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World AIDS Day — December 1, 2013

World AIDS Day draws attention to the current status of the human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) epidemic worldwide. The theme for this year's December 1 observance is "Shared Responsibility: Strengthening Results for an AIDS-Free Generation."

The first cases of AIDS were reported more than 32 years ago in the June 5, 1981, issue of *MMWR*. Since then, an estimated 36 million persons worldwide have died from HIV/AIDS; an estimated 35.3 million persons continue to live with HIV infection (*1*).

In the United States, approximately 636,000 persons with AIDS diagnoses have died since the first cases were reported (*2*); an estimated 1.1 million persons continue to live with HIV infection (*3*).

Global efforts, including the U.S. President's Emergency Plan for AIDS Relief (for which CDC is an implementing partner), provided antiretroviral therapy to approximately 9.7 million persons in low-income and middle-income countries in 2012, an increase of 1.6 million persons from 2011 (*4*).

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Differences Between HIV-Infected Men and Women in Antiretroviral Therapy Outcomes — Six African Countries, 2004–2012

Evaluation of differences between human immunodeficiency virus (HIV)-infected men and women in antiretroviral therapy (ART) enrollment characteristics and outcomes might identify opportunities to improve ART program patient outcomes and prevention impact. During September 2008–February 2012, retrospective cohort studies to estimate attrition of enrollees (i.e., from death, stopping ART, or loss to follow-up) at 6-month intervals after ART initiation were completed among samples of adult men and women (defined as aged ≥15 years or aged ≥18 years) who initiated ART during 2004–2010 in six African countries: Côte d'Ivoire in western Africa; Swaziland, Mozambique, and Zambia in southern Africa; and Uganda and Tanzania in eastern Africa. Records for 13,175 ART enrollees were analyzed; sample sizes among the six countries ranged from 1,457 to 3,682. In each country, women comprised 61%–67% of ART enrollees. Median CD4 count range was 119–141 cells/μL for men and 137–161 cells/μL for women. Compared with women, a greater percentage of men initiated ART who had World Health Organization (WHO) HIV stage IV disease. In cohorts from western Africa and

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southern Africa, the risk for attrition was 15%–26% lower among women compared with men in multivariable analysis. However, in eastern Africa, differences between men and women in risk for attrition were not statistically significant. Research to identify country-specific causes for increased attrition and delayed initiation of care among men could identify strategies to improve ART program outcomes among men, which might contribute to prevention of new HIV infections in female partners.

In each of the six countries, a representative sample of ART facilities was selected. To keep the studies feasible, small facilities were excluded from the sample frames of countries with >100 ART facilities at the time of sampling. Therefore, in Côte d'Ivoire and Mozambique, facilities that had enrolled <50 adults on ART were excluded, whereas in Zambia, Uganda, and Tanzania, facilities that had enrolled <300 adults on ART were excluded (Table 1).

From the eligible number of facilities in Côte d'Ivoire (78), Swaziland (31), and Mozambique (94), totals of 34, 16, and 30 study facilities, respectively, were randomly selected using probability-proportional-to-size sampling (Table 1). From the eligible number of facilities in Zambia (129), Uganda (114), and Tanzania (85), six study facilities were purposefully (nonrandomly) selected in each country to represent different types of ART facilities.

At each selected facility, a sample frame of study-eligible ART patients was created, and simple random sampling used to select the desired sample size of patient medical records. Eligibility criteria included having started ART during 2004–2010 and ≥6 months before data abstraction. Data were abstracted by trained study personnel from ART medical records onto standardized abstraction forms.

Attrition was the primary outcome of interest. A patient was considered lost to attrition if the record showed 1) the patient had died, 2) the patient had stopped ART because of a personal or clinician decision, or 3) the patient had not attended the facility in the 90 days preceding data abstraction for either medication refill or a clinician visit, in which case the patient was considered lost to follow-up.

Variables routinely collected on Ministry of Health medical records at ART initiation including sex, age, CD4 count, WHO HIV disease stage, and ART regimen, were entered into standardized abstraction forms. Data were analyzed using statistical software, and study design was controlled for during analysis. Data for Côte d'Ivoire, Swaziland, and Mozambique were weighted to account for the probability-proportional-to-size sampling.

To estimate the effect of sex on attrition, Cox proportional hazards regression models were used to estimate unadjusted and adjusted hazard ratios, 95% confidence intervals, and p-values. Multivariate models included only cases with complete data for sex, age, CD4 count, WHO HIV disease stage, and ART regimen. The proportional hazards assumption was assessed using visual methods and the Grambsch and Therneu test (*1*). For all countries, a shared frailty model was used to account for intrafacility correlation. Chi-square tests were used to compare

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TABLE 1. Summary of sampling criteria and methods*† used to select adult antiretroviral therapy (ART) enrollees for retrospective cohort studies conducted — six African countries, 2008–2012

Characteristic	Côte d'Ivoire	Swaziland	Mozambique	Zambia	Uganda	Tanzania	Total
Stage 1: Selection of study facilities							
No. of ART clinics	124 by Dec 2007	31 by Dec 2009	152 by Dec 2006	322 by Dec 2007	286 by Dec 2007	210 by Dec 2007	
No. of enrollees at ART clinics	36,943	50,767	43,295	65,383	45,946	41,920	
Clinic eligibility criteria for study	Enrolled ≥50 adults on ART by Dec 2007	All ART initiation sites eligible	Enrolled ≥50 adults on ART by Dec 2006	Enrolled ≥300 adults on ART by Dec 2007	Enrolled ≥300 adults on ART by Dec 2007	Enrolled ≥300 adults on ART by Dec 2007	
No. of study-eligible clinics	78	31	94	129	114	85	**531**
Estimated no. of study-eligible enrollees at clinics	36,110	50,767	42,234	58,845§	41,351§	37,728§	**267,035**
No. of clinics selected	34	16	30	6	6	6	**98**
Stage 2: Selection of study patients							
Age at ART initiation criteria for study enrollees	≥15 yrs	≥15 yrs	≥15 yrs	≥18 yrs	≥18 yrs	≥18 yrs	
Years of ART enrollment	2004–2007	2004–2010	2004–2007	2004–2009	2004–2009	2004–2009	
Planned sample size	4,000	2,500	2,600	1,500	1,500	1,500	**13,600**
No. of eligible study enrollees	3,682	2,510	2,596	1,457	1,472	1,458	**13,175**
Date of data collection	Nov 2009–March 2010	Nov 2011–Feb 2012	Sept–Nov 2008	April–July 2010	April–July 2010	April–July 2010	

* In Côte d'Ivoire, Swaziland, and Mozambique, study facilities were randomly selected using probability-proportional-to-size sampling. In Zambia, Uganda, and Tanzania, study facilities were purposefully selected to represent different types of ART facilities in each country.
† In all six countries, at each selected facility, a sample frame of study-eligible ART patients was created, and simple random sampling was used to select the desired sample size of patient medical records.
§ Estimate from available published data.

distributions of categorical variables, and t-tests were used to compare distributions of continuous variables between men and women. Attrition at 6-month intervals after ART initiation was analyzed using the Kaplan-Meier product-limit estimate of the survivor function.

The sample sizes in the six countries ranged from 1,457 to 3,682, with a total of 13,175 records analyzed (Table 2). In each country, 61%–67% of ART enrollees were women. In each country, men were significantly older than women at ART initiation. Median age range for men was 37–40 years, and for women was 32–35 years.

Compared with women, median CD4 count at ART initiation was significantly lower among men in Côte d'Ivoire (119/μL compared with 155/μL), Swaziland (121/μL compared with 161/μL), and Uganda (128/μL compared with 144/μL). Median CD4 count was lower for men compared with women in Mozambique, Zambia, and Tanzania, although these differences were not statistically significant ($p>0.05$).

In all countries, men initiated ART at a more advanced WHO disease stage (Table 2). For example, a higher proportion of men than women initiated ART at WHO stage IV disease in Côte d'Ivoire (26% compared with 21%), Swaziland (18% compared with 10%), Mozambique (20% compared with 13%), Zambia (11% compared with 9%), Uganda (16% compared with 10%), and Tanzania (30% compared with 27%).

For both men and women across all six countries, nevirapine-containing first-line regimens were more common than efavirenz-containing or protease inhibitor–containing regimens, or triple nucleoside reverse transcriptase inhibitor regimens (Table 2). The distribution of first-line ART regimen choices for men differed from choices for women in all countries, with women more likely to be prescribed nevirapine-containing regimens than men (Table 2).

In all countries, point estimates for attrition during the first 4.5 years of ART were lower for women than men (Table 3). This difference was statistically significant in countries in western and southern Africa, where women had 21%–27% lower rates of attrition in unadjusted analysis and 15%–26% lower rates of attrition in adjusted analysis (Table 3). In Uganda and Tanzania, women had 7%–18% lower rates of attrition in unadjusted analysis and 11%–12% lower rates of attrition in adjusted analysis, although the associations between sex and attrition rates were not statistically significant in these two countries.

TABLE 2. Enrollment characteristics of adults (N = 13,175) initiating antiretroviral therapy (ART) — six African countries, 2004–2010

Characteristic	Côte d'Ivoire* (N = 3,682) No.	Median age	p-value§	Swaziland* (N = 2,510) No.	Median age	p-value	Mozambique* (N = 2,596) No.	Median age	p-value
Sex, no., and median age									
Women	2,422	34	<0.001	1,621	32	<0.001	1,576	32	<0.001
Men	1,260	40		889	38		1,020	38	
	No.	**Median CD4**	**p-value**	**No.**	**Median CD4**	**p-value**	**No.**	**Median CD4**	**p-value**
Sex, no., and median CD4 count at ART initiation (cells/μL)									
Women	1,811	155	<0.001	1,487	161	<0.001	1,373	161	0.063
Men	935	119		809	121		881	141	
Missing data	936	—		214	—		342	—	
	No.	**(%)**	**p-value**	**No.**	**(%)**	**p-value**	**No.**	**(%)**	**p-value**
Sex, no., and %									
Women	2,422	(67)		1,621	(65)		1,576	(62)	
Men	1,260	(33)		889	(35)		1,020	(38)	
WHO HIV disease stage									
Stage I/II									
Women	363	(19)	0.064	700	(50)	<0.001	386	(39)	0.001
Men	224	(22)		260	(34)		233	(34)	
Stage III									
Women	987	(61)		590	(40)		451	(48)	
Men	453	(53)		377	(48)		288	(46)	
Stage IV									
Women	331	(21)		149	(10)		136	(13)	
Men	223	(26)		144	(18)		123	(20)	
Missing data	1,101	(30)		290	(12)		979	(38)	
Female regimens									
NVP-3TC-D4T/AZT/TDF	1,219	(49)	0.077	1,153	(72)	<0.001	1,430	(91)	<0.001
EFV-3TC-D4T/AZT/TDF	692	(30)		372	(23)		124	(8)	
Triple NRTI	90	(3)		0	—		13	(1)	
PI-based	122	(4)		0	—		1	(<1)	
Unknown	211	(10)		96	(5)		8	(<1)	
Other	88	(5)		0	—		0	—	
Male regimens									
NVP-3TC-D4T/AZT/TDF	548	(42)		519	(59)		881	(85)	
EFV-3TC-D4T/AZT/TDF	430	(36)		309	(35)		120	(13)	
Triple NRTI	48	(3)		0	—		4	(<1)	
PI-based	84	(6)		1	(<1)		2	(<1)	
Unknown	110	(9)		60	(6)		13	(1)	
Other	40	(3)		0	—		0	—	

See table footnotes on page 949.

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TABLE 2. (*Continued*) Enrollment characteristics of adults (N = 13,175) initiating antiretroviral therapy (ART) — six African countries, 2004–2010

Characteristic	Zambia† (N = 1,457)			Uganda† (N = 1,472)			Tanzania† (N = 1,458)		
	No.	Median age	p-value	No.	Median age	p-value	No.	Median age	p-value
Sex, no., and median age									
Women	880	34	<0.001	964	34	<0.001	973	35	<0.001
Men	575	37		502	37		484	39	
	No.	**Median CD4**	**p-value**	**No.**	**Median CD4**	**p-value**	**No.**	**Median CD4**	**p-value**
Sex, no., and median CD4 count at ART initiation (cells/μL)									
Women	639	139	0.261	774	144	0.012	742	137	0.232
Men	411	127		395	128		379	121	
Missing data	407	—		303	—		337	—	
	No.	**(%)**	**p-value**	**No.**	**(%)**	**p-value**	**No.**	**(%)**	**p-value**
Sex, no., and %									
Women	882	(61)		968	(66)		974	(67)	
Men	575	(39)		504	(34)		484	(33)	
WHO HIV disease stage									
Stage I/II									
Women	326	(41)	0.029	434	(51)	0.006	225	(29)	0.006
Men	170	(34)		205	(45)		76	(20)	
Stage III									
Women	390	(49)		330	(39)		347	(44)	
Men	277	(55)		178	(39)		192	(50)	
Stage IV									
Women	73	(9)		87	(10)		212	(27)	
Men	54	(11)		73	(16)		113	(30)	
Missing data	167	(11)		165	(11)		293	(20)	
Female regimens									
NVP-3TC-D4T/AZT/TDF	606	(69)	<0.001	772	(80)	0.013	760	(78)	0.088
EFV-3TC-D4T/AZT/TDF	260	(29)		179	(18)		201	(21)	
Triple NRTI	0	—		3	(<1)		0	—	
PI-based	6	(1)		8	(1)		0	—	
Unknown	0	—		0	—		0	—	
Other	10	(1)		6	(1)		13	(1)	
Male regimens									
NVP-3TC-D4T/AZT/TDF	334	(58)		362	(72)		357	(74)	
EFV-3TC-D4T/AZT/TDF	225	(39)		133	(26)		122	(25)	
Triple NRTI	0	—		1	(<1)		0	—	
PI-based	9	(2)		5	(1)		1	(<1)	
Unknown	0	—		0	—		0	—	
Other	7	(1)		3	(<1)		974	(1)	

Abbreviations: WHO = World Health Organization; NVP = nevirapine; EFV = efavirenz; 3TC = lamivudine; D4T = stavudine; AZT = zidovudine; TDF = tenofovir; NRTI = nucleoside reverse transcriptase inhibitor; PI = protease inhibitor.

* Data for Côte d'Ivoire, Swaziland, and Mozambique are weighted to account for the sampling method.

† Data were missing for two enrollees in Zambia, six in Uganda, and one in Tanzania.

§ p-value for comparison of ART enrollee characteristics for men and women (t-test for continuous variables and chi-square test for categorical variables).

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Editorial Note

Equitable access to ART for both men and women is a principle endorsed by most African governments and international donors, including the U.S. President's Emergency

TABLE 3. Percentage of antiretroviral therapy (ART) enrollees alive and on therapy, by years after ART initiation, and attrition* rate and risk for attrition, by sex — retrospective cohort studies, six African countries

	Côte d'Ivoire		Swaziland		Mozambique	
Years after ART initiation	Women %	Men %	Women %	Men %	Women %	Men %
0.5	81	75	86	81	84	81
1	76	70	82	77	78	73
1.5	72	66	79	74	74	69
2	67	60	76	71	71	66
2.5	63	55	74	68	69	64
3	59	51	71	64	68	59
3.5	56	48	71	63	65	53
4	51	43	68	62	65	52
4.5	47	40	65	62	62	52

Attrition rate	Per 100 person-years	(95% CI)	Per 100 person-years	(95% CI)	Per 100 person-years	(95% CI)
Sex						
Men	24.7	(22.4–27.2)	16.2	(14.4–18.2)	23.0	(19.8–26.9)
Women	18.7	(17.4–20.2)	12.4	(11.3–13.6)	17.9	(15.7–20.4)

Unadjusted risk for attrition	HR	(95% CI)	p-value	HR	(95% CI)	p-value	HR	(95% CI)	p-value
Sex									
Men	Referent	—		Referent	—		Referent	—	
Women	0.78	(0.70–0.86)	<0.001	0.78	(0.68–0.90)	0.002	0.79	(0.71–0.88)	<0.001

Adjusted risk for attrition†	HR	(95% CI)	p-value	HR	(95% CI)	p-value	HR	(95% CI)	p-value
Sex									
Men	Referent	—		Referent	—		Referent	—	
Women	0.74	(0.65–0.83)	<0.001	0.85	(0.74–0.97)	0.021	0.79	(0.70–0.89)	<0.001

See table footnotes on page 951.

plan for AIDS Relief and the Global Fund to Fight HIV/AIDS, Tuberculosis, and Malaria (*2,3*). However, in Africa, proportionally more HIV-infected women are accessing ART services than men (*4*). Evaluating differences in ART enrollment characteristics and treatment outcomes between men and women might help program managers understand these differences in ART enrollment and identify opportunities for ART program improvement.

This report has two main findings: 1) among representative samples of adult ART enrollees in six African countries, men were more likely than women to initiate ART with advanced HIV disease, and 2) men had higher attrition risk than women after ART initiation. However, differences between men and women in rate of attrition varied by country, being larger and statistically significant in western and southern African cohorts, but smaller and not statistically significant in cohorts from eastern Africa (Uganda and Tanzania).

As in other reports from African ART programs (*2,5–7*), men initiated ART at more advanced HIV disease stages than women. Late initiation of ART among men has commonly been attributed to sex differences in health-seeking behavior, with men considered more likely to delay access to health care for various reasons, including stigma, male norms that discourage admitting ill health, and employment responsibilities (*2*). However, some have proposed that the prioritization of maternal and child health services by global and national public health organizations in Africa has resulted in inequitable access to health services, including ART (*2,3*). Recent reports suggest that whereas nearly all African countries include initiatives focused on women in their national AIDS strategies, only 10% of countries are effectively engaging men and boys in the national AIDS response (*8*). To address delayed enrollment in ART among men, increased attention from national governments and international donors to identify and implement evidence-based strategies that achieve earlier HIV testing and ART among men might be needed (*2,3*).

As in other studies from western and southern Africa (*2,5,6,9*), adjusting for possible baseline predictors of ART outcomes, including CD4 count, WHO HIV disease stage, age, and ART regimen, did not fully account for the increased rate of attrition among men in Côte d'Ivoire, Swaziland, Mozambique, and Zambia. This suggests unmeasured factors are contributing to either increased rates of death or loss to follow-up among men (*2*). Some reports have suggested sex differences in health-seeking

TABLE 3. (*Continued*) Percentage of antiretroviral therapy (ART) enrollees alive and on therapy, by years after ART initiation, and attrition rate and risk for attrition, by sex — retrospective cohort studies, six African countries

	Zambia		Uganda		Tanzania	
Years after ART initiation	Women %	Men %	Women %	Men %	Women %	Men %
0.5	81	75	94	91	76	75
1	77	69	90	88	71	67
1.5	73	65	87	84	65	62
2	70	60	85	81	62	59
2.5	66	57	82	78	58	57
3	63	54	78	76	57	55
3.5	61	51	77	74	52	52
4	57	49	75	73	49	50
4.5	55	47	73	71	48	44

Attrition rate	Per 100 person-years	(95% CI)	Per 100 person-years	(95% CI)	Per 100 person-years	(95% CI)
Sex						
Men	22.9	(20.3–25.9)	9.9	(8.2–11.9)	25.5	(22.2–29.2)
Women	16.2	(14.5–18.1)	7.9	(6.8–9.1)	24.0	(21.7–26.6)

Unadjusted risk for attrition	HR	(95% CI)	p-value	HR	(95% CI)	p-value	HR	(95% CI)	p-value
Sex									
Men	Referent	—		Referent	—		Referent	—	
Women	0.73	(0.62–0.86)	<0.001	0.82	(0.65–1.03)	0.091	0.93	(0.78–1.10)	0.406

Adjusted risk for attrition	HR	(95% CI)	p-value	HR	(95% CI)	p-value	HR	(95% CI)	p-value
Sex									
Men	Referent	—		Referent	—		Referent	—	
Women	0.82	(0.65–1.02)	0.079	0.88	(0.66–1.18)	0.407	0.89	(0.71–1.12)	0.311

Abbreviations: CI = confidence interval; HR = hazard ratio.

* From death, stopping ART, or loss to follow-up.

† Multivariate analysis included only complete cases: Côte d'Ivoire (2,394), Swaziland (2,090), Mozambique (1,426), Zambia (972), Uganda (1,056), and Tanzania (938). In addition to sex, multivariate analysis adjusted for the following characteristics at ART initiation: age, CD4 count, World Health Organization HIV disease stage, and treatment regimen.

behavior, biologic differences in response to ART, increased male risk for opportunistic infections, worse adherence to ART pill-taking among men, or background differences in mortality rates by sex in the general population are responsible for higher attrition rates among men taking ART (*2*).

In this analysis, although rates of attrition were marginally higher among men than women in Uganda and Tanzania, the effect of sex on attrition risk was smaller than that observed in cohorts from western and southern Africa. This might indicate variations in the effect of sex on attrition risk by country or region. One possible explanation is that internal and cross-border migration patterns vary by country and region. Historically, cross-border migration for work, which is more common among men than women, varies by region in Africa, being most common in western (*10*) and southern Africa, where South Africa is a hub for migrant labor from surrounding countries (*10*). Further research into variations in the effect of sex on attrition risk by country or region might inform interventions to reduce rates of male attrition.

The findings in this report are subject to at least two limitations. First, missing data for certain covariates of interest at ART initiation might have introduced some measurement error, and might have affected estimates of hazard ratios. Second, because of differences in cohort size, there was greater power to detect differences in outcomes between men and women in Swaziland, Mozambique, and Côte d'Ivoire than in Zambia, Uganda, and Tanzania, which limits ability to make conclusions about country variations in the effect of sex on attrition risk.

Across six countries in Africa, men initiated ART with more advanced disease and had statistically significant higher attrition in western and southern African cohorts. Reasons for differences between men and women in ART enrollment are not fully understood but might include lack of emphasis by donors and national governments on the importance of engaging men early in ART (*3*). Higher attrition rates among men are not fully explained by traditional predictors of poor outcomes (e.g., low CD4 count and advanced WHO HIV

What is already known on this topic?

Evaluating differences between human immunodeficiency virus (HIV)-infected men and women in antiretroviral therapy (ART) enrollment characteristics and treatment outcomes can help program managers understand why proportionally more women than men are accessing ART.

What is added by this report?

This retrospective cohort study of six African countries found lower median CD4 counts and more World Health Organization stage IV HIV disease in men at enrollment in all six countries. In addition, the risk of attrition during ART was significantly higher in men in western and southern African countries, even after controlling for possible baseline predictors of ART outcomes. This finding suggests that unidentified factors are contributing to this higher attrition risk in these countries. In eastern Africa, risk for attrition did not differ significantly between men and women.

What are the implications for public health practice?

Further research on country-specific reasons for differences between HIV-infected men and women in ART enrollment and in attrition while on ART are needed. The results of such studies could potentially identify strategies to improve early diagnosis and treatment among men and improve program outcomes.

disease stage). Identifying and implementing evidence-based interventions to improve male enrollment and retention in ART programs is important to reduce male AIDS-related mortality and might contribute to prevention of new HIV infections in female partners (*3*).

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Voluntary Medical Male Circumcision — Southern and Eastern Africa, 2010–2012

Sub-Saharan Africa bears the greatest global burden of human immunodeficiency virus (HIV) infection; 70% (25.0 million) of all persons living with HIV reside in this region (*1*). Voluntary medical male circumcision (VMMC) has been shown to reduce the risk for heterosexually acquired HIV among men by approximately 60% in three randomized controlled trials (*2–5*). Further studies found that the protection from HIV acquisition conferred by VMMC was sustained for 6 years following surgery (*6,7*). In 2007, the World Health Organization (WHO) and Joint United Nations Programme on HIV/AIDS (UNAIDS) recommended that 14 countries with generalized HIV epidemics (i.e., where >1% of the population is HIV-positive) and low male circumcision prevalence* prioritize scale-up of VMMC for HIV prevention (*8*). On December 1, 2011 (World AIDS Day), funding through the President's Emergency Plan for AIDS Relief (PEPFAR) was announced to support >4.7 million VMMCs over the next 2 years.† This report presents the results of VMMC scale-up in nine countries where national ministries of health and CDC are implementing VMMC services for HIV prevention: Botswana, Kenya, Malawi, Mozambique, Namibia, South Africa, Tanzania, Uganda, and Zambia. During October 2009–September 2012,§ a total of 1,924,792 VMMCs were performed in 14 countries using PEPFAR funding provided through U.S. government agencies¶; of this total, 1,020,424 were conducted at approximately 1,600 CDC-supported VMMC sites: 137,096 VMMCs in 2010, 347,724 in 2011, and 535,604 in 2012.** Continued program monitoring and quality assurance activities are required to ensure that CDC-supported country programs meet World AIDS Day targets for VMMC.

Data were collected from VMMC client medical forms and country-specific data collection and summarization tools from CDC-supported sites. These data include only VMMCs for HIV prevention, performed under local anesthesia in medical settings by trained clinicians in southern and eastern Africa. All VMMC clients provided informed consent, or assent with permission from a parent or guardian for those aged <18 years. If clinicians determine that a client aged <15 years understands the information provided and is able to cooperate with VMMC under local anesthesia, then surgery can be performed, as long as assent and permission is provided. Data from approximately 1,600 CDC-supported sites were pooled by CDC country offices from local VMMC implementing partners and used to generate summary statistics. Multicountry analyses were conducted to document VMMC progress by examination of data for VMMCs performed, client age, HIV testing and counseling (HTC) acceptance and results, postoperative reviews, and postoperative moderate and severe adverse events (AEs) from 2010–2012. Moderate and severe AEs (e.g., excessive bleeding, infection, swelling, or wound disruption) were classified by type and severity according to PEPFAR's indicator guidance.†† Some countries use AE definitions that vary slightly from country to country. Annual data were not available from all countries (Table 1).

During 2010–2012, approximately 1,020,424 males were circumcised at CDC-supported sites in the nine countries. The total number of VMMCs has increased each year: 137,096 VMMCs performed in 2010 (seven countries), 347,724 in 2011 (eight countries), and 535,604 in 2012 (nine countries). CDC-supported VMMC programs in Kenya and Uganda performed the most VMMCs during these years: 386,752 and 205,812, respectively (Table 1).

Of the countries reporting data on HTC for VMMC clients (n = 533,143), 86.5% (461,323) of VMMC clients accepted HTC during 2010–2012. Among clients accepting HTC, 2.4% (10,933) tested HIV-positive and were referred to care and treatment services (Table 2). HTC acceptance among VMMC clients varied during this period but remained high: 84.1% in 2010 (four countries), 95.4% in 2011 (five countries), and 83.8% in 2012 (eight countries).

All VMMC clients are advised to return to a health facility for postoperative assessment. Of the countries reporting data on postoperative visits of VMMC clients (n = 614,478), a total of 359,881 clients (58.6%) returned for assessment at the circumcising site within 14 days of surgery. Postoperative follow-up rates have been inconsistent at 75.7% (three countries), 50.0% (five countries), and 64.8% (seven countries) for 2010, 2011, and 2012, respectively. Among all clients returning for postoperative follow-up review within 14 days, the overall postoperative moderate or severe AE rate was low (0.8%), and

* The 14 countries with 2013 HIV prevalence reported include Botswana (23.0%), Ethiopia (1.3%), Kenya (6.1%), Lesotho (23.1%), Malawi (10.8%), Mozambique (11.1%), Namibia (13.3%), Rwanda (2.9%), South Africa (17.9%), Swaziland (26.5%), Tanzania (5.1%), Uganda (7.2%), Zambia (12.7%), and Zimbabwe (14.7%).

† Additional information available at http://www.whitehouse.gov/the-press-office/2011/12/01/fact-sheet-beginning-end-aids.

§ Data are reported by fiscal year in this report, unless noted otherwise. U.S. government fiscal year is October 1–September 30.

¶ Summary results from PEPFAR's 2012 annual progress report are available at http://www.pepfar.gov/documents/organization/201387.pdf.

** CDC support includes hiring of clinical staff to provide VMMCs, conducting trainings and quality assurance assessments, providing technical assistance, and procurement of VMMC supplies, medications, and instruments.

†† PEPFAR's indicator reference sheet for VMMC is available at http://www.malecircumcision.org/resources/documents/PEPFAR_Guide_Monitoring_Reporting_VMMC_Indicators_Appendices.pdf.

TABLE 1. Voluntary medical male circumcisions (VMMCs) performed by CDC-supported programs, by country and fiscal year, 2010–2013

Country	No. of VMMCs			
	2010	2011	2012	Total
Botswana	—	—	8,590	**8,590**
Kenya*	104,131	166,310	116,311	**386,752**
Malawi†	—	778	7,420	**8,198**
Mozambique	4,009	18,472	68,924	**91,405**
Namibia	1,197	5,292	5,965	**12,454**
South Africa§	3,820	15,574	80,701	**100,095**
Tanzania¶	1,519	50,325	49,756	**101,600**
Uganda	9,052	57,132	139,628	**205,812**
Zambia	13,368	33,841	58,309	**105,518**
Total	**137,096**	**347,724**	**535,604**	**1,020,424**

Source: President's Emergency Plan for AIDS Relief (PEPFAR) annual progress report (APR) submissions for CDC-supported partners, for fiscal years October 1–September 30, except where noted.

* Kenya's data for 2010 and 2011 are reported from January–December, but data from 2012 are from October–September.

† Malawi's data are from APR results and CDC Malawi's partner reports for 2012.

§ South Africa's data are reported from January–December for 2010–2012.

¶ Tanzania's data for 2010–2012 are from APR reports and Tanzania's national database.

within acceptable rates for minor surgery. The proportion of clients experiencing a moderate or severe AE has declined from 1.7% in 2010 (three countries) to 0.9% in 2011 (five countries) and 0.8% in 2012 (six countries) (Table 2).

For 986,392 (96.7%) VMMC clients with age reported, the proportion of clients aged ≥15 years increased during 2010–2012. In 2010, the proportion of clients aged ≥15 years was 67.0% (89,280) (six countries), increasing to 78.7% (272,038) (eight countries) in 2011 and 79.4% (400,560) (eight countries) in 2012. The proportion of VMMC clients aged ≥25 years has increased from 0.1% (70) in 2010 (one country), 3.0% (10,249) in 2011 (five countries), and 6.0% (30,553) in 2012 (six countries) (Table 3).

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What is already known on this topic?

Voluntary medical male circumcision (VMMC) has been recognized by the World Health Organization and Joint United Nations Programme on HIV/AIDS as an effective human immunodeficiency virus (HIV) prevention intervention in settings with a generalized HIV epidemic and low male circumcision prevalence.

What is added by this report?

This report summarizes progress toward the 2011 World AIDS Day VMMC target of 4.7 million circumcisions by 2013. During 2010–2012, VMMC progress has been increasing in nine countries where CDC supports VMMC service delivery, with 137,096 VMMCs in 2010, 347,724 in 2011, and 535,604 in 2012.

What are the implications for public health practice?

Accelerated VMMC scale-up can be achieved in southern and eastern Africa while maintaining high acceptance of HIV testing and counseling and low rates of adverse events.

Editorial Note

VMMC is an effective HIV prevention intervention that can be implemented safely in countries in southern and eastern Africa. The announcement on World AIDS Day in 2011 that PEPFAR would support 4.7 million circumcisions provided an achievable goal for VMMC scale-up. In the nine CDC-supported countries, VMMC acceptance has increased nearly fourfold from 2010 to 2012.The postoperative moderate or severe AEs have remained low. Mathematical modeling suggests that reaching 80% VMMC coverage among males aged 15–49 years in the priority countries would require 20.3 million circumcisions by 2015, which would avert approximately 3.4 million HIV infections through 2025 and result in $16.5 billion in net savings from averted HIV care and treatment costs (*9*).

To reach 80% coverage and the World AIDS Day VMMC goals, country programs have implemented various efficiency models to expedite scale-up. Each of the nine countries included in this analysis has introduced components of WHO's model for optimizing the volume and efficiency of male circumcision services (i.e., MOVE) (*10*), including the use of standardized VMMC surgical techniques (nine countries), electrocautery (four countries), use of nonphysicians and lower cadres of health-care providers (nine countries). Most countries rely on nonphysicians (i.e., nurses and clinical officers) to perform VMMC surgery. VMMC country programs are also

TABLE 2. Voluntary medical male circumcision (VMMC) progress, HIV testing and counseling (HTC) acceptance, human immunodeficiency virus (HIV) prevalence among VMMC clients, postoperative follow-up reviews among VMMC clients, and postoperative moderate or severe VMMC adverse event (AE) rates, by country and year, 2010–2012

	Total VMMCs performed	HTC uptake among VMMC clients		HIV prevalence among VMMC clients		Postoperative follow-up within 14 days of VMMC		Postoperative moderate or severe AEs	
Country	No.	No.	(%)	No.	(%)	No.	(%)	No.	(%)
2012									
Botswana	8,590	7,702	(89.7)	234	(3.0)	6,571	(76.5)	136	(2.1)
Kenya	116,311	97,647	(84.0)	3,386	(3.5)	40,084	(34.5)	506*	(1.3)
Malawi	7,420	526	(53.1)	38	(7.2)	398	(40.2)	—	—
Mozambique	68,924	68,924	(100.0)	1,915	(1.3)	—	—	—	—
Namibia	5,965	5,259	(88.2)	69	(1.3)	5,777	(96.8)	62	(1.1)
South Africa	80,701	79,087	(98.0)	1,788	(2.3)	72,631	(90.0)	290	(0.4)
Tanzania†	49,756	43,637	(87.7)	590	(1.4)	41,561	(83.5)	272*	(0.7)
Uganda	139,628	—	—	—	—	—	—	—	—
Zambia	58,309	23,802	(40.8)	165	(0.7)	45,026	(77.2)	351*	(0.8)
Total	**535,604**	**326,584**	**(83.8)**	**8,185**	**(2.5)**	**212,048**	**(64.8)**	**1,617**	**(0.8)**
2011									
Botswana	—	—	—	—	—	—	—	—	—
Kenya	166,310	—	—	—	—	42,937	(25.8)	284*	(0.7)
Malawi	778	—	—	—	—	—	—	—	—
Mozambique	18,472	18,472	(100.0)	753	(4.1)	—	—	—	—
Namibia	5,292	4,770	(90.1)	71	(1.5)	5,084	(96.1)	92	(1.8)
South Africa	15,574	13,091	(84.1)	526	(4.0)	12,023	(77.2)	87	(0.7)
Tanzania†	50,325	47,658	(94.8)	636	(1.3)	48,078	(95.5)	421*	(0.9)
Uganda	57,132			—		—	—	—	—
Zambia	33,841	33,841	(100.0)	339	(1.0)	27,530	(81.4)	252	(0.9)
Total	**347,724**	**117,832**	**(95.4)**	**2,325**	**(2.0)**	**135,652**	**(50.0)**	**1,196**	**(0.9)**
2010									
Botswana	—	—	—	—	—	—	—	—	—
Kenya	104,131	—	—	—	—	—	—	—	—
Malawi	—	—	—	—	—	—	—	—	—
Mozambique	4,009	3,701	(92.3)	154	(4.2)	—	—	—	—
Namibia	1,197	996	(83.2)	26	(2.6)	891	(74.4)	20	(2.2)
South Africa	3,820	—	—	—	—	—	—	—	—
Tanzania†	1,519	1,346	(88.6)	16	(1.2)	1,267	(83.4)	53*	(4.2)
Uganda	9,052	—	—	—	—	—	—	—	—
Zambia	13,368	10,864	(81.3)	227	(2.1)	10,023	(75.0)	130	(1.3)
Total	**137,096**	**16,907**	**(84.1)**	**423**	**(2.5)**	**12,181**	**(75.7)**	**203**	**(1.7)**
Summary 2010–2012									
Botswana	8,590	7,702	(89.7)	234	(3.0)	6,571	(76.5)	136	(2.1)
Kenya	386,752	97,647	(84.0)	3,386	(3.5)	—	—	790	(—)
Malawi	8,198	526	(53.1)	38	(7.2)	398	(5.4)	—	(—)
Mozambique	91,405	91,097	(99.7)	2,822	(3.1)	—	—	446	(—)
Namibia	12,454	11,025	(88.5)	166	(1.5)	11,752	(94.4)	174	(1.5)
South Africa	100,095	92,178	(95.7)	2,314	(2.5)	84,654	(87.9)	377	(0.4)
Tanzania†	101,600	92,641	(91.2)	1,242	(1.3)	90,906	(89.5)	746	(0.8)
Uganda	205,812	—	—	—	—	—	—	470	(—)
Zambia	105,518	68,507	(64.9)	731	(1.1)	82,579	(78.3)	733	(0.9)
Total	**1,020,424**	**461,323**	**(86.5)**	**10,933**	**(2.4)**	**359,881**	**(58.6)**	**3,016**	**(0.8)**

* Contains both intraoperative and moderate or severe postoperative AEs.

† Tanzania's data for postoperative follow-up visits are within 48 hours of surgery, not 14 days. Tanzania's national database collects HTC data on all patients regardless of whether they received VMMC. HTC acceptance among VMMC clients in this table has been imputed by using HTC data from all clients testing at the VMMC site.

implementing standardized training programs for all cadres of VMMC providers; targeted, client-specific campaigns to increase demand for VMMC; and routine, site-level quality assurance assessments. Many countries are moving toward a mixed-service delivery model that combines fixed VMMC sites (e.g., permanent sites within existing health-care facilities, such as hospitals and health centers) with mobile and outreach sites (e.g., use of tents, prefabricated structures, and other temporary locations for VMMC service delivery). All sites offering VMMC must provide the "minimum package" of complementary services specified by WHO, including information about the risks and benefits of the procedure, HTC, screening, and treatment of sexually transmitted infections; preoperative and postoperative counseling; and promotion and provision of condoms (*10*).

In sub-Saharan Africa, men aged 20–39 years are at highest risk for acquiring HIV (*1*). Only 12.5% (33,420 of 267,158)

TABLE 3. Voluntary medical male circumcisions, by age group, country, and year, 2010–2012

	2012					
	Age group (yrs)					
Country	**<15**	**≥15**	**15–19**	**20–24**	**≥25**	**Total**
Botswana	865	7,725	2,385	2,267	3,073	**8,590**
Kenya*	16,725	99,586	99,586	—	—	**116,311**
Malawi	—	—	—	—	—	—
Mozambique*	36,504	32,420	20,388	6,988	5,044	**68,924**
Namibia	1,183	4,782	4,782	—	—	**5,965**
South Africa	11,825	68,876	37,069	16,738	15,069	**80,701**
Tanzania†	24,209	25,547	22,139	—	3,408	**49,756**
Uganda*,§	43,540	90,549	90,549	—	—	**134,089**
Zambia	13,121	30,150	23,518	2,673	3,959	**43,271**
Total	**147,972**	**400,560**	**300,416**	**28,666**	**30,553**	**507,607**
Percentage	29.2%	79.4%	59.2%	5.6%	6.0%	**100.0%**
	2011					
	Age group (yrs)					
Country	**<15**	**≥15**	**15–19**	**20–24**	**≥25**	**Total**
Botswana	—	—	—	—	—	—
Kenya*	20,129	146,181	146,181	—	—	**166,310**
Malawi*	180	598	598	—	—	**778**
Mozambique*	7,181	11,291	5,958	3,185	2,148	**18,472**
Namibia*	976	4,316	4,316	—	—	**5,292**
South Africa§	295	13,064	6,467	3,651	2,946	**13,359**
Tanzania†	19,432	30,893	26,919	—	3,974	**50,325**
Uganda*	16,406	40,726	40,726	—	—	**57,132**
Zambia	8,872	24,969	20,139	3,649	1,181	**33,841**
Total	**73,471**	**272,038**	**251,304**	**10,485**	**10,249**	**345,509**
Percentage	21.3%	78.7%	72.7%	3.0%	3.0%	**100.0%**
	2010					
	Age group (yrs)					
Country	**<15**	**≥15**	**15–19**	**20–24**	**≥25**	**Total**
Botswana	—	—	—	—	—	—
Kenya*	36,565	67,566	67,566	—	—	**104,131**
Malawi	—	—	—	—	—	—
Mozambique*	492	3,517	3,517	—	—	**4,009**
Namibia*	28	1,169	1,169	—	—	**1,197**
South Africa	—	—	—	—	—	—
Tanzania†	417	1,102	1,032	—	70	**1,519**
Uganda*	2,561	6,491	6,491	—	—	**9,052**
Zambia	3,933	9,435	9,435	—	—	**13,368**
Total	**43,969**	**89,280**	**89,210**	**—**	**70**	**133,276**
Percentage	33.0%	67.0%	66.9%	0.0%	0.1%	**100.0%**
	Summary 2010–2012					
	Age group (yrs)					
Country	**<15**	**≥15**	**15–19**	**20–24**	**≥25**	**Total**
Botswana	865	7,725	2,385	2,267	3,073	**8,590**
Kenya*	73,419	313,333	313,333	0	0	**386,752**
Malawi	180	598	598	0	0	**778**
Mozambique*	44,177	47,228	29,863	10,173	7,192	**91,405**
Namibia*	2,187	10,267	10,267	0	0	**12,454**
South Africa	12,120	81,940	43,536	20,389	18,015	**94,060**
Tanzania†	44,058	57,542	50,090	0	7,452	**101,600**
Uganda*	62,507	137,766	137,766	0	0	**200,273**
Zambia	25,926	64,554	53,092	6,322	5,140	**90,480**
Total	**265,439**	**761,878**	**640,930**	**39,151**	**40,872**	**986,392**
Percentage	26.9%	77.2%	65.0%	4.0%	4.1%	**100.0%**

* These countries only reported age groups as 1–14 years and ≥15 years.
† Tanzania's age groups reported as <15, 15–25, and ≥26 years.
§ Age missing for some VMMC clients.

of VMMC clients during 2010–2012 were aged ≥25 years among those countries reporting this age disaggregation (three countries in 2011 and four in 2012). VMMC programs need to identify innovative approaches to increase VMMC acceptability for men aged ≥25 years. CDC is working in Kenya, Tanzania, and South Africa to evaluate strategies to increase the proportion of older males receiving VMMC and to promote HTC among VMMC clients.

HIV prevalence among adolescents and adults aged 15–49 years of both sexes is high in the nine countries (range: 5.1%–23.0%). Because VMMC clients are all male and generally young (median age: 15–19 years), they would be expected to have a lower HIV prevalence than the general population of persons aged 15–49 years. Among the 461,323 VMMC clients included in this analysis who accepted HTC, 2.4% (10,933) tested HIV-positive (Table 2).

The findings in this report are subject to at least four limitations. First, several countries did not begin scaling up VMMC until 2010 or 2011, which is partially responsible for missing data. Second, because of differing numbers of countries included in the analyses of different variables across years, trends found might not be representative of all VMMC clients. Third, ministry of health–approved client-level data collection tools are not identical across countries, which contributed to difficulties in data aggregation across countries, including the lower age limit for VMMC clients. Finally, some national ministries of health have similar but not identical definitions for classifying type, severity, and clinical signs for VMMC AEs. Although PEPFAR guidance for AE reporting is used in all of PEPFAR's VMMC programs, discrepant diagnoses and management might result in differences in reporting.

Quality assurance processes should monitor routine reporting of additional VMMC indicators to ensure data availability and to improve data quality. CDC's external quality assurance activities provide an opportunity to work with ministry of health officials and VMMC implementers to assess and improve data collection and reporting practices. Improved data collection and reporting practices will help CDC-supported country programs meet the World AIDS Day targets for VMMC and achieve an AIDS-free generation.

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HIV Testing and Risk Behaviors Among Gay, Bisexual, and Other Men Who Have Sex with Men — United States

The burden of human immunodeficiency virus (HIV) is high among gay, bisexual, and other men who have sex with men (MSM) (*1*). High HIV prevalence, lack of awareness of HIV-positive status, unprotected anal sex, and increased viral load among HIV-positive MSM not on antiretroviral treatment contribute substantially to new infections among this population. CDC analyzed data from the National HIV Surveillance System (NHSS) to estimate the percentage of HIV diagnoses among MSM by area of residence and data from the National HIV Behavioral Surveillance System (NHBS) to estimate unprotected anal sex in the past 12 months among MSM in 2005, 2008, and 2011; unprotected discordant anal sex at last sex (i.e., with a partner of opposite or unknown HIV status) in 2008 and 2011; and HIV testing history and the percentage HIV-positive but unaware of their HIV status by the time since their last HIV test in 2011. This report describes the results of these analyses. In all but two states, the majority of new HIV diagnoses were among MSM in 2011. Unprotected anal sex at least once in the past 12 months increased from 48% in 2005 to 57% in 2011 (p<0.001). The percentage engaging in unprotected discordant anal sex was 13% in 2008 and 2011. In 2011, 33% of HIV-positive but unaware MSM reported unprotected discordant anal sex. Among MSM with negative or unknown HIV status, 67% had an HIV test in the past 12 months. Among those tested recently, the percentage HIV-positive but unaware of their infection was 4%, 5%, and 7% among those tested in the past ≤3, 4–6, and 7–12 months, respectively. Expanded efforts are needed to reduce HIV risk behaviors and to promote at least annual HIV testing among MSM.

Data reported through June 2012 to NHSS were used to estimate* HIV diagnoses among MSM by area of residence in 2011. Data from NHBS† were used to describe adjusted trends in unprotected anal sex§ in the past 12 months among MSM in 2005, 2008, and 2011.¶ Data from 2008 and 2011 were used to calculate the prevalence of unprotected discordant

What is already known on this topic?

Although men who have sex with men (MSM) are a small proportion of the population, MSM represent the majority of persons diagnosed with human immunodeficiency virus (HIV) in the United States.

What is added by this report?

Unprotected anal sex increased among MSM from 2005 to 2011; unprotected discordant anal sex was the same in 2008 and 2011. In 2011, one third of HIV-positive MSM who did not know they were infected with HIV reported recent unprotected anal sex with a partner of HIV-negative or unknown status, compared with 13% of HIV-positive aware and 12% of HIV-negative MSM. Only 67% of sexually active MSM reported getting an HIV test in the past year.

What are the implications for public health?

Expanded efforts are needed to reduce HIV risk behaviors and to promote at least annual HIV testing among MSM. Health-care providers and public health officials should work to ensure that 1) sexually active, HIV-negative MSM are tested for HIV at least annually (providers may recommend more frequent testing, for example every 3–6 months); 2) HIV-negative MSM who engage in unprotected sex receive risk-reduction interventions; and 3) HIV-positive MSM receive HIV care, treatment, and prevention services.

* Estimated numbers of HIV diagnoses resulted from statistical adjustment that accounted for reporting delays and missing transmission category but not for incomplete reporting. Diagnoses data are used to describe the geographic distribution of the HIV burden among MSM.

† NHBS monitors HIV-associated behaviors and HIV prevalence within selected metropolitan statistical areas (MSAs) with high acquired immunodeficiency syndrome (AIDS) prevalence among three populations at high risk for HIV infection: MSM, injection drug users, and heterosexual adults at increased risk for HIV infection. Data for NHBS are collected in annual rotating cycles. All NHBS participants must be aged ≥18 years, live in a participating MSA, and be able to complete a behavioral survey in English or Spanish. MSM participants were recruited using venue-based sampling. The first MSM cycle of NHBS in 2003–2005 (referred to as 2005 in this report) included the following cities: Atlanta, Georgia; Baltimore, Maryland; Boston, Massachusetts; Chicago, Illinois; Denver, Colorado; Fort Lauderdale, Florida; Houston, Texas; Los Angeles, California; Miami, Florida; Newark, New Jersey; New York City, New York; Philadelphia, Pennsylvania; San Diego, California; San Francisco, California; and San Juan, Puerto Rico. The second MSM cycle of NHBS in 2008 included all the cities in the first cycle except Fort Lauderdale, Florida; plus the following cities: Washington, DC; Dallas, Texas; Detroit, Michigan; New Orleans, Louisiana; Nassau-Suffolk, New York; St. Louis, Missouri; and Seattle, Washington. The third MSM cycle of NHBS included all the cities in the second cycle except for St. Louis.

§ Unprotected anal sex was defined as sex without a condom with a male partner at least once in the 12 months before the survey interview. The outcome is reported for self-reported HIV-positive and self-reported HIV-negative or unknown-status MSM. Self-reported negative and unknown-status MSM are grouped together to represent the group "at risk" for HIV infection based on self-reported status. Persons of unknown status include: last HIV test results were indeterminate, did not receive test results, did not know the results, or had never been tested. The analysis included all MSM participating in NHBS irrespective of whether they had an HIV test through NHBS. Men who consented to and completed the survey and reported having a male sex partner in the past year were included in the analyses. All cities that participated in any of the three cycles of NHBS among MSM were included. Because the studies used different geographic eligibility criteria with slightly different cities participating in each cycle, a sensitivity analysis limited to the 14 cities that participated in all three cycles was conducted and found similar results.

¶ Generalized estimating equations using a robust variance estimate and assuming a Poisson model were used to test if a linear trend exists between 2005, 2008, and 2011 in the percentage of MSM that had unprotected anal sex at least once with a male partner in the past 12 months. All models included year, age, race/ethnicity, and city and interactions for year × age and year × race. Year was treated as a continuous variable. P-values for the 2005 to 2011 trend were calculated (Table 1); p<0.05 was considered statistically significant.

anal sex** at last sex. Chi-square tests†† were used to evaluate differences between 2008 and 2011 by HIV status, race/ethnicity, and age. Data from 2011 were used to evaluate the difference in the percentage engaging in unprotected discordant anal sex at last sex among HIV-positive aware,§§ HIV-positive unaware, and HIV-negative MSM. Adjusted¶¶ prevalence ratios (APRs) and 95% confidence intervals (CIs) are presented. Data from 2011 were used to assess HIV testing history after excluding self-reported HIV-positive MSM, and the percentage HIV-positive but unaware, by time since the last HIV test.

In 2011, MSM accounted for at least half of persons diagnosed with HIV in all but two states (Figure 1). The percentage of MSM reporting unprotected anal sex at least once in the past 12 months increased from 2005 to 2011, from 48% in 2005, to 54% in 2008, and 57% in 2011 (p<0.001). The trend was statistically significant among self-reported HIV-negative or unknown status MSM (47%, 54%, and 57%, respectively; p<0.001), but not statistically significant for self-reported HIV-positive MSM (55%, 57%, and 62%, respectively; p=0.054) (Table 1).

The percentage of MSM engaging in unprotected discordant anal sex at last sex was 13% in both 2008 and 2011 (Table 2). In 2011, 33% of HIV-positive but unaware MSM had unprotected discordant anal sex at last sex. This percentage was more than twice as high as the percentage among those who were HIV-positive aware (13%) (APR = 2.2; CI = 1.7–2.9; p<0.001) or HIV-negative (12%) (APR = 2.8; CI = 2.2–3.5; p<0.001).

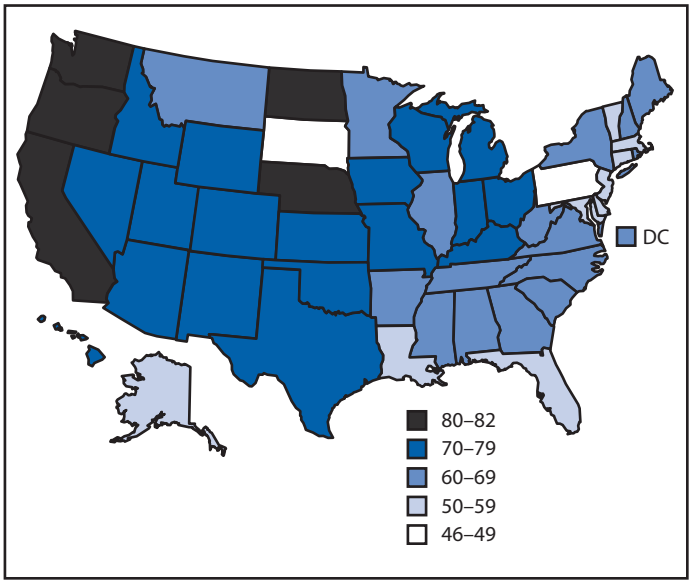
** Data from 2008 and 2011 for MSM with a valid HIV test result (positive or negative) were used to describe unprotected discordant anal sex, defined as not using a condom at last sex with a male partner of opposite or unknown HIV status. Based on HIV-test results, the analysis subgroups for the first outcome (self-reported positive and self-reported negative or unknown status MSM) are further divided into HIV-positive aware, HIV-positive unaware, and HIV-negative MSM. HIV-positive aware MSM are defined as self-reported HIV-positive MSM with a confirmed positive HIV test result in the NHBS survey. HIV-positive unaware MSM are defined as MSM with a confirmed positive HIV test result in the NHBS survey who reported their last HIV test result was negative, indeterminate, did not receive test results, did not know the results, or had never been tested. HIV-negative MSM are defined as self-reported negative or unknown HIV status participants with an HIV-negative test result in the NHBS survey. Data from 2005 were excluded from this analysis since HIV testing was only conducted in five cities.

†† Because no statistically significant difference (p<0.05) was found in the percentage engaging in unprotected discordant sex between years, a multivariate analysis was not conducted for this outcome (Table 2).

§§ Respondents with a confirmed positive HIV test result in NHBS who reported having previously tested positive for HIV were considered to be aware of their infection. Those with a confirmed positive HIV test result in NHBS, who reported previously testing negative, not knowing their last test result or never testing, were considered unaware of their HIV status.

¶¶ Generalized estimating equations using a robust variance estimate and assuming a Poisson model were used to determine the associations between unprotected discordant sex and HIV status (using HIV-positive unaware as the reference category) after adjusting for race/ethnicity, age, and city.

FIGURE 1. Estimated percentage of persons diagnosed with HIV with infection attributed to male-to-male contact or male-to-male contact and injection drug use, by area of residence — National HIV Surveillance System, United States, 2011



Among HIV-negative or unknown status MSM, 67% reported testing for HIV in the past 12 months. A higher percentage tested in the past 3 months (31%) than in the past 4–6 months (17%) or in the past 7–12 months (19%) (Figure 2). The percentage HIV-positive but unaware was 5% among those who tested in the past 12 months: 4%, 5%, and 7% among those tested ≤3, 4–6, and 7–12 months ago, respectively (Figure 3).

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Editorial Note

Although MSM are a small proportion of the population, they represent the majority of persons diagnosed with HIV in nearly every U.S. state. Unprotected anal sex in the last 12 months increased nearly 20% among MSM from 2005 to 2011. MSM unaware of their HIV-positive status were more than twice as likely to have unprotected discordant anal sex at last sex as MSM who were either HIV-negative or HIV-positive aware. Only 67% of MSM had tested for HIV in the past 12 months.

TABLE 1. Number and percentage of men who have sex with men who reported unprotected* anal sex with a male partner in the past 12 months, by self-reported human immunodeficiency virus (HIV) status — National HIV Behavioral Surveillance System, United States, 2005, 2008, and 2011†

Characteristic	2005			2008			2011			p-value§
	No. in sample	No.	(%)	No. in sample	No.	(%)	No. in sample	No.	(%)	
Self-reported HIV-positive										
Overall	**1,441**	**796**	**(55)**	**1,101**	**623**	**(57)**	**1,244**	**769**	**(62)**	**0.054**
Race/Ethnicity										
Black, non-Hispanic	296	140	(47)	269	137	(51)	417	235	(56)	0.026
Hispanic¶	285	146	(51)	228	124	(54)	262	156	(60)	0.198
White, non-Hispanic	744	446	(60)	526	320	(61)	488	332	(68)	0.051
Other/Multiple races**	103	59	(57)	78	42	(54)	72	43	(60)	0.771
Age group (yrs)										
18–24	49	26	(53)	79	41	(52)	143	78	(55)	0.776
25–29	98	64	(65)	123	77	(63)	167	116	(69)	0.246
30–39	569	342	(60)	326	207	(63)	316	227	(72)	0.002
≥40	725	364	(50)	573	298	(52)	618	348	(56)	0.092
Self-reported HIV-negative or unknown status††										
Overall	**10,016**	**4,693**	**(47)**	**8,152**	**4,394**	**(54)**	**8,009**	**4,546**	**(57)**	**<0.001**
Race/Ethnicity										
Black, non-Hispanic	1,732	697	(40)	1,919	952	(50)	2,068	1,003	(49)	0.113
Hispanic¶	2,677	1,265	(47)	2,004	1,138	(57)	2,145	1,340	(62)	<0.001
White, non-Hispanic	4,506	2,235	(50)	3,498	1,921	(55)	3,177	1,840	(58)	<0.001
Other/Multiple races**	993	443	(45)	725	380	(52)	600	350	(58)	<0.001
Age group (yrs)										
18–24	2,186	996	(46)	1,992	1,133	(57)	2,209	1,302	(59)	<0.001
25–29	1,813	912	(50)	1,588	944	(59)	1,583	965	(61)	<0.001
30–39	3,310	1,646	(50)	2,236	1,232	(55)	1,874	1,119	(60)	0.003
≥40	2,707	1,139	(42)	2,336	1,085	(46)	2,343	1,160	(50)	<0.001
Total	**11,457**	**5,489**	**(48)**	**9,253**	**5,017**	**(54)**	**9,253**	**5,315**	**(57)**	**<0.001**

* Neither the respondent nor his sex partner used a condom all the time.
† Percentages might not add to 100 because of rounding; numbers might not add to total because of missing data.
§ Adjusted p-values for the 2005 to 2011 trend; all models include year, age, race/ethnicity, and city and interactions for year × age and year × race/ethnicity. Interactions for year × age and year × race/ethnicity were not statistically significant, suggesting that no overall difference in trend existed between race/ethnicity categories, likewise for age categories. P<0.05 is considered statistically significant.
¶ Respondents of Hispanic ethnicity might be of any race.
** Other races include American Indian/Alaska Native, Asian, Native Hawaiian/other Pacific Islander, and mixed race.
†† Includes respondents who reported their last HIV test result was negative, indeterminate, did not receive test results, did not know the results, or had never been tested.

Unprotected anal sex is a high-risk practice for HIV infection, with receptive anal sex having the highest risk (*2*). Unprotected anal sex also places MSM at risk for other sexually transmitted infections such as syphilis, chlamydia, and gonorrhea. Although condoms can reduce the risk for HIV transmission, they do not eliminate risk and often are not used consistently (*3*). Some MSM attempt to decrease their HIV risk by engaging in unprotected sex only with partners perceived to have the same HIV status as their own. However, this practice is risky, especially for HIV-negative MSM, because MSM with HIV might not know or disclose that they are infected and men's assumptions about the HIV status of their partners can be wrong (*2*).

The reasons for the increase in unprotected anal sex are not fully known but might partially reflect the adoption of presumed risk-reduction strategies, such as engaging in unprotected sex only with partners perceived to have the same HIV status as one's own (*4*). The fact that the same percentage of MSM engaged in unprotected discordant anal sex at last sex in 2008 and 2011 supports this hypothesis.

Among MSM participating in the National HIV Behavioral Surveillance System (NHBS) in 2011, 18% were HIV-positive (*5*). Awareness of HIV-positive status among HIV-infected MSM increased from 56% in 2008 to 66% in 2011 in the 20 cities participating in NHBS (*5*). However, one third of HIV-positive MSM in NHBS did not know that they were infected with HIV (*5*), and a high percentage of them reported recent unprotected discordant anal sex with a partner of HIV-negative or unknown status. CDC found that MSM who were HIV-positive but unaware were more than two times more likely to engage in unprotected discordant anal sex, compared with HIV-positive aware or HIV-negative MSM. Persons aware of their infection are less likely to transmit the virus (*6*), and HIV testing is an essential first step in the care and treatment of those who are HIV-positive. HIV treatment can lower viral load, improving health outcomes and reducing the likelihood

TABLE 2. Number and percentage of men who have sex with men who reported unprotected* anal sex at last sex with a male partner of human immunodeficiency virus (HIV) discordant or unknown status, by HIV status of the participant — National HIV Behavioral Surveillance System, United States, 2008 and 2011†

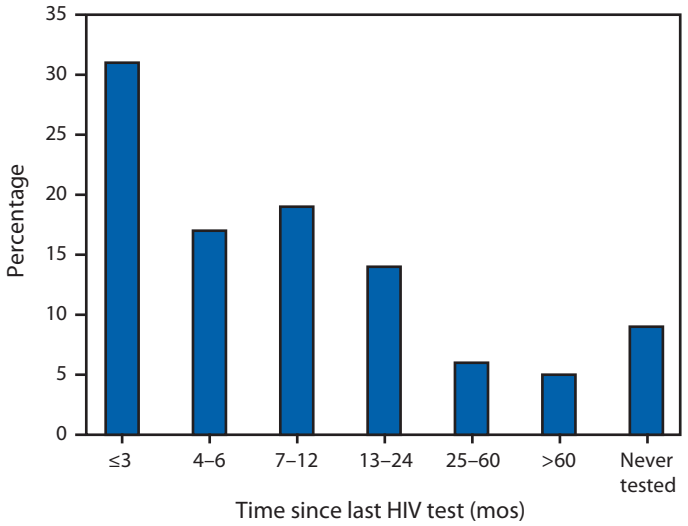
Characteristic	2008			2011			p-value§
	No. in sample	No.	(%)	No. in sample	No.	(%)	
Self-reported HIV-positive							
HIV-positive aware¶ with a partner of HIV-negative or unknown status							
Overall	**882**	**139**	**(16)**	**1,032**	**139**	**(13)**	**0.16**
Race/Ethnicity							
Black, non-Hispanic	219	36	(16)	357	47	(13)	0.28
Hispanic**	190	29	(15)	216	41	(19)	0.32
White, non-Hispanic	410	69	(17)	394	42	(11)	0.01
Other/Multiple races††	63	5	(8)	60	9	(15)	0.22
Age group (yrs)							
18–24	62	8	(13)	123	15	(12)	0.89
25–29	95	15	(16)	139	26	(19)	0.56
30–39	256	50	(20)	254	39	(15)	0.21
>40	469	66	(14)	516	59	(11)	0.21
Self-reported HIV-negative or unknown status							
HIV-positive unaware§§ with a partner of HIV-negative or unknown status							
Overall	**676**	**201**	**(30)**	**521**	**174**	**(33)**	**0.18**
Race/Ethnicity							
Black, non-Hispanic	314	82	(26)	307	97	(32)	0.13
Hispanic**	163	44	(27)	124	44	(35)	0.12
White, non-Hispanic	138	52	(38)	65	24	(37)	0.92
Other/Multiple races††	61	23	(38)	24	8	(33)	0.71
Age group (yrs)							
18–24	135	33	(24)	129	41	(32)	0.18
25–29	128	40	(31)	104	29	(28)	0.58
30–39	212	65	(31)	127	51	(40)	0.07
≥40	201	63	(31)	161	53	(33)	0.75
HIV-negative with partner of HIV-positive or unknown status							
Overall	**6,591**	**734**	**(11)**	**6,867**	**806**	**(12)**	**0.27**
Race/Ethnicity							
Black, non-Hispanic	1,346	164	(12)	1,551	198	(13)	0.64
Hispanic**	1,676	249	(15)	1,885	260	(14)	0.37
White, non-Hispanic	2,959	271	(9)	2,879	291	(10)	0.22
Other/Multiple races††	605	49	(8)	538	53	(10)	0.30
Age group (yrs)							
18–24	1,691	196	(12)	1,930	236	(12)	0.56
25–29	1,306	143	(11)	1,382	141	(10)	0.53
30–39	1,761	187	(11)	1,597	191	(12)	0.22
≥40	1,833	208	(11)	1,958	238	(12)	0.44
Total	**8,149**	**1,074**	**(13)**	**8,420**	**1,119**	**(13)**	**0.83**

* Neither the respondent nor his sex partner used a condom all the time.
† Percentages might not add to 100 because of rounding; numbers might not add to total because of missing data.
§ Chi-square p-value for comparison of 2008 and 2011 percentages. P<0.05 is considered statistically significant.
¶ Respondents with a confirmed positive HIV test result in the survey who reported having previously tested positive for HIV.
** Respondents of Hispanic ethnicity might be of any race.
†† Other races include American Indian/Alaska Native, Asian, Native Hawaiian/other Pacific Islander, and mixed race.
§§ Includes respondents with a confirmed positive HIV test result in the survey who reported their last HIV test result was negative, indeterminate, did not receive test results, did not know the results, or had never been tested.

of HIV transmission. About eight transmissions would be averted for every 100 persons newly aware of their infection as a result of HIV treatment and reductions in risk behavior (*6*). CDC recommends that persons at high-risk for HIV, such as sexually active MSM, be tested at least annually (*7,8*). However, in this analysis one third of MSM had not tested for HIV in the past 12 months. Increased use of HIV testing and more frequent testing among sexually active MSM might reduce the number of men unaware of their HIV status and reduce HIV transmission.

The findings in this report are subject to at least two limitations. First, NHBS data are from MSM who were recruited at venues in large cities. Thus, results might not be generalizable to all MSM. Second, except for HIV testing results, analyses were based on self-reported data and might be subject to social desirability and recall bias.

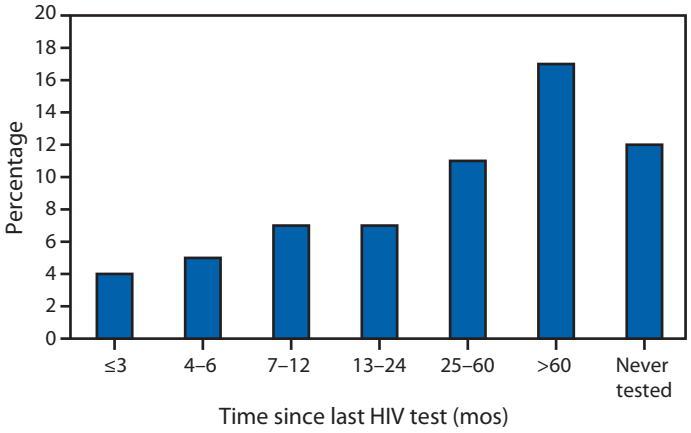
FIGURE 2. Time since last human immunodeficiency virus (HIV) test among men who have sex with men who reported negative or unknown HIV status,* — National HIV Behavioral Surveillance System, United States, 2011†



* Includes respondents who reported their last HIV test result was negative, indeterminate, did not receive test results, did not know the results, or had never been tested.

† N = 7,312; excludes 76 respondents missing data for time of HIV test.

FIGURE 3. Percentage who were human immunodeficiency virus (HIV)-positive unaware among men who have sex with men who reported negative or unknown HIV status, by time since last HIV test — National HIV Behavioral Surveillance System, United States, 2011*



* N = 7,312; excludes 76 respondents missing data for time of HIV test. Bars represents percentage testing positive in the survey among men who have sex with men who reported having had an HIV test at each time interval.

Sexually active MSM should be tested at least annually for HIV and other sexually transmitted infections. Sexually active MSM can take steps to make sex safer such as choosing less risky behaviors, using condoms consistently and correctly if they have vaginal or anal sex, reducing the number of sex partners, and if HIV-positive, letting potential sex partners know their status (*2*). For some MSM at high risk, taking preexposure or postexposure prophylaxis can reduce risk (*9*). Health-care providers and public health officials should work to ensure that 1) sexually active, HIV-negative men are tested for HIV at least annually (providers may recommend more frequent testing, for example every 3–6 months); 2) HIV-negative MSM who engage in unprotected sex receive risk-reduction interventions; and 3) HIV-positive MSM receive HIV care, treatment, and prevention services. Reducing the burden of HIV among MSM is fundamental to reducing HIV infection in this country.

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Tularemia — United States, 2001–2010

Tularemia is a rare but potentially serious bacterial zoonosis that has been reported from all U.S. states except Hawaii. The etiologic agent, *Francisella tularensis*, is highly infectious and can be transmitted through arthropod bites, direct contact with infected animal tissue, inhalation of contaminated aerosols, and ingestion of contaminated food or water (*1*). *F. tularensis* has been designated a Tier 1 select agent because it meets several criteria, including low infectious dose, ability to infect via aerosol, and a history of being developed as a bioweapon (*2*). This report summarizes tularemia cases reported to CDC during 2001–2010 via the National Notifiable Diseases Surveillance System (NNDSS) and compares the epidemiology of these cases with those reported during the preceding decade. During 2001–2010, a total of 1,208 cases were reported (median: 126.5 cases per year; range: 90–154). Incidence was highest among children aged 5–9 years and men aged >55 years. Clinicians and public health practitioners should be familiar with the current epidemiology and clinical features of tularemia to identify and adequately treat individual cases and recognize unusual patterns that might signal an outbreak or bioterrorism event.

In humans, *F. tularensis* causes distinct clinical syndromes depending on the route of exposure. Percutaneous inoculation typically produces ulceroglandular tularemia, characterized by a cutaneous ulcer at the site of inoculation and tender regional lymphadenopathy. A less common presentation after percutaneous inoculation is glandular tularemia, in which patients develop regional lymphadenopathy without ulcer. Inhalation of *F. tularensis* can result in a primary pneumonia, whereas ingestion causes oropharyngeal disease consisting of tonsillitis or pharyngitis with cervical lymphadenopathy. Other forms of tularemia include oculoglandular (infection of the eye) and typhoidal (fever without localizing signs) (*3*). Certain strains of *F. tularensis* subspecies *tularensis* (also known as type A) are associated with more severe disease and a greater risk for death (*4,5*). Mortality is less than 2% overall but ranges up to 24% depending on the strain (*1,4*).

For national surveillance purposes, a confirmed case of tularemia is defined as clinically compatible illness with either a four-fold or greater change in serum antibody titer to *F. tularensis* antigen or isolation of *F. tularensis* from a clinical specimen. A probable case is defined as clinically compatible illness with either a single elevated antibody titer to *F. tularensis* antigen or detection of *F. tularensis* in a clinical specimen by fluorescent assay (*6*). In this report, incidence is calculated using 2005 census population estimates.

A total of 1,208 cases of tularemia were reported via NNDSS during 2001–2010. The median number of cases per year was 126.5, with a range of 90–154 cases per year. Of these 1,208 reported cases, 64% were categorized as confirmed and 35% as probable (Figure 1). Median age of patients was 39 years (range: 1–92 years), and 68% were male. Average annual incidence was 0.041 cases per 100,000 persons. By age group and sex, annual incidence was highest among children aged 5–9 years (0.071) and among men aged 65–69 years (0.11) (Figure 2). Race was recorded for 887 patients (73%). Among these, 86% were white, 9% were American Indian/Alaska Native, and 3% were black. Ethnicity was recorded for 718 patients (59%), of whom 5% were Hispanic. The highest annual incidence by race was among American Indians/Alaska Natives (0.3 per 100,000 persons).

Cases were reported from 47 states (Figure 3). Six states accounted for 59% of reported cases: Missouri (19%), Arkansas (13%), Oklahoma (9%), Massachusetts (7%), South Dakota (5%), and Kansas (5%). Among the 10 states with the highest incidence of tularemia, all but Massachusetts were located in the central or western United States (Table).

Tularemia cases were reported from 505 U.S. counties (16%) during 2001–2010. County of residence was available for 1,198 patients (99%), although in some cases this might not have been the county of exposure. Among these, 53% of patients resided in counties classified as rural by CDC National Center for Health Statistics' *Urban-Rural Classification Scheme for Counties* (*7*), although rural counties accounted for only 17% of the U.S. population in 2006. The county with the highest annual incidence was Dukes County (Martha's Vineyard and the Elizabeth Islands), Massachusetts (67 cases; 43 per 100,000 persons). Cases in Dukes County were reported consistently during the 10-year period (range: 2–16 cases per year), with substantial increases in 2005 (11 cases), 2006 (10 cases), and 2008 (16 cases). Additional counties with high incidence rates were Buffalo County, South Dakota (six cases; 29 per 100,000), and Shannon County, South Dakota (24 cases; 18 per 100,000).

The majority of cases (77%) occurred during May through September, consistent with peak arthropod activity and increased outdoor human activity. However, seasonal patterns varied by region. In the New England states, no cases occurred in the nonpeak winter months of December through March. In contrast, 20% of cases in the South Atlantic states, 15% in the East South Central states, and 14% in the Pacific states occurred from December through March.

The total number of cases reported during 2001–2010 was similar to the number reported during the 10-year period 1991–2000 (1,208 versus 1,216, respectively). Nevertheless, notable changes occurred in the number of cases reported from some individual states: Montana (72% decrease), Arkansas (42% decrease),

South Dakota (29% decrease), Massachusetts (155% increase), Nebraska (120% increase), and Oklahoma (35% increase) (*8*).

Reported by

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FIGURE 1. Number of reported cases of tularemia, by case status and year — United States, 2001–2010

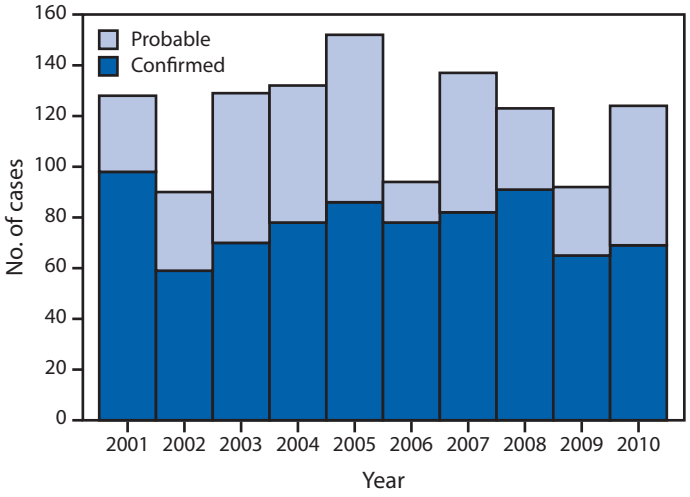
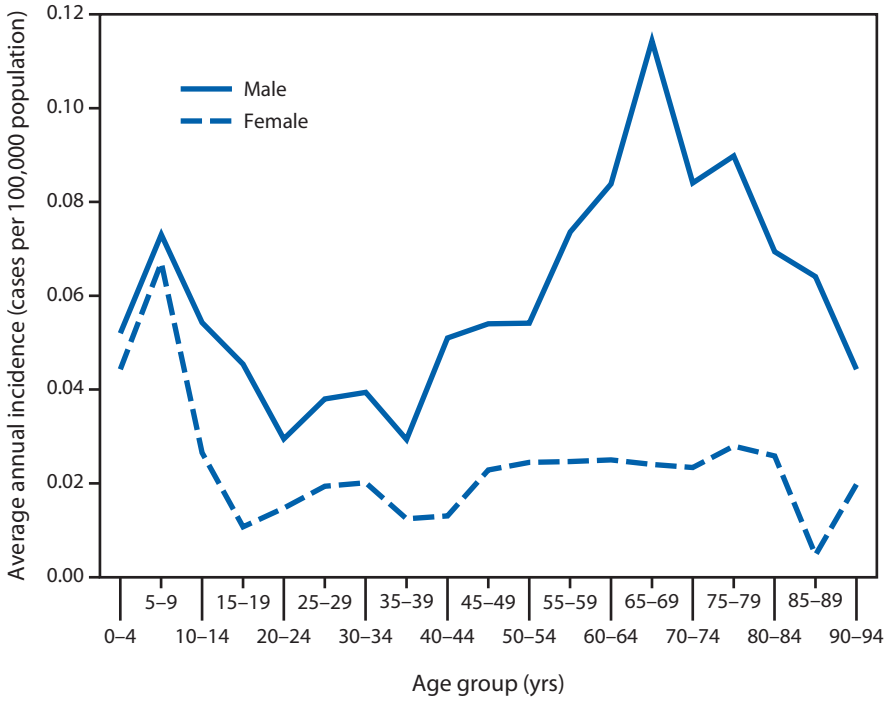


FIGURE 2. Average annual incidence of tularemia, by age group and sex — United States, 2001–2010



Editorial Note

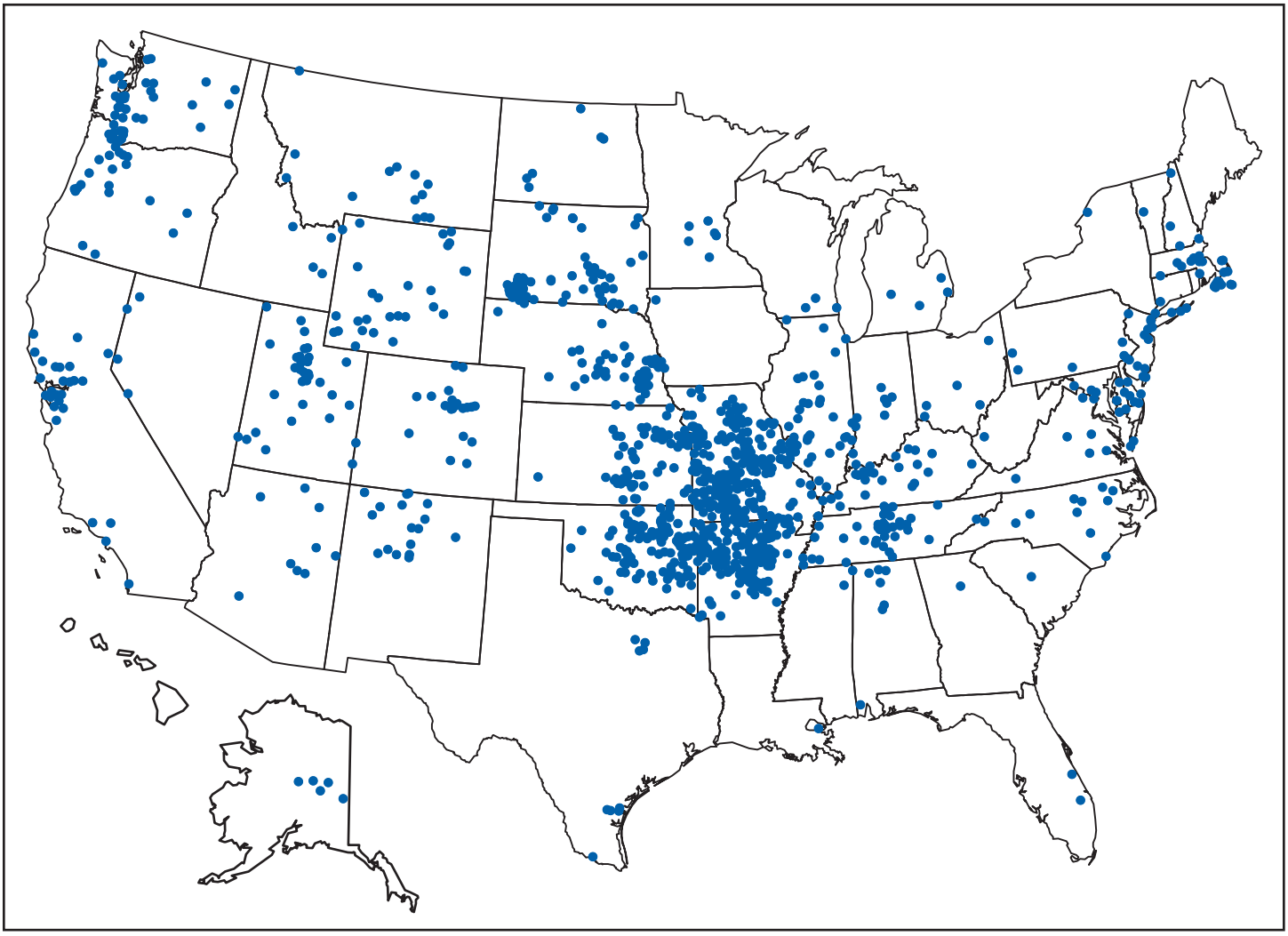
During 2001–2010, the number and demographic features of reported tularemia cases were similar to those reported during the preceding decade. Nevertheless, several differences were noted between the two periods. The geographic distribution of reported cases was slightly less concentrated in the central states during 2001–2010, with a greater proportion of cases reported from the Northeast and the Pacific states of Washington and California than in previous years. In addition, four states that had not reported cases during 1991–2000 (Connecticut, New Hampshire, Vermont, and West Virginia) reported cases during 2001–2010. Further investigation is needed to determine whether the change in distribution was caused by alterations in reporting patterns, vector distribution, human behavior, or other factors.

Seasonal variations by region are likely attributable in part to climate differences, because states with milder climates have longer arthropod activity and thus extended periods of risk. Seasonal variations might also reflect, to some extent, hunting activities that can occur year-round, in contrast to landscaping and other outdoor recreational activities that are concentrated in the summer months. Hunting can result in human exposure to tularemia through direct contact with infected animals and ingestion of infected meat. Hunting of rabbits, which typically occurs in the fall and winter, might explain the higher proportion of winter cases in South Atlantic and East South Central states, where small game hunting is common (*9*).

In a previous surveillance report for the period 1990–2000, CDC recommended improving surveillance by increasing documentation of laboratory confirmation and collecting more detailed epidemiologic and clinical data (*8*). Documentation of laboratory confirmation has indeed improved; during 1990–2000, only 65% of case reports included documentation indicating whether they met the probable versus confirmed case definition, compared with 99% during 2001–2010. Although the amount of epidemiologic and clinical data collected through NNDSS has not changed, CDC does regularly request additional patient information from health departments to better characterize the disease.

The findings in this report are subject to at least two limitations. First, the tularemia cases described in this report might not be fully representative of all cases diagnosed in the United States because case ascertainment and

FIGURE 3. Reported cases of tularemia — United States, 2001–2010*



* One dot is placed randomly within county of residence for each reported case.

TABLE. Ten states with the highest incidence of tularemia — United States, 2001–2010

State	Total no. of reported cases	Incidence*
South Dakota	65	0.84
Arkansas	162	0.58
Wyoming	29	0.57
Missouri	231	0.40
Nebraska	55	0.31
Oklahoma	108	0.30
Kansas	59	0.22
Montana	13	0.14
Massachusetts	84	0.13
Utah	32	0.13

* Incidence calculated as reported cases per 100,000 persons per year.

reporting might be incomplete and differ by state. Second, missing data and small numbers limit statistical comparisons and interpretation.

Tularemia is not a common disease, but it continues to cause approximately 100 reported human cases annually in the United States and is a serious and potentially fatal disease. Although outbreaks do occur (*10*), the majority of reported tularemia cases in the United States are sporadic. Clinicians should consider tularemia in patients with a compatible clinical profile, particularly in children and elderly males with acute fever and regional lymphadenopathy. This report shows that the distribution of tularemia might be gradually changing; therefore, tularemia should be considered even in areas where it has rarely been reported.

What is already known on this topic?

Tularemia is a bacterial zoonosis that can be acquired through various exposure routes. It has been reported in every state except Hawaii, but cases most commonly occur in central U.S. states. It is caused by *Francisella tularensis*, an organism classified as a Tier 1 select agent based on its potential use for bioterrorism.

What is added by this report?

The total number of tularemia cases reported via the National Notifiable Diseases Surveillance System during 2001–2010 did not differ from the number reported during the preceding decade. Geographic distribution was less centrally concentrated; 66% of northeastern states and two Pacific states reported more cases during 2001–2010 compared with 1991–2000. Although the majority of patients with tularemia (53%) resided in rural counties, a substantial proportion of patients (47%) resided in urban counties.

What are the implications for public health practice?

Although aspects of tularemia surveillance have improved, such as documentation of laboratory confirmation, underreporting and other limitations remain. It is important to maintain and enhance surveillance and collect detailed clinical information on each case to enhance understanding of the disease and elucidate the causes of recent epidemiologic shifts.

State and local public health departments are encouraged to report tularemia cases in a timely manner and provide additional patient information, including exposure history, clinical syndrome, and outcome, to CDC when possible. Because the threat of bioterrorism remains, clinicians and health departments should remain vigilant; for example, an urban cluster of tularemia cases among persons without a common natural exposure could be the first sign of a bioterrorism attack.

Acknowledgments

State and local health departments.

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Very High Blood Lead Levels Among Adults — United States, 2002–2011

Over the past several decades there has been a remarkable reduction in environmental sources of lead, improved protection from occupational lead exposure, and an overall decreasing trend in the prevalence of elevated blood lead levels (BLLs) in U.S. adults. As a result, the U.S. national BLL geometric mean among adults was 1.2 μg/dL during 2009–2010 (*1*). Nonetheless, lead exposures continue to occur at unacceptable levels (*2*). Current research continues to find that BLLs previously considered harmless can have harmful effects in adults, such as decreased renal function and increased risk for hypertension and essential tremor at BLLs <10 μg/dL (*3–5*). CDC has designated 10 μg/dL as the reference BLL for adults; levels ≥10 μg/dL are considered elevated (*2*). CDC's Adult Blood Lead Epidemiology and Surveillance (ABLES) program tracks elevated BLLs among adults in the United States (*2*). In contrast to the CDC reference level, prevailing Occupational Safety and Health Administration (OSHA) lead standards allow workers removed from lead exposure to return to lead work when their BLL falls below 40 μg/dL (*6*). During 2002–2011, ABLES identified 11,536 adults with very high BLLs (≥40 μg/dL). Persistent very high BLLs (≥40 μg/dL in ≥2 years) were found among 2,210 (19%) of these adults. Occupational exposures accounted for 7,076 adults with very high BLLs (91% of adults with known exposure source) and 1,496 adults with persistent very high BLLs. Adverse health effects associated with very high BLLs (*4,5,7*) underscore the need for increased efforts to prevent lead exposure at workplaces and in communities.

Forty-one states participated in the ABLES program in 2011.* These states received adult BLL data from laboratories and physicians through mandatory reporting. Adults were defined as persons aged ≥16 years at the time of BLL testing. Each state ABLES program assigned a unique identifier to each adult to protect individual privacy while permitting longitudinal analyses (*2*). For this analysis, a BLL ≥40 μg/dL was defined as a very high BLL. A very high BLL measured over a period ≥2 years was defined as a persistent very high BLL. The number of adults with very high BLLs and the number with persistent very high BLLs during 2002–2011 were counted. Persistent very high BLLs can result in spontaneous abortion, reduced newborn birthweight, neurocognitive deficits, sperm abnormalities, subclinical peripheral neuropathy, hypertension, anemia, kidney dysfunction, and nonspecific symptoms (*4,5*).

* Federal funding for state ABLES program was discontinued in September 2013. The ABLES program continues to provide technical assistance to states with adult blood lead surveillance programs and maintains the ABLES website for reporting ongoing analyses of ABLES data.

As part of their regular activities, and to the extent resources allow, state ABLES programs 1) investigate the circumstances associated with reports of elevated BLLs; 2) contact health-care providers, workers, and employers to gather industry and occupation data and additional exposure information and provide information and educational materials; and 3) refer employers in occupational cases to OSHA offices for technical assistance or enforcement of the lead standards.

From 2002 to 2011, a total of 11,536 adults had very high BLLs among the 1,201,669 adults reported to the ABLES program during this period. Among these adults, 2,210 (19%) had persistent very high BLLs, 1,487 (13%) had BLLs ≥60 μg/dL, and 96 had BLLs ≥60 μg/dL for ≥2 years (Table 1). A total of 7,076 adults with very high BLLs (91% of adults with known exposure source) were exposed at work (Table 2), and 1,496 of these had persistent very high BLLs (93% of adults with known exposure source). These 7,076 workers were predominantly employed in the manufacturing, construction, services, or mining sectors. Within this group, 49% of the workers were employed in three subsectors (i.e., battery manufacturing, nonferrous metal production and processing, and painting and wall covering contractors). Shooting firearms; remodeling, renovating, or painting; and using lead-containing alternative medicines (Table 2) were the most common sources for nonoccupational very high BLLs. The following four case histories illustrate the persistent problem of adults with very high BLLs in the United States (Figure).

Case Histories

Worker A. Worker A is a man aged 48 years who was working for a bridge painting firm and was responsible for recycling grit and steel shot from sandblasting operations. His primary protection from lead exposure was an air-supplied sandblasting hood. This worker had BLLs of 67 μg/dL in May and June of 2010. He was removed from all work and received chelation treatments (therapy to remove heavy metals from the body). His BLL dropped to 42 μg/dL in July and to 26 μg/dL in September 2010. At last contact in February 2011, he continued to be removed from work per physician orders.

Worker B. Worker B is a painter for a small construction company, aged 46 years, who, in December 2007, was seen in a hospital emergency department because of severe stomach pain. His BLL was 143 μg/dL; he was given a chelation treatment and was followed at an occupational health clinic. His last BLL on record in February 2010 was 13 μg/dL. At the time of initial testing, this worker was scraping paint from a house that was >100 years old. He used no respirator and

TABLE 1. Number of adults with very high blood lead levels (BLLs ≥40 μg/dL) in multiple years — Adult Blood Lead Epidemiology and Surveillance (ABLES) Program, United States, 2002–2011

Characteristic	No. of adults with BLLs ≥40 μg/dL	No. of adults with BLLs ≥60 μg/dL*
No. of years with very high BLLs		
1	9,326	1,391
2	1,415	74
3	402	17
4	197	2
5	91	2
6	50	0
7	29	1
8	8	0
9	13	0
10	5	0
Total no. of adults with at least one very high BLL in 10 years	11,536	1,487
Total no. of adults with persistent very high BLLs (≥2 years)	2,210	96

*Adults with BLLs ≥60 μg/dL are a subset of those adults with BLLs ≥40 μg/dL.

wore no protective clothing except for gloves. He was not informed about lead hazards. His employer did not provide laundry services or disposable clothing. No other source of lead exposure was identified.

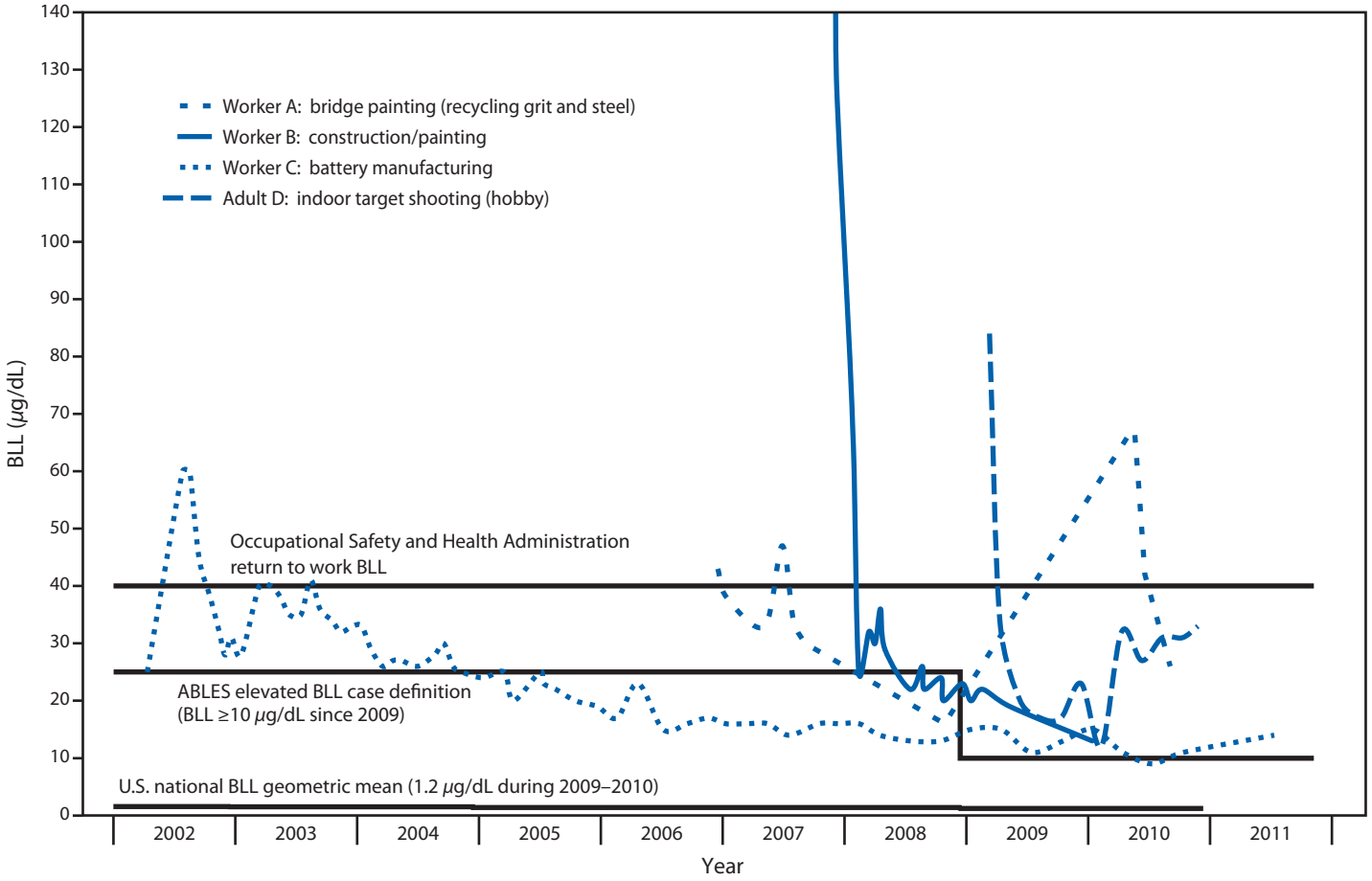
Worker C. Worker C is a man aged 45 years who began working for a battery manufacturing company in May 2000. He worked in maintenance and was responsible for cleaning under lead pots. He did not use a respirator as instructed by his employer because of the heat in the factory. His first BLL was 25 μg/dL in March 2001, and by August 2002 his BLL was 60 μg/dL. Because of the very high BLL, the company moved him into a job with low likelihood of lead exposure. After his BLL dropped below 40 μg/dL in November 2002, he was reassigned to job duties with high likelihood of lead exposure. When his BLL rose to 40 μg/dL again in April 2003, the company issued him a full-face respirator and required him to use it. He was also instructed to shower at the end of the day and for breaks and lunch. He later transferred into jobs

TABLE 2. Number and percentage of adults with very high blood lead levels (BLLs ≥40 μg/dL), by industry subsector, and number and percentage by nonoccupational sources of exposure — Adult Blood Lead Epidemiology and Surveillance (ABLES) Program, United States, 2002–2011

Characteristic	40–59 μg/dL		≥60 μg/dL		Total (≥40 μg/dL)	
	No.	(%)	No.	(%)	No.	(%)
Overall	**10,049**	**(100.0)**	**1,487**	**(100.0)**	**11,536**	**(100.0)**
Exposure type						
Occupational	6,330	(63.0)	746	(50.2)	7,076	(61.3)
Nonoccupational	497	(4.9)	166	(11.2)	663	(5.7)
Unknown exposure source	3,222	(32.1)	575	(38.7)	3,797	(32.9)
Industry subsector [NAICS codes]	**6,330**		**746**		**7,076**	**(100.0)**
Manufacturing	**3,393**	**(100.0)**	**253**	**(100.0)**	**3,646**	**(51.5)**
Battery manufacturing [33591]	1,671	(49.2)	70	(27.7)	1,741	
Nonferrous metal production and processing [3313 and 3314]	577	(17.0)	47	(18.6)	624	
Foundries [3315]	244	(7.2)	28	(11.1)	272	
Fabricated metal product manufacturing [332]	257	(7.6)	31	(12.3)	288	
Other manufacturing industries	644	(19.0)	77	(30.4)	721	
Construction	**1,575**	**(100.0)**	**318**	**(100.0)**	**1,893**	**(26.8)**
Painting and wall covering contractors [23832]	890	(56.5)	185	(58.2)	1,075	
Highway, street, and bridge construction [23731]	262	(16.6)	37	(11.6)	299	
Site preparation contractors [23891]	96	(6.1)	21	(6.6)	117	
Other construction industries	327	(20.8)	75	(23.6)	402	
Services (except public safety)	**555**	**(100.0)**	**87**	**(100.0)**	**642**	**(9.1)**
Remediation services [56291]	186	(33.5)	27	(31.0)	213	
All other amusement and recreation industries [71399]	102	(18.4)	17	(19.5)	119	
Automotive repair and maintenance [8111]	71	(12.8)	9	(10.3)	80	
Other services industries	196	(35.3)	34	(39.1)	230	
Mining (except oil and gas extraction)	**428**	**(100.0)**	**16**	**(100.0)**	**444**	**(6.3)**
Lead ore and zinc ore mining [212231]	418	(97.7)	14	(87.5)	432	
Other mining industries	10	(2.3)	2	(12.5)	12	
Other/missing industry data	**379**		**72**		**451**	**(6.4)**
Nonoccupational exposures	**497**	**(100.0)**	**166**	**(100.0)**	**663**	**(100.0)**
Shooting firearms (target shooting)	144	(29.0)	17	(10.2)	161	(24.3)
Remodeling/renovation/painting	89	(17.9)	22	(13.3)	111	(16.7)
Complementary and alternative medicines (e.g., Ayurvedic medicines)	31	(6.2)	28	(16.9)	59	(8.9)
Eating food containing lead	39	(7.8)	18	(10.8)	57	(8.6)
Retained bullets (gunshot wounds)	30	(6.0)	15	(9.0)	45	(6.8)
Casting (e.g., bullets and fishing weights)	33	(6.6)	6	(3.6)	39	(5.9)
Pica (i.e., the eating of nonfood items)	16	(3.2)	20	(12.0)	36	(5.4)
Other or unknown nonoccupational source	115	(23.1)	40	(24.1)	155	(23.4)

Abbreviation: NAICS = North American Industry Classification System.

FIGURE. Four adults with very high blood lead levels (BLL ≥40 μg/dL) in multiple years, by year — Adult Blood Lead Epidemiology and Surveillance (ABLES) Program, United States, 2002–2011



at the plant with lower lead exposures and his BLL continued to drop. His most recent BLL in August 2011 was 14 μg/dL.

Adult D. Adult D is a man aged 60 years with a BLL of 84 μg/dL in March 2009 who had no known occupational exposure. His known exposures were target shooting at an indoor shooting range and casting bullets. He was given a chelation treatment in April 2009. Approximately 100 BLLs analyzed through June 2012 ranged from 6 μg/dL to 84 μg/dL, with a mean of 28 μg/dL. He and his physician were informed about the detrimental effects of lead and how to limit his exposure, but the patient continues his two hobbies.

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Editorial Note

Reducing lead exposures at work and in the community is essential to avoid adverse health effects in humans. Reducing by 10% the rate of persons who have elevated BLLs (i.e., BLLs ≥10 μg/dL) from work exposures is a *Healthy People 2020* objective (OHS-7) (*8*). The 2010 baseline rate for BLLs ≥10 μg/dL is 26.4 adults per 100,000 employed adults (*2*). Reducing adverse health effects resulting from lead exposures requires 1) adherence to engineering controls and safe work practices; 2) BLL testing and management of elevated BLLs according to the most current medical guidelines and recommendations; and 3) education in the workplace and community (*4–7,9*). OSHA lead standards give the examining physician broad flexibility to tailor special protective

What is already known on this topic?

The vast majority of elevated blood lead levels (BLLs) in the United States are workplace-related. Most lead exposures at work occur in the manufacturing, construction, services, and mining industries. Current research has found that even BLLs <10 μg/dL can cause harm in adults. CDC considers BLLs ≥10 μg/dL to be elevated. In contrast to the CDC reference level, prevailing Occupational Safety and Health Administration (OSHA) lead standards allow workers removed from lead exposure to return to lead work when their BLL falls below 40 μg/dL.

What is added by this report?

Data collected by the Adult Blood Lead Epidemiology and Surveillance program during 2002–2011 identified 11,536 adults with very high BLLs (≥40 μg/dL), of whom 19% had elevated BLLs recorded during ≥2 years. Among those with known exposure source, occupational exposures accounted for 91% of adults with very high BLLs.

What are the implications for public health practice?

The finding that many workers have harmful BLLs, some that are persistent for ≥2 years, is of grave concern. Examining physicians should be aware that the OSHA lead standards give them broad flexibility to tailor protections to the worker's needs, including consideration of removal from lead exposure at BLLs lower than the current OSHA lead standards require. To prevent adverse health outcomes caused by very high BLLs, public health practitioners need to increase lead exposure prevention activities directed at employers, workers, health-care providers, and the community.

procedures to the needs of individual employees (*6*). Therefore, the most current guidelines for management of lead-exposed adults (*4,5,7*) should be implemented by the medical community at the current CDC reference BLL of 10 μg/dL (*2*), including consideration of removal from lead exposure at lower levels than the current OSHA lead standards require. Increasing the number and timeliness of referrals to OSHA of workplaces identified by state ABLES programs fosters prompt intervention and mitigation of lead exposure hazards.

The findings of this report demonstrate that many adults in the United States continue to have very high BLLs. The fact that some adults had persistent very high BLLs is of grave concern. These adults were chronically exposed to lead above BLLs known to cause neurologic, cardiovascular, reproductive, hematologic, and kidney adverse effects (*3–5*). The risks for adverse chronic health effects are even higher if the exposure is maintained for many years (*4,5,7*).

The findings in this report are subject to at least three limitations, all of which suggest that ABLES underestimates the number of adults with elevated BLLs. First, employers might not provide BLL testing to all lead-exposed workers as required by OSHA regulations (*10*). Second, nonoccupationally exposed adults might not be tested. Finally, some laboratories might not report all tests as required by state laws or regulations (Susan Payne, California Department of Public Health, personal communication, June 18, 2012).

Possible factors contributing to the persistence of very high BLLs include 1) prevailing OSHA lead standards require medical removal from lead exposures only after a construction worker's BLL reaches or exceeds 50 μg/dL or a general industry worker's BLL reaches or exceeds 60 μg/dL; 2) examining physicians rarely recommend more stringent worker protections, which the OSHA lead standards allow but do not require; 3) some employers fail to implement appropriate engineering protections and workplace controls; 4) some adults fail to comply with safe practices and behaviors; and 5) state ABLES programs do not always have the resources to investigate and refer to OSHA all cases with very high BLLs.

Very high BLLs continue to be documented in adults in the United States. Actions that might decrease the number of adults with harmful BLLs include 1) increased employer efforts to reduce work-related lead exposure (*6,9*) and to comply with current guidance (*4,7*) for testing and managing lead-exposed workers; 2) adherence by lead-exposed workers to safe work practices, such as properly using personal protective equipment, washing before eating, and showering and changing clothes before going home; 3) education of the medical community to use current guidelines and recommendations for management of lead-exposed adults with BLLs ≥10 μg/dL (*4,5,7*); and 4) increased involvement of the public health community to prevent nonoccupational lead exposures.

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