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Journal

Public Health Reports, 130(5)

ISSN

0033-3549

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Publication Date

2015-09-01

DOI

10.1177/003335491513000514

Peer reviewed

Trends in HIV Testing Among U.S. Older Adults Prior to and Since Release of CDC's Routine HIV Testing Recommendations: National Findings from the BRFSS

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ABSTRACT

Objective. This study examined temporal trends in HIV testing among U.S. older adults (50–64 years of age) before and after the release of CDC's routine HIV testing recommendations in 2006.

Methods. The sample (n=872,797; 51.4% female) comprised 2003–2010 Behavioral Risk Factor Surveillance System respondents in the oldest categories to which the recommendations apply: 50–54 years (34.5%, n=301,519), 55–59 years (34.1%, n=297,865), and 60–64 years (31.3%, n=273,413). We calculated (*1*) four-year pooled prevalences of past-year HIV testing before and after 2006, when the recommendations were released; and (*2*) annual prevalences of HIV testing overall and by age category from 2003–2010. Using weighted, multivariable logistic regression analyses, we examined binary (pre- vs. post-recommendations) and annual changes in testing, controlling for covariates. We stratified the data by recent doctor visits, examined racial/ethnic differences, and tested for linear and quadratic temporal trends.

Results. Overall and within age categories, the pooled prevalence of past-year HIV testing decreased following release of the recommendations (p<0.001). The annual prevalence decreased monotonically from 2003 (5.5%) to 2006 (3.6%) (β=−0.16, p<0.001) and then increased immediately after release of the recommendations, but decreased to 3.7% after 2009 (β=0.01, p<0.001). By race/ethnicity, testing increased over time among non-Hispanic black people only. Annual prevalence also increased among respondents with recent doctor visits.

Conclusion. CDC's HIV testing recommendations were associated with a reversal in the downward trend in past-year HIV testing among older adults; however, the gains were neither universal nor sustained over time.

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In 2006, the Centers for Disease Control and Prevention (CDC) began recommending routine opt-out human immunodeficiency virus (HIV) testing of all adults <65 years of age seeking health care in any setting where HIV prevalence is ≥0.1%.[1] Routine testing is an efficient, cost-effective strategy for early detection of HIV infection.[2] It involves screening every patient (except those who decline testing) regardless of any reported risk behaviors; therefore, it can facilitate detection of undiagnosed HIV infection among people unlikely to seek an HIV test, including those presumed to have little or no HIV risk.[3]

Routine testing may be particularly important for older adults (i.e., those aged ≥50 years), among whom 11% of U.S. HIV infections occur. Of concern, HIV-infected older adults are disproportionately diagnosed late in the course of HIV disease.[4,5] Late diagnosis is associated with rapid progression to acquired immunodeficiency syndrome (AIDS), and it exacerbates the management of both HIV disease and the non-HIV conditions that are prevalent among older adults (e.g., hypertension).[6–9] Rates of HIV testing generally decrease with age;[10–13] however, it is unclear if the release and implementation of the recommendations have helped to improve HIV testing levels in this age group.[14,15]

To understand the recommendations' potential influence on HIV testing among older adults, we examined trends in HIV testing from January 1, 2003, to December 31, 2010, among Behavioral Risk Factor Surveillance System (BRFSS) respondents in the three categories of older adulthood (50–54, 55–59, and 60–64 years of age) to which the routine HIV testing recommendations apply. The study period began four years prior to CDC's publication of the recommendations and concluded four years thereafter, enabling us to compare HIV testing levels before and after their release. Full implementation should produce a sustained increase in testing that begins in 2007 and is most apparent among people with a recent doctor visit. This study sought to determine if:

1. The annual prevalence of past-year HIV testing increased among older adults since release of the routine HIV testing recommendations,
2. Racial/ethnic differences in past-year HIV testing exist over time among older adults,
3. The odds of testing increased more for those with vs. without a recent doctor visit since release of the recommendations, and
4. The characteristics of older testers changed over time.

METHODS

Conceptual model

Our conceptual model adapted Andersen's Healthcare Utilization Model[16–18] to explain how predisposing, enabling, and need factors may influence HIV testing.[19–21] Predisposing factors are personal attributes that may incline one toward or against HIV testing. Enabling factors represent a person's means for obtaining services, and these factors may either facilitate or impede access to HIV testing. Need factors indicate if HIV testing is warranted.

Population and setting

We conducted a secondary analysis of BRFSS data from all 50 U.S. states and the District of Columbia. The BRFSS is the nation's most comprehensive system for monitoring the health behaviors and health-care use of U.S. residents.[22] BRFSS samples are representative of each state and the nation.

Sample

From January 1, 2003, to December 31, 2010, BRFSS interviewed 899,965 adults aged 50–64 years in the 50 states and District of Columbia; 40% (n=350,052) of the interviews occurred before release of the recommendations and 60% (n=549,913) of the interviews occurred thereafter. Of those interviewed, 97% (n=872,797) had complete data on HIV testing and served as the sample. Analysis of the adjusted annual trends excluded 3% (n=29,442) of respondents due to data missing on any study variable. The definition of older adults followed CDC's use of age 50 as the start of older adulthood[23] and age 64 as the upper limit for HIV screening.[1]

Measures

Dependent variable. The dependent variable, past-year HIV testing, indicated whether or not a respondent had an HIV test in the past 12 months. We calculated the dependent variable based on responses to an item asking if one had ever tested for HIV and, if so, the month and year of the last test. We coded it "1" if testing occurred within 12 months of the interview and "0" for all other responses. We calculated the annual prevalence of past-year HIV testing using the number of "yes" codes per calendar year as the numerator and the total number of respondents in that year as the denominator.

Time. To compare pooled periods before and after the recommendations and examine annual changes over time, we assessed this main predictor in two ways.

Pooled period was a dichotomized variable indicating whether a respondent was interviewed in the four-year period preceding (2003–2006) or following (2007–2010) release of the recommendations. Based on the date of the interview, we coded it "1" for respondents interviewed from January 1, 2007, to December 31, 2010, and "0" for those interviewed from January 1, 2003, to December 31, 2006. Year was a continuous variable indicating the calendar year of the interview. Both measures included a three-month lag time (from September to December 2006) to approximate dissemination and implementation of the recommendations.

Age category. Age category, a predisposing factor, was assessed in years. We recoded it into three five-year categories (50–54, 55–59, and 60–64 years of age).

Covariates. Additional predisposing factors included race/ethnicity (Hispanic, non-Hispanic white, non-Hispanic black [hereinafter, black], non-Hispanic Asian, non-Hispanic Native Hawaiian/other Pacific Islander, non-Hispanic American Indian/Alaska Native, and non-Hispanic other), sex (male or female), marital status (divorced/separated/never married, widowed, or married/living together), employment status (unemployed, employed, or retired), and educational attainment (<high school, high school diploma, or at least some college). Enabling factors included total annual household income (<$20,000 vs. ≥$20,000); any doctor visit in the past year for routine checkup (yes/no), which was only available in BRFSS from 2005 onward; whether any medical costs prevented a doctor visit in the past year (yes/no); insurance status (insured or not insured); and having a usual source of care (yes/no). The need factors included self-report of any HIV risk behaviors (intravenous drug use, sexually transmitted diseases, exchanging sex for drugs or money, or anal sex without a condom) in the past year (yes/no), although it was not assessed in 2006 or 2007; and drinking (on average >2 drinks for men or >1 drink for women per episode in one week), which some suggest may adversely affect well-being among older adults.[24,25]

Analysis

We obtained univariate and bivariate statistics in exploratory analyses. Because risk behaviors tend to decrease with age, we assessed potential interaction between age and HIV risk behaviors. We also assessed potential interaction between time period and recent doctor visits, but none was present (p=0.87). We assessed confounding by the covariates in our conceptual model. Using t-tests and Pearson's chi-squared tests, we determined if (*1*) the proportions, characteristics, and primary care-seeking behaviors of older testers changed before and after 2006; and (*2*) the prevalence estimates between the two periods differed statistically. We stratified the data based on whether or not respondents had had a doctor visit in the past year and examined testing prevalence (as proportions) over time.

Using multivariable logistic regression with an indicator for the pooled four-year periods before and after the recommendations, we determined if the odds of past-year HIV testing changed following release of the recommendations. The analysis controlled for factors that were significant in the bivariate analyses and combined sample weights as recommended by Korn and Graubard[26] for pooled data from population-based surveys. To estimate annual patterns, we replaced the pooled-year variable with linear and quadratic terms. Routine testing is provided regardless of risk, and the BRFSS did not assess risk behaviors in 2006 and 2007; therefore, we ran each analysis with and without HIV risk behaviors in the models. To identify racial/ethnic disparities, we compared groups' odds ratios (ORs) and corresponding 95% confidence intervals (CIs). Data on recent doctor visits were not available in 2003 and 2004; therefore, we examined recent visits by restricting these analyses to the two years before and after 2006. All analyses excluded observations missing information on any model variables. To account for unequal probability of selection, nonresponse, and noncoverage, all analyses included survey weights and used the SVY suite of commands in Stata® version 10.[27]

RESULTS

More than two-thirds of respondents had health insurance (88.0%), a usual source of care (88.4%), and a doctor visit in the past year (73.5%); these proportions increased with age category. Past-year medical costs kept 12.6% of respondents from accessing care. Overall, only 4.3% reported HIV testing in the past year, and this percentage decreased with age category. Very few (1.4%) reported engaging in HIV risk behaviors. The weighted estimates in Table 1 corresponded to 344,804 (95% CI 327,758, 361,849) respondents reporting at least one risk behavior in the past year, of which 54,676 (95% CI 46,447, 62,905) reported a past-year HIV test (data not shown). Among testers, more than half (57.7%) had tested at a private doctor or clinic, and hospital-based testing increased with age category (Table 1).

Temporal trends in the unadjusted annual prevalence of past-year HIV testing overall and by age category (Figure 1a), by race/ethnicity (Figure 1b), and by any doctor visit in the past year (Figure 1c) are shown. Overall, the annual prevalence of past-year

Table 1. Weighted sample characteristics of U.S. adults aged 50–64 years, overall and by age category, BRFSS 2003–2010 (*n*=899,965)

	Overall age (years)	*Age category (years)*		
Characteristic	*50–64 (n=899,965) Percent (95% CI)*	*50–54 (n=311,285) Percent (95% CI)*	*55–59 (n=306,933) Percent (95% CI)*	*60–64 (n=281,747) Percent (95% CI)*
Female	51.3 (51.1, 51.5)	50.9 (50.5, 51.2)	52.0 (51.6, 52.3)	51.3 (50.9, 51.7)
Race				
NH white	76.1 (75.9, 76.3)	74.9 (74.5, 75.2)	76.0 (75.6, 76.3)	78.2 (77.8, 78.6)
NH black	9.2 (9.1, 9.3)	9.3 (90.7, 94.9)	9.6 (9.3, 9.8)	8.7 (8.4, 8.9)
NH Asian	2.3 (2.2, 2.4)	2.5 (2.3, 2.6)	2.2 (2.1, 2.4)	2.1 (1.9, 2.3)
NH Native Hawaiian/other Pacific Islander	0.2 (0.2, 0.2)	0.2 (0.2, 0.3)	0.2 (0.2, 0.3)	0.2 (0.2, 0.2)
NH American Indian/Alaska Native	1.1 (1.1, 1.2)	1.1 (1.0, 1.2)	1.1 (1.0, 1.2)	1.1 (1.0, 1.2)
NH other	2.1 (2.0, 2.2)	2.1 (2.0, 2.2)	2.1 (2.0, 2.2)	2.1 (2.0, 2.2)
Hispanic	8.9 (8.8, 9.1)	9.9 (9.6, 10.2)	8.8 (8.5, 9.1)	7.7 (7.4, 8.0)
Marital status				
Divorced/separated/never married	22.6 (22.4, 22.7)	23.9 (23.6, 24.1)	23.0 (22.7, 23.2)	20.3 (20.0, 20.5)
Widowed	4.7 (4.6, 4.8)	2.8 (2.7, 2.9)	4.5 (4.4, 4.6)	7.8 (7.6, 8.0)
Married/living together	72.7 (72.6, 72.9)	73.4 (73.1, 73.7)	72.5 (72.3, 72.8)	71.9 (71.6, 72.2)
Employment status				
Unemployed	33.2 (33.0, 33.4)	33.7 (33.4, 34.1)	34.6 (34.2, 34.9)	30.9 (30.6, 31.2)
Employed	52.4 (55.2, 52.6)	62.8 (62.5, 63.1)	53.5 (53.2, 53.9)	35.8 (35.4, 36.1)
Retired	14.3 (14.2, 14.5)	3.5 (3.3, 3.6)	11.9 (11.7, 12.1)	33.4 (33.0, 33.7)
Educational attainment				
College	37.6 (37.4, 37.8)	38.1 (37.7, 38.4)	38.3 (38.0, 38.7)	36.0 (35.7, 36.3)
Some college	26.6 (26.4, 26.8)	26.8 (26.5, 27.1)	27.1 (26.8, 27.4)	25.7 (25.4, 26.0)
High school	27.1 (26.9, 27.3)	27.0 (26.7, 27.3)	26.1 (25.9, 26.4)	28.3 (28.0, 28.6)
<High school	8.7 (8.6, 8.9)	8.1 (7.9, 8.4)	8.5 (8.2, 8.7)	10.0 (9.7, 10.2)
Household income <$20,000/year	12.8 (12.7, 13.0)	12.0 (11.8, 12.3)	12.6 (12.4, 12.9)	14.2 (14.0, 14.5)
Have health insurance	88.0 (87.8, 88.1)	87.0 (86.8, 87.3)	88.6 (88.3, 88.8)	88.5 (88.3, 88.8)
Have a usual source of care	88.4 (88.3, 88.5)	86.4 (86.1, 86.6)	89.1 (88.9, 89.4)	90.6 (90.4, 90.9)
No doctor visits in past 12 months because of medical costs	12.6 (12.4, 12.7)	14.2 (13.9, 14.4)	12.3 (12.0, 12.5)	10.6 (10.4, 10.9)
Saw a medical doctor in past year	73.5 (73.3, 73.7)	69.6 (69.2, 69.9)	74.5 (74.1, 74.8)	78.3 (77.9, 78.6)
HIV risk behaviors in past 12 months	1.4 (1.3, 1.4)	1.7 (1.6, 1.8)	1.3 (1.2, 1.4)	1.0 (0.9, 1.1)
Multiple drinks per episode[a]	4.9 (4.9, 5.0)	5.3 (5.2, 5.5)	5.2 (4.6, 4.9)	4.6 (4.4, 4.7)
HIV test in past 12 months	4.3 (4.2, 4.4)	5.1 (5.0, 5.3)	4.2 (4.0, 4.4)	3.2 (3.0, 3.3)
HIV test location				
Private doctor/health maintenance organization/clinic	57.7 (57.3, 58.2)	59.3 (58.7, 60.0)	57.0 (56.3, 57.8)	55.3 (54.4, 56.1)
Hospital	23.5 (23.2, 23.9)	21.7 (21.2, 22.3)	24.1 (23.5, 24.7)	26.9 (26.1, 27.6)
Other	18.7 (18.4, 19.0)	19.0 (18.4, 19.5)	18.9 (18.3, 19.5)	17.9 (17.2, 18.5)

[a]Refers to >2 drinks per episode among men and >1 drink per episode among women.

BRFSS = Behavioral Risk Factor Surveillance System

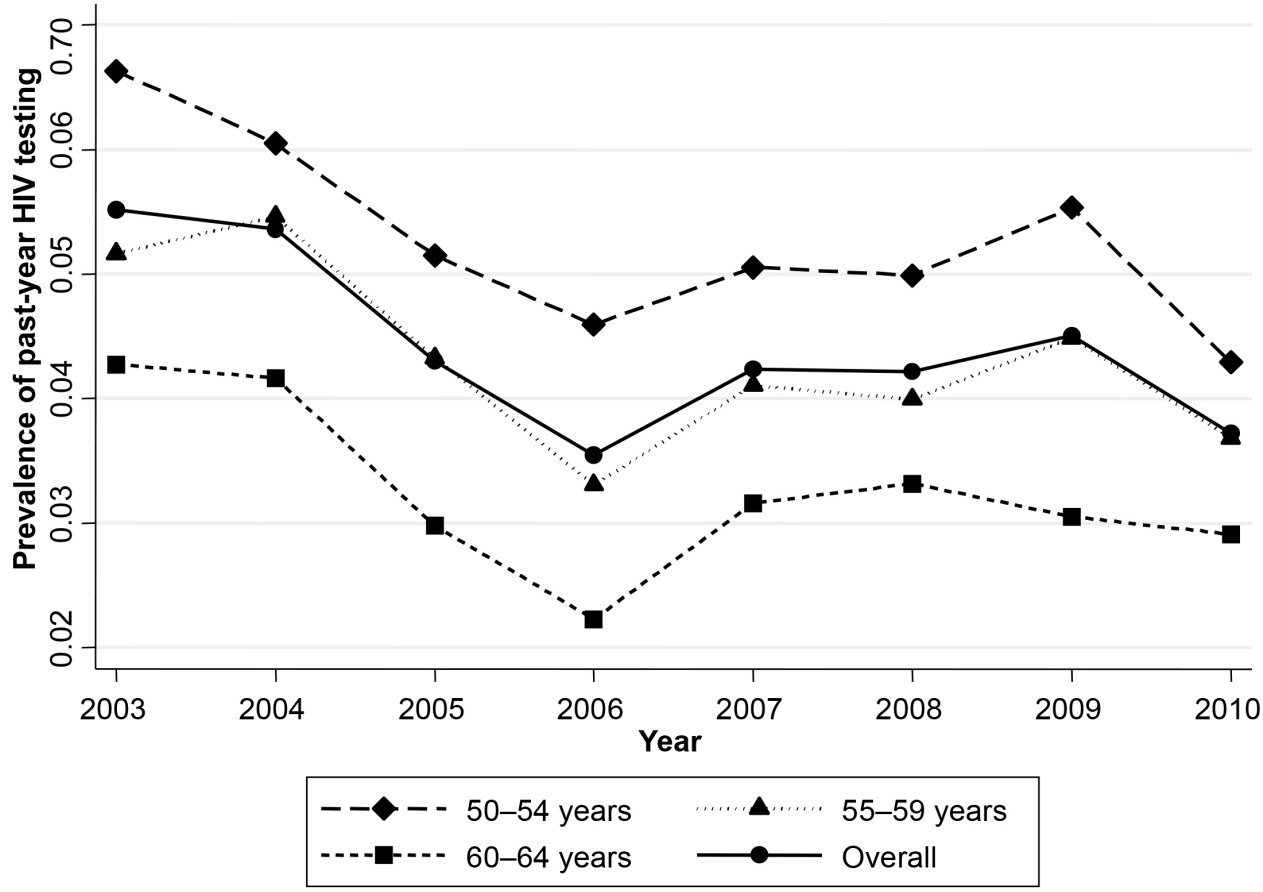
CI = confidence interval

NH = non-Hispanic

HIV = human immunodeficiency virus

HIV testing decreased with age and over time, from 5.5% in 2003 to 3.6% in 2006 ($p<0.001$). It increased after 2006, reaching 4.5% by 2009 ($p<0.001$), but was followed by a slight downturn to 3.7% by 2010 ($p<0.001$). Post-recommendations testing levels never returned to the heights observed before 2005. By race/ethnicity, prevalences fluctuated slightly across the eight-year period, but generally remained higher among black people than among other groups. In both time periods, the annual prevalence was consistently lower among people with no vs. any doctor visit in the past year. In analyses stratified by doctor visits, testing increased in both strata from 2007 to 2009, but the increase was only significant among those with a recent doctor visit (global F-test$_{visit}$<0.001 vs. global F-test$_{no\ visit}$=0.335).

Figure 1a. Temporal trends in annual prevalence of past-year HIV testing, overall and by age category, among U.S. adults aged 50–64 years, 2003–2010 BRFSS (*n*=872,797)



HIV = human immunodeficiency virus
BRFSS = Behavioral Risk Factor Surveillance System

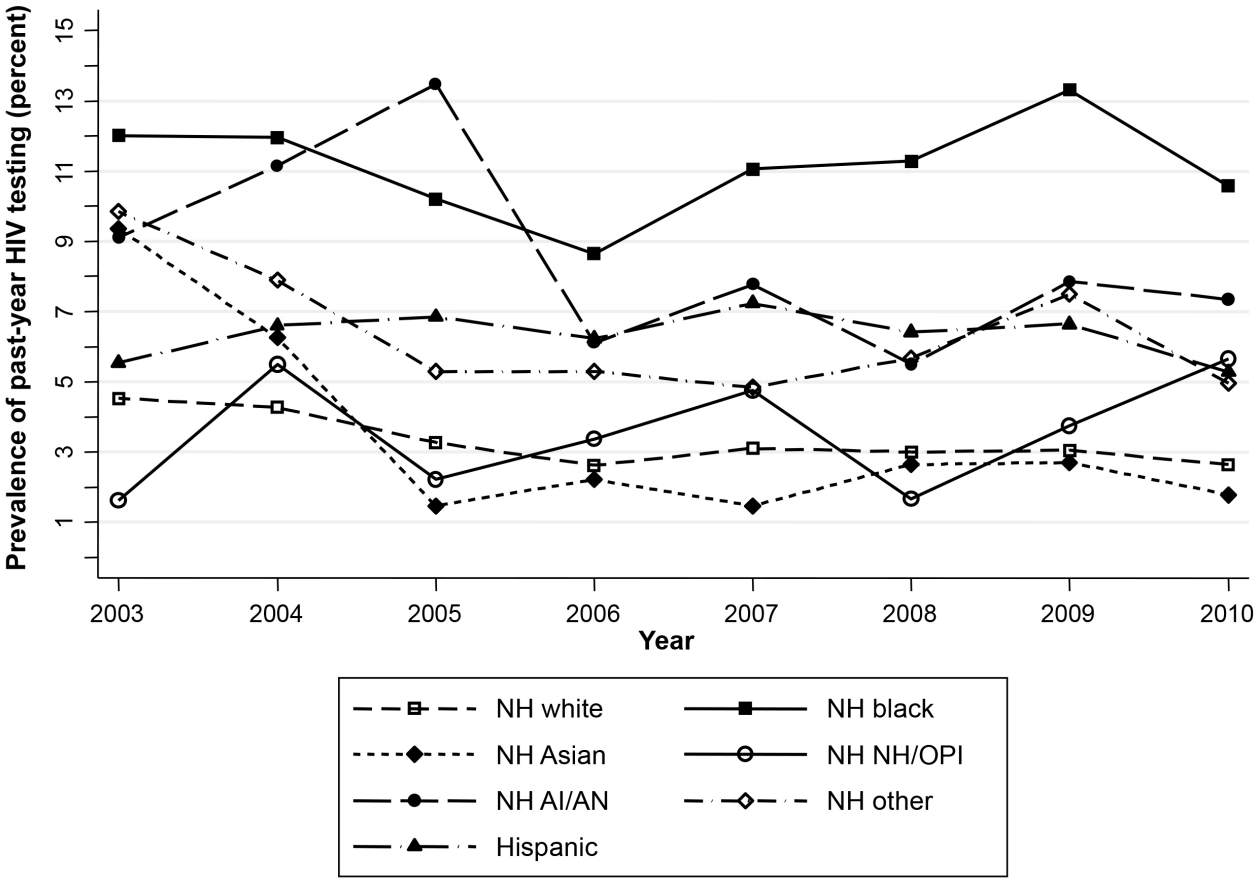
Testers in the post-recommendations period differed slightly from earlier testers (data not shown). Greater proportions of them were black or Hispanic, unemployed but not retired, low income (i.e., annual household income <$20,000), and had recently engaged in HIV risk behaviors; a smaller proportion was insured. The proportion of testers who had recently seen a doctor did not change.

Table 2 compares the weighted prevalence of past-year HIV testing in the pooled periods preceding (2003–2006) and following (2007–2010) release of the recommendations. *P*-values ≤0.05 indicate a significant change (either increase or decrease) over time. Overall, the prevalence of HIV testing decreased 7% ($p<0.001$), from 4.5% (95% CI 4.4, 4.7) during the pre-recommendations period to 4.2% (95% CI 4.0, 4.3) thereafter. By race/ethnicity, a significant increase in testing occurred among black people only; a nearly significant increase occurred among the oldest non-Hispanic American Indians/Alaska Natives. The prevalence of testing was unchanged among Hispanic people and decreased among those reporting non-Hispanic white, non-Hispanic Asian, and non-Hispanic other race/ethnicity. No difference in the proportion of people reporting HIV risk behaviors before vs. after the recommendations was found (Table 2).

Multivariable analysis

In the logistic regression analysis comparing the pooled periods, the adjusted odds of HIV testing were lower during the post-recommendations period whether the models included all covariates (OR=0.87, 95% CI 0.83, 0.91) or excluded HIV risk behaviors (OR=0.88, 95% CI 0.84, 0.92). People with recent doctor visits had higher odds of HIV testing (OR=2.44, 95% CI 2.13, 2.79).

Figure 1b. Temporal trends in annual prevalence of past-year HIV testing among U.S. adults aged 50–64 years, by race/ethnicity, 2003–2010 BRFSS (*n*=865,310)



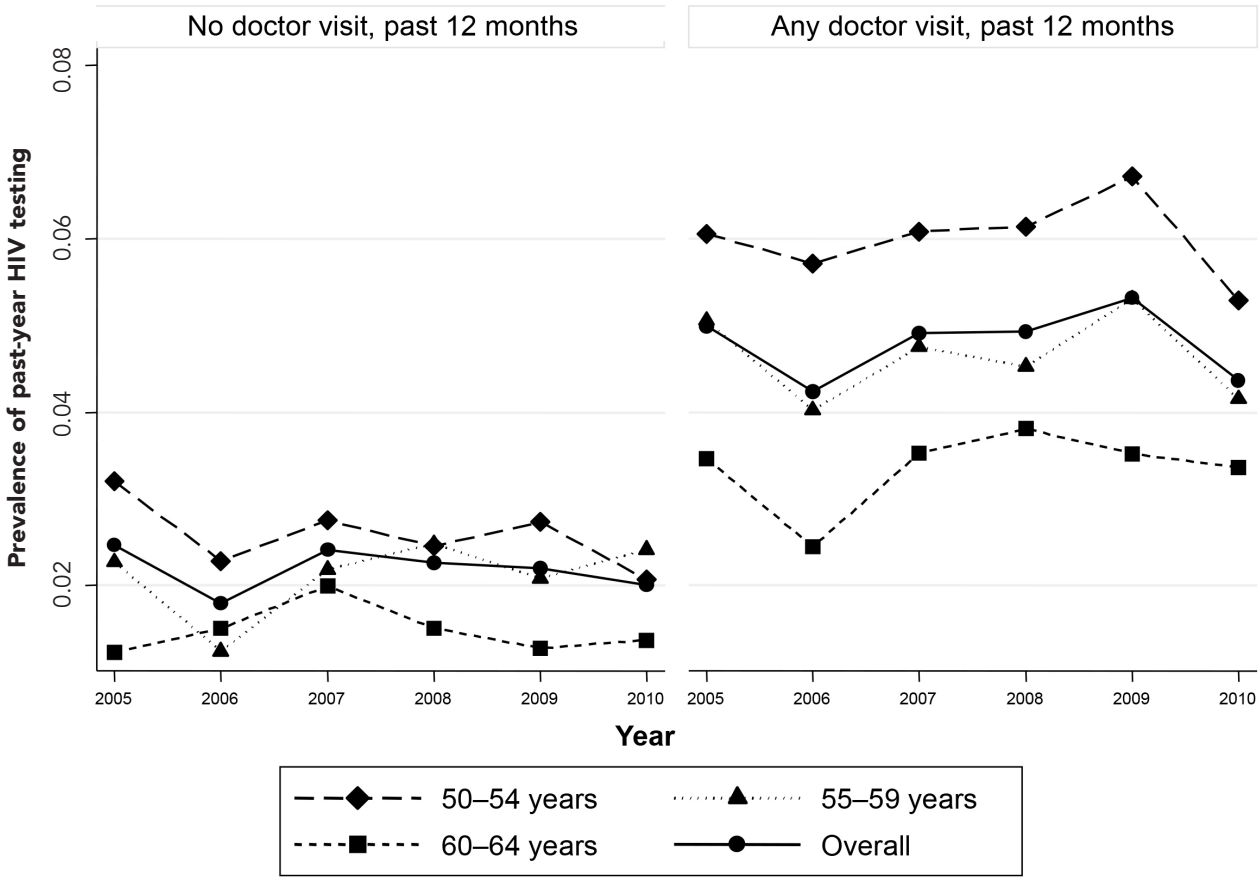
HIV = human immunodeficiency virus
BRFSS = Behavioral Risk Factor Surveillance System
NH = non Hispanic
AI/AN = American Indian/Alaska native
NH/OPI = Native Hawaiian/other Pacific Islander

We analyzed annual trends from 2003 to 2010. In Model 1, which controlled for all covariates, the linear test for trend was significant but the quadratic test was not; this result confirmed the linear decrease in testing but not the increase after 2006. In Model 2, which excluded HIV risk behaviors missing in 2006 and 2007, both the linear and quadratic terms were significant, indicating a significant decrease in the adjusted odds of testing from 2003 to 2006 and a significant albeit modest increase thereafter (Table 3). In the analyses on doctor visits, people with recent doctor visits had nearly 2.5 times the odds of an HIV test.

DISCUSSION

This study of HIV testing trends from 2003 through 2010 suggests that CDC's routine HIV testing recommendations, which were released in 2006, have not yet been fully implemented among people in the three categories of older adulthood (i.e., those aged 50–54, 55–59, and 60–64 years) to which they apply. Across age category, the annual prevalence of past-year HIV testing increased immediately following release of the recommendations and generally continued to increase modestly though unevenly through 2009. The prevalence of past-year HIV testing decreased slightly from 2009 to 2010, however, and never returned to the higher levels observed before 2005. In response to our research questions, we learned that:

Figure 1c. Annual prevalence of past-year HIV testing among U.S. adults aged 50–64 years, stratified by whether or not participants saw a doctor in the past year for routine care, 2003–2010 BRFSS (*n*=866,679)[a]



[a]The sample size was reduced by 6,118 because BRFSS did not ask respondents if they saw a doctor during the past year until the 2005 BRFSS.

HIV = human immunodeficiency virus

BRFSS = Behavioral Risk Factor Surveillance System

1. The annual prevalence of HIV testing increased initially, but the increase was not sustained through 2010; in fact, prevalence decreased over time.
2. Racial/ethnic patterns existed. Testing only increased among black people, who were targeted by various HIV testing initiatives during this period.
3. People with recent doctor visits had higher odds of HIV testing; however, the proportions tested remained low (<5%), even among those with recent visits.
4. The characteristics of older testers changed over time.

Although the recommendations were associated with a reversal of the downward trend in HIV testing among older adults from 2003 to 2006, subsequent levels of HIV testing reached neither the higher levels observed before 2006 nor the universal levels for which the recommendations call. Similar research based on the National Health Interview Survey (NHIS) found a nonsignificant decrease in past-year HIV testing, from 10.5% in 2000 to 10.1% in 2010, among adults aged 18–64 years.[28] Although the longer time frame of the NHIS masks some of the year-to-year changes we observed, neither survey provides evidence of an overall increase in testing. As surveillance data from 2007–2010 indicate, new HIV/AIDS diagnoses were stable among older adults during this period;[15,29] therefore, decreases in testing did not correspond to changes in population diagnoses. The fact that the oldest respondents were tested in hospitals whereas younger respondents were tested in doctors' offices or clinics supports prior

Table 2. Weighted prevalence estimates of past-year HIV testing within and across age categories and by selected characteristics, BRFSS 2003–2010 (*n*=872,797)

Characteristics	Testers N	*Pre-recommendations period (2003–2006) Age category (in years) Percent (95% CI)*				Testers N	*Post-recommendations period (2007–2010) Age category (in years) Percent (95% CI)*				P-value
		50–54	*55–59*	*60–64*	*Total*		*50–54*	*55–59*	*60–64*	*Total*	
Sex											
Male	135,987	7.0 (6.6, 7.5)	6.1 (5.6, 6.5)	4.6 (4.1, 5.0)	6.1 (5.8, 6.3)	208,519	6.0 (5.7, 6.4)	5.4 (5.1, 5.8)	4.4 (4.1, 4.7)	5.6 (5.5, 5.8)	<0.001
Female	204,149	3.9 (3.6, 4.2)	2.9 (2.6, 3.2)	2.0 (1.8, 2.3)	3.1 (2.9, 3.2)	324,142	3.9 (3.7, 4.1)	2.8 (2.6, 3.0)	1.9 (1.7, 2.0)	3.0 (2.9, 3.1)	0.394
Race											
NH white	283,308	4.3 (4.0, 4.6)	3.3 (3.1, 3.6)	2.6 (2.4, 2.8)	3.5 (3.4, 3.7)	436,878	3.4 (3.2, 3.6)	2.9 (2.8, 3.1)	2.3 (2.2, 2.5)	2.9 (2.8, 3.0)	<0.001
NH black	23,996	12.1 (10.9, 13.2)	10.4 (9.2, 11.7)	7.8 (6.4, 9.1)	10.4 (9.7, 11.1)	40,741	14.2 (13.1, 15.3)	11.3 (10.2, 12.4)	7.8 (6.8, 8.6)	11.6 (10.9, 12.2)	0.025
NH Asian	3,682	4.7 (2.2, 7.2)	3.2 (0.6, 5.8)	4.1 (0.5, 7.8)	4.1 (2.5, 5.8)	6,601	1.9 (1.1, 2.7)	1.8 (0.8, 2.8)	2.8 (1.1, 4.6)	2.1 (1.5, 2.8)	0.009
NH Native Hawaiian/other Pacific Islander[a]	511	1.9	5.3	2.5	3.1 (1.1, 5.2)	696	5.5	3.8	2.0	4.1 (2.0, 6.2)	0.520
NH American Indian/Alaska Native	4,827	12.4 (7.1, 17.7)	11.3 (6.0, 16.7)	4.4 (1.8, 6.9)	9.9 (7.0, 12.9)	7,229	8.8 (6.0, 11.6)	5.7 (3.6, 7.8)	6.3 (3.7, 8.9)	7.1 (5.6, 8.6)	0.070
NH other	7,561	7.0 (5.3, 8.8)	7.6 (5.3, 9.9)	5.1 (2.8, 7.4)	6.7 (5.5, 7.9)	11,670	7.0 (5.3, 8.6)	5.4 (3.8, 7.0)	4.1 (3.0, 5.3)	5.7 (4.8, 6.6)	0.206
Hispanic	13,551	7.5 (6.0, 9.1)	6.3 (4.6, 8.0)	4.3 (3.0, 5.6)	6.4 (5.4, 7.3)	24,059	7.5 (6.4, 8.5)	5.8 (4.7, 6.8)	4.8 (3.6, 5.9)	6.3 (5.7, 7.0)	0.963
Marital status											
Divorced/separated/never married	101,413	8.5 (7.9, 9.1)	7.0 (6.3, 7.7)	5.5 (4.8, 6.2)	7.3 (6.9, 7.7)	159,593	8.5 (8.0, 8.9)	6.9 (6.4, 7.4)	4.9 (4.5, 5.3)	7.1 (6.8, 7.3)	0.282
Widowed	25,149	8.4 (6.7, 10.1)	5.3 (4.4, 6.2)	3.8 (2.9, 4.7)	5.3 (4.7, 5.8)	36,826	8.7 (7.1, 10.3)	5.3 (4.5, 6.1)	4.0 (3.3, 4.6)	5.5 (5.0, 6.1)	0.632
Married/living together	212,505	4.3 (4.0, 4.6)	3.5 (3.2, 3.8)	2.6 (2.3, 2.8)	3.6 (3.4, 3.8)	334,598	3.7 (3.5, 3.9)	3.1 (2.9, 3.3)	2.5 (2.3, 2.7)	3.2 (3.0, 3.3)	<0.001
Employment status											
Unemployed	110,865	6.6 (6.1, 7.2)	5.2 (4.7, 5.7)	3.9 (3.5, 4.4)	5.5 (5.2, 5.8)	180,462	6.2 (5.9, 6.6)	5.1 (4.7, 5.5)	3.9 (3.5, 4.2)	5.3 (5.0, 5.5)	0.227
Employed	175,263	4.8 (4.5, 5.1)	4.0 (3.6, 4.4)	3.0 (2.6, 3.4)	4.2 (4.0, 4.4)	269,572	4.2 (4.0, 4.4)	3.4 (3.1, 3.6)	2.8 (2.5, 3.0)	3.7 (3.5, 3.8)	<0.001
Retired	53,365	5.9 (4.7, 7.0)	3.9 (3.4, 4.5)	2.9 (2.5, 3.3)	3.5 (3.2, 3.8)	81,289	5.7 (4.7, 6.9)	4.2 (3.6, 4.7)	2.7 (2.5, 3.0)	3.4 (3.1, 3.6)	0.573

continued on p. 522

Table 2 (continued). Weighted prevalence estimates of past-year HIV testing within and across age categories and by selected characteristics, BRFSS 2003–2010 (*n*=872,797)

Characteristics	Testers N	Pre-recommendations period (2003–2006) Age category (in years) Percent (95% CI)				Testers N	Post-recommendations period (2007–2010) Age category (in years) Percent (95% CI)				P-value
		50–54	55–59	60–64	Total		50–54	55–59	60–64	Total	
Educational attainment											
College	121,128	5.3 (4.8, 5.7)	4.5 (4.1, 5.0)	3.6 (3.1, 4.0)	4.6 (4.3, 4.9)	196, 598	4.4 (4.2, 4.7)	3.7 (3.4, 4.0)	3.2 (2.9, 3.5)	3.9 (3.7, 4.0)	<0.001
Some college	92,940	5.8 (5.3, 6.3)	4.6 (4.1, 5.1)	3.0 (2.6, 3.4)	4.7 (4.4, 5.0)	148,871	5.4 (4.9, 5.8)	4.6 (4.2, 5.0)	3.1 (2.8, 3.4)	4.5 (4.3, 4.7)	0.265
High school	98,780	5.0 (4.5, 5.5)	3.9 (3.4, 4.4)	2.9 (2.5, 3.2)	4.0 (3.7, 4.3)	150,004	4.6 (4.3, 5.0)	3.7 (3.3, 4.0)	2.5 (2.2, 2.7)	3.7 (3.5, 3.9)	0.116
<High school	27,288	6.4 (5.2, 7.5)	5.0 (4.1, 5.9)	3.9 (3.0, 4.7)	5.1 (4.6, 5.7)	37,188	7.1 (6.1, 8.0)	5.3 (4.3, 6.2)	4.4 (3.5, 5.3)	5.7 (5.2, 6.3)	0.129
Household income <$20,000/ year	50,488	8.6 (7.7, 9.5)	7.3 (6.2, 8.3)	4.9 (4.1, 5.7)	7.0 (6.5, 7.5)	76,250	9.7 (8.8, 10.6)	7.1 (6.4, 7.8)	4.9 (4.3, 5.4)	7.4 (7.0, 7.9)	0.222
Saw a medical doctor in past year[b]	142,687	5.9 (5.4, 6.4)	4.5 (4.1, 5.0)	2.9 (2.6, 3.3)	4.6 (4.3, 4.9)	387,161	6.0 (5.8, 6.3)	4.7 (4.4, 4.9)	3.5 (3.3, 3.7)	4.9 (4.7, 5.0)	0.086
No doctor visits because of medical costs	40,714	7.3 (6.4, 8.1)	6.4 (5.2, 7.5)	4.2 (3.3, 5.1)	6.3 (5.7, 6.8)	68,285	6.7 (6.0, 7.3)	5.3 (4.7, 5.9)	4.1 (3.5, 4.8)	5.6 (5.3, 6.0)	0.064
Have health insurance	298,961	5.5 (5.2, 5.8)	4.4 (4.1, 4.7)	3.3 (3.1, 3.6)	4.5 (4.4, 4.7)	467,977	4.8 (4.6, 5.0)	4.0 (3.8, 4.2)	3.1 (2.9, 3.3)	4.1 (4.0, 4.2)	<0.001
Have a usual source of care	300,718	5.6 (5.3, 5.9)	4.5 (4.2, 4.8)	3.3 (3.0, 3.5)	4.6 (4.4, 4.8)	473,433	5.0 (4.8, 5.2)	4.1 (3.9, 4.3)	3.1 (3.0, 3.3)	4.2 (4.1, 4.3)	<0.001
Test location											
Private doctor/health maintenance organization/ clinic	43,464	19.7 (18.5, 20.9)	19.1 (17.7, 20.5)	19.6 (17.9, 21.3)	19.5 (18.7, 20.3)	72,791	16.3 (15.4, 17.1)	16.8 (15.8, 17.8)	16.6 (15.4, 17.8)	16.5 (15.9, 17.0)	<0.001
Hospital	18,860	21.9 (19.7, 24.0)	20.6 (18.7, 22.5)	19.8 (17.3, 22.2)	21.0 (19.7, 22.3)	29,781	17.2 (16.8, 18.5)	18.5 (17.0, 20.0)	17.2 (15.7, 18.7)	17.6 (16.7, 18.4)	<0.001
Other	13,430	17.6 (15.7, 19.5)	18.8 (15.9, 21.8)	16.5 (13.6, 19.5)	17.8 (16.3, 19.3)	22,969	16.2 (14.7, 17.6)	15.4 (13.7, 17.1)	12.8 (11.1, 14.4)	15.2 (14.3, 16.2)	0.003
Drinking	15,739	6.0 (4.6, 7.4)	4.4 (3.4, 5.5)	2.5 (1.4, 3.5)	4.6 (3.9, 5.4)	27,653	4.8 (4.0, 5.6)	3.3 (2.7, 4.0)	2.8 (2.2, 3.4)	3.9 (3.4, 4.3)	0.064
HIV risk behaviors[c] in past 12 months	3,205	18.5 (14.6, 22.4)	13.4 (9.2, 17.7)	8.4 (4.9, 12.0)	14.7 (12.3, 17.1)	5,207	18.0 (14.5, 21.4)	15.9 (12.4, 19.5)	10.4 (7.27, 13.5)	15.9 (13.8, 18.1)	0.477

[a]95% CIs excluded due to small sample size

[b]The number of doctor visits in the past year was not assessed in 2003 or 2004.

[c]HIV risk behaviors were not assessed in 2006 and 2007.

HIV = human immunodeficiency virus

BRFSS = Behavioral Risk Factor Surveillance System

CI = confidence interval

NH = non-Hispanic

Table 3. Multiple logistic regression examining annual changes in recent HIV testing from 2003 to 2010 among U.S. adults aged 50–64 years responding to the BRFSS (*n*=843,355)[a]

	Model 1[b] *Past-year HIV test*		*Model 2*[c] *Past-year HIV test*	
Variable	*AOR (95% CI)*	P-*value*	*AOR (95% CI)*	P-*value*
Change over time				
Linear annual trend	0.93 (0.88, 0.99)	0.021	0.84 (0.80, 0.88)	<0.001
Quadratic annual trend	1.00 (1.00, 1.01)	0.456	1.01 (1.01, 1.02)	<0.001
Age	0.96 (0.95, 0.96)	<0.001	0.95 (0.95, 0.96)	<0.001
Race/ethnicity				
Non-Hispanic white	Ref.		Ref.	
Non-Hispanic black	3.25 (3.03, 3.49)	<0.001	3.32 (3.12, 3.52)	<0.001
American Indian/Alaska Native	2.46 (1.95, 3.11)	<0.001	2.41 (1.95, 2.98)	<0.001
Hispanic/Latino	2.10 (1.87, 2.35)	<0.001	2.12 (1.92, 2.35)	<0.001
Sex	2.23 (2.11, 2.35)	<0.001	2.28 (2.18, 2.39)	<0.001
HIV risk behaviors[c]	2.68 (2.34, 3.08)	<0.001	NA[c]	NA[c]

[a]The complete case analysis excludes people (*n*=29,442) missing data on any of the variables in the model. Both models controlled for marital status, employment status, educational attainment, low-income status, insurance status, usual source of care, prohibitive medical costs, and heavy drinking.

[b]Includes all covariates, including HIV risk behaviors

[c]Excludes HIV risk behaviors, which BRFSS did not assess in 2006 and 2007

HIV = human immunodeficiency virus

BRFSS = Behavioral Risk Factor Surveillance System

AOR = adjusted odds ratio

CI = confidence interval

Ref. = reference group

NA = not available

work suggesting that older adults may receive their diagnoses only after they are already ill. A 2013 survey of hospitals, which found that only 6.6% of hospitals in high HIV prevalence communities routinely test all patients, supports the assertion that people tested in hospitals may already be patients.[30]

While past-year HIV testing decreased over time among members of most racial/ethnic groups, it increased among black people. Similar findings, although not specific to older adults, were reported based on the National Health and Nutrition Examination Survey (NHANES) and NHIS.[31] BRFSS differs from these national surveys because it is administered separately by each state; national findings are obtained by pooling data across states. Several studies have shown both that it is appropriate to pool data across states and that national estimates obtained using BRFSS data are generally comparable with those estimates obtained using NHANES or NHIS, although to our knowledge HIV testing has not specifically been compared.[32] Higher levels of testing among non-Hispanic black people may reflect the greater impact of the epidemic in this population. Various public health efforts[33–38] during the study period (including CDC's Expanded Testing Initiative,[39] which began in 2007) have targeted the disproportionate impact of HIV/AIDS among black people. If our finding reflects the success of these initiatives, then older adults from racial/ethnic minority communities may benefit from race-based initiatives even if the initiatives do not specifically focus on older adults.[39] Health coverage is generally low among non-Hispanic American Indians/Alaska Natives;[40] however, a modest, nonsignificant increase in testing occurred among the oldest non-Hispanic American Indians/Alaska Natives. The settings where they tested shifted over time, from private doctors' offices and hospitals to clinics and counseling/testing sites. Their small numbers in this sample, nearly significant findings, and the unique social conditions of this population underscore the need to further examine their HIV prevention needs.

Implications for research, practice, and policy

HIV testing levels were very low, but access to care was high and improved with age; thus, even modest improvements in implementing the recommendations may improve rates of HIV testing among older adults. Older adults are very receptive to prevention messages

from their providers;[4,41] therefore, routinizing HIV testing may facilitate earlier HIV detection among those seeking care.[42] Many older adults have access to care, and opportunities to screen them in diverse healthcare settings have expanded with implementation of the Affordable Care Act.[43] Reasons that providers may not universally screen older adults for HIV infection include limited awareness of the recommendations, age-related assumptions about older adults' sexual and drug use behaviors,[3,44] concerns about reimbursement, complacency regarding HIV/AIDS prevention, and time constraints. We recommend identifying provider-level barriers to screening, learning what motivates providers to screen older patients, and training them to integrate HIV/AIDS prevention into these patient visits.

Limitations and strengths

Self-reported HIV testing may overestimate actual testing.[45] Because the findings were based on a very large sample, statistically significant findings cannot be assumed to reflect large effect sizes. Based on these survey data, it is unclear whether the observed patterns stem from changes in patients' or providers' behaviors. A strength of this study was its use of methodologically rigorous BRFSS data; however, as with other nationwide health surveys, the measure of HIV risk behaviors was not optimal. It was not assessed in 2006 and 2007, and it did not distinguish between higher and lower sources of risk. Routine testing is provided regardless of reported risk, however; as such, the findings remain instructive. State-level variations may exist in how the BRFSS is administered; nevertheless, BRFSS estimates are generally valid and comparable with those of NHANES and NHIS.[32] BRFSS selected respondents via random digit dial of households with landline telephones, which excludes the growing share of U.S. households with cell phones only. Such households have higher rates of HIV testing,[28] but the residents are on average younger in age. Our focus on older adults partially circumvents this concern because landline telephone use remains high among older adults, although poor and minority older adults may rely on cell phones.[46,47]

CONCLUSION

Our findings suggest that CDC's routine HIV testing recommendations are only partially implemented among older adults. While their release corresponds with a reversal of the prior downward trend in HIV testing, the improvements have been neither universal nor sustained. Although HIV testing has increased over time among older black adults and those with a recent doctor visit, in general, it has decreased even among those with insurance and/or a usual source of care. Next steps include identifying and addressing implementation barriers to HIV screening among older adults.

Chandra Ford received support from a University of California Los Angeles (UCLA) Faculty Career Development Award and the Eunice Kennedy Shriver National Institute of Child Health and Human Development via the UCLA California Center for Population Research (#5R24HD041022). Tommi Gaines received support from the National Institute on Drug Abuse (#K01DA034523-01). Mesfin Mulatu participated in this endeavor in his personal capacity. The authors acknowledge Ron Andersen, William Cunningham, Martin Shapiro, and Mignon Moore for feedback on an early draft of the article; and Julia T. Caldwell for assistance in preparing manuscript tables and figures.

The findings and conclusions in this article are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention, the Agency for Toxic Substances and Disease Registry, the National Institute on Alcohol Abuse and Alcoholism, the Eunice Kennedy Shriver National Institute of Child Health and Human Development, or the U.S. government.

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