be necessary to develop prevention and education programs specific to Hispanics/Latinos in the border region and to target limited resources to those at high risk for HIV infection.

REFERENCES

Amato, D. A. (1988). A generalized Kaplan-Meier estimator for heterogeneous populations. *Communications in Statistics: Theory and Methods*, *17*, 263–286.

Brouwer, K. C., Case, P., Ramos, R., Magis-Rodriquez, C., Bucardo, J., Patterson, T. L., et al. (2006). Trends in production trafficking and consumption of methamphetamine and cocaine in Mexico. *Substance Use and Misuse*, *41*(5), 707–727.

Bucardo, J., Brouwer, K.C., Magis-Rodriquez, C., Ramos, R., Fraga, M., Garcia Perez, S., et al. (2006). Historical trends in the production and consumption of illicit drugs in Mexico: Implications for prevention of blood borne infections. *Drug and Alcohol Dependence*, *79*, 281–293.

California Department of Health Services, Office of AIDS. (2006). *Prevalence of HIV infections and related risk behaviors among young Latino men who have sex with men: San Diego–Tijuana border region.* Retrieved August 28, 2008, from http://www.cdph.ca.gov/programs/AIDS/Pages/OAReportsandPublications.aspx

Center for Applied Social Research. (2005). *A description of demographics, lifestyle and culture, risk factors, quality of life, and barriers reported by HIV positive clients living in the U.S.–Mexico border region.* Norman: University of Oklahoma Press.

Centers for Disease Control and Prevention. (1999a). Guidelines for national human immunodeficiency virus case surveillance, including monitoring for human immuno-

deficiency virus infection and acquired immunodeficiency syndrome. *Morbidity and Mortality Recommendations and Reports*, *48*(RR-13), 29–31.

Centers for Disease Control and Prevention. (1999b). Increases in unsafe sex and rectal gonorrhea among men who have sex with men—San Francisco, California, 1994–1997. *Morbidity and Mortality Weekly Report, 48,* 45–48.

Centers for Disease Control and Prevention, National Center for Health Statistics. (2006). Bridged-race vintage 2006 postcensal population estimates for July 1, 2000–July 1, 2006, by year, county, single-year of age, bridged-race, Hispanic origin, and sex. Retrieved September 29, 2008, from http://www.cdc.gov/nchs/about/major/dvs/popbridge/datadoc.htm#vintage2006

Centers for Disease Control and Prevention. (2008a). *HIV/AIDS surveillance report, 2006.* (Vol. 18). Atlanta, GA: Author. Retrieved September 29, 2008, from http://www.cdc.gov/hiv/topics/surveillance/resources/reports/2006report/

Centers for Disease Control and Prevention. (2008b). Persons tested for HIV—United States, 2006. *Morbidity and Mortality Weekly Report, 53,* 1106–1110.

Centers for Disease Control and Prevention. (2008c). Trends in HIV/AIDS diagnoses among men who have sex with men—33 states, 2001–2006. *Morbidity and Mortality Weekly Report, 67,* 681–686.

Deiss, R. G., Brouwer, K. C., Loza, O., Lozada, R. M., Ramos, R., Cruz, M.A, et al. (2008). High-risk sexual and drug using behaviors among male injection drug users who have sex with men in 2 Mexico-U.S. border cities. *Sexually Transmitted Diseases, 35*(3), 243–249.

Doyle, T. J., & Bryan, R.T. (2000). Infectious disease morbidity in the U.S. region bordering Mexico, 1990–1998. *Journal of Infectious Diseases, 182,* 1503–1510.

Ekstrand, M. L., Stall, R. D., Paul, J. P., Osmond, D. H., & Coates, T. J. (1999). Gay men report high rates of unprotected anal sex with partners of unknown or discordant HIV status. *AIDS, 13,* 1525–1533.

Espinoza, L., Hall, H. I., Selik, R. M., & Hu, S. (2008). Characteristics of HIV infection among Hispanics, United States, 2003–2006. *Journal of Acquired Immune Deficiency Syndromes, 49*(1), 94–101.

Fleming, P. L., Wortley, P. M., Karon, J. M., De Cock, K. M., & Janssen, R. S. (2000). Tracking the HIV epidemic: current issues, future challenges. *American Journal of Public Health, 90,* 1037–1041.

Green T. A. (1998). Using surveillance data to monitor trends in the AIDS epidemic. *Statistics in Medicine, 17,*143–154.

Green, T. A., Karon, J. M., & Nwanyanwu, O. C. (1992). Changes in AIDS incidence trends in the United States. *Journal of Acquired Immune Deficiency Syndromes, 5,* 547–555.

Guo, G., & Phillips, L. (2006). Key informants' perceptions of health care for elders at the U.S.–Mexico border. *Public Health Nursing, 23*(3), 224–233.

Hall, H. I., McDavid, K., Ling, Q., & Sloggett, A. (2006). Determinants of progression to AIDS or death after HIV diagnosis, United States, 1996 to 2001. *Annals of Epidemiology, 16,* 824–833.

Hall, H. I., Song, R., Rhodes, P., Prejean J., An, Q., Lee, L. M., et al. (2008). **Estimation of HIV incidence in the United States.** *Journal of the American Medical Association, 300,* **520–529.**

Hirsch, J. S., Higgins, J., Bentley, M. E., & Nathanson, C. A. (2002). The social constructions of sexuality: Marital infidelity and sexually transmitted disease—HIV risk in a Mexican migrant community. *American Journal of Public Health, 92,* 1227–1237.

Inungu, J.N. (2002). Potential barriers to seeking human immunodeficiency virus testing among adults in the United States: Data from the 1998 National Health Interview Survey. *AIDS Patient Care and STDs, 16,* 293–299.

Karon, J. M., Devine, O. J., & Morgan W. M. (1990). Predicting AIDS incidence by extrapolating from recent trends. In C. Castillo-Chavez (Vol. Ed.), *Lecture notes in biomathematics: Vol. 83.Mathematical and statistical approaches to AIDS epidemiology* (pp. 58-88). New York: Springer-Verlag.

Kleinbaum, D. G., Kupper, L. L., & Muller, K. E. (1988). Applied regression analysis and other multivariable methods. Boston: PWS-Kent.

Lee, L. M., Karon, J. M., Selik, R., Neal, J. J., & Fleming, P. L. (2001). Survival after AIDS diagnosis in adolescents and adults during the treatment era, United States, 1984–1997. *Journal of the American Medical Association, 285,* 1308–1315.

McDavid, K., Gerstle, J. E., Hammett, T. A., Ellison, D. M., Stephens, D. G., Kirk, J., et al. (2006). Results of the Expanded HIV Risk Factor Assessment Project (EHRAP). *AIDS Care, 18,* 77–81.

Neal, J. J., Fleming, P. L., Green, T. A., & Ward, J. W. (1997). Trends in heterosexually acquired AIDS in the United States, 1988 through 1995. *Journal of Acquired Immune Deficiency Syndromes, 14,* 465–474.

Office of Management and Budget. (1997). Revisions to the standards for the classification of federal data on race and ethnicity. *Federal Register*, *62*, 58781–58790. Also available at http://www.whitehouse.gov/omb/fedreg/ombdir15.html (Accessed December 8, 2008).

Patterson, T. L., Semple, S. J., Bucardo, J., De La Torre, A., Fraga, M., Staines, H., et al. (2005, June). *A comparison of drug use patterns and HIV/STD prevalence among female sex workers in two Mexican–U.S. border cities*. Paper presented at the 67th Annual Meeting of the College of Problems of Drug Dependence, Orlando, FL.

Pérez, A., Brown, H. S., & Restrepo, B. I. (2006). Association between tuberculosis and diabetes in the Mexican border and nonborder regions of Texas. *American Journal of Tropical Medicine and Hygiene, 74*(4), 604–611.

Pezzotti, P., Phillips, A. N., Dorrucci, M., Lepri, A. D., Galai, N., Vlahov, D., et al. (1996). Category of exposure to HIV and age in the progression to AIDS: Longitudinal study of 1199 people with known dates of seroconversion. *British Medical Journal, 313*, 583–586.

Redlinger, T., O'Rourke, K., Nickey, L., & Martinez, G. (1998). Elevated hepatitis A and E seroprevalence rates in a Texas/Mexico border community. *Texas Medicine, 94*, 68–71.

Strathdee, S.A., & Magis-Rodriquez, C. (2008). Mexico's evolving HIV epidemic. *Journal of the American Medical Association, 300*(5), 571–573.

Texas Secretary of State. (2008). *Colonias FAQ's*. Retrieved September 29, 2008, from http://www.sos.state.tx.us/border/colonias/faqs.shtml

Turner, B. J., Cunningham, W. E., Duan, N., Andersen, R. M., Shapiro, M. F., Bozzette, S. A., et al. (2000). Delayed medical care after diagnosis in a U.S. national probability sample of persons infected with human immunodeficiency virus. *Archives of Internal Medicine, 160*, 2614–2622.

United States–Mexico Border Health Commission. (2001). *Annual report*. El Paso, TX: Author.

U.S. Census Bureau. (2001a). *The Hispanic population: 2000*. Retrieved September 29, 2008, from http://www.census.gov/prod/2001pubs/c2kbr01-3.pdf

U. S. Census Bureau. (2001b). *Population change and distribution: 1990 to 2000*. Retrieved September 29, 2008, from http://www.census.gov/prod/2001pubs/c2kbr01-2.pdf

U.S. Census Bureau. (2006a). News Conference on 2005 Income and poverty estimates from the current population survey and the American Community Survey. Available at http://www.census.gov/Press-release/www/2006/djohnson_income_script.html (Accessed August 6, 2008).

U.S. Census Bureau. (2006b). *Population estimates*. Published July 1, 2006. Retrieved September 29, 2008, from http://www.census.gov/popest/archives/2000s/vintage_2006/

U.S. Census Bureau. (2007). Facts for features: *Hispanic heritage month 2007: Sept. 15–Oct. 15*. Retrieved September 29, 2008, from http://www.census.gov/Press-Release/www/releases/archives/facts_for_features_special_editions/010327.html

U.S. Census Bureau. (2008). *Health insurance coverage: 2007*. Retrieved September 29, 2008, from http://www.census.gov/hhes/www/hlthins/hlthin07/hlth07asc.html

U.S. Department of Health and Human Services. (2000). *Healthy People 2010* (2nd ed., 2 vols.) Washington, DC: U.S. Government Printing Office. Retrieved September 3, 2008, from http://www.health.gov/healthypeople

U.S. Department of Health and Human Services, Health Resources and Services Administration. (2007). *Public health and information technology at the United States–Mexico border*. Retrieved September 29, 2008, from http://ruralhealth.hrsa.gov/pub/border.htm

U.S. Department of State. (1986). *Environmental cooperation: Agreement between the United States of America and Mexico signed at La Paz, August 14, 1983*. Washington DC: Author.

Wolitski, R. J., Valdiserri, R. O., Denning, P. H., & Levine, W. C. (2001). Are we headed for a resurgence of the HIV epidemic among men who have sex with men? *American Journal of Public Health, 91*, 883–888.

Zúñiga, M. L., Brennan, J., Scolari, R., & Strathdee, S. A. (2008). Barriers to HIV care in the context of cross-border health care utilization among HIV-positive persons living in California/Baja California U.S.–Mexico Border Region. *Journal of Immigrant and Minority Health, 10*, 219–227.