Delivery of Preventive Services to Adults Aged 50–64: Monitoring Performance Using a Composite Measure, 1997–2004

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OBJECTIVE: Population-based rates for the delivery of adult vaccinations or screenings are typically tracked as individual services. The current approach is useful in monitoring progress toward national health goals but does not yield information regarding how many U.S. adults receive a combination of preventive services routinely recommended based on a person's age and gender. A composite measure is important for policy-making, for developing public health interventions, and for monitoring the quality of clinical care. During the period under study, influenza vaccination was newly recommended (2000) to be routinely delivered to adults in this age range. The objective of the study was to compare the delivery of routine clinical preventive services to U.S. adults aged 50–64 years between 1997 and 2004 using a composite measure that includes cancer screenings and vaccinations.

DESIGN: Data were collected via telephone surveys in 1997, 2002, and 2004 as part of the Behavioral Risk Factor Surveillance System.

PARTICIPANTS: The participants were randomly selected adults aged 50–64 years in the 50 states and the District of Columbia in the selected years. Sample sizes ranged from 24,917 to 77,244.

MEASUREMENTS AND MAIN RESULTS: The composite measure includes screening for colorectal cancer, cervical cancer, breast cancer, and vaccination against influenza (2002 and 2004 only). The composite measure quantifies the percentage of adults who are up-to-date with the complete set according to recommended schedules. With the inclusion of newly recommended influenza vaccination, the percentage of men and women aged 50–64 who were up-to-date on all selected measures in 2004 was 23.4% and 23.0%, respectively, compared with 37.6% and 30.5% in 1997. Without including influenza vaccination, the percentage of up-to-date adults aged 50–64 would have risen in 2004 to 50.5% (men) and to 44.7% (women). For both sexes, results varied by education, race/ethnicity, marriage status, insurance status, health status, and state.

CONCLUSION: In 2004, the percentage of adults aged 50–64 years receiving routinely recommended cancer screenings and influenza vaccination was low with fewer than 1 in 4 being up to date.

KEY WORDS: clinical preventive services; cancer screening and prevention; vaccinations; surveillance; preventive health services; preventive medicine; elderly; behavioral risk factor surveillance system; medical system.

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INTRODUCTION

The provision of clinical preventive services to older adults is an important part of medicine and public health practice. In 1997, preventive services routinely recommended to adults aged 50–64 years included screening for colorectal cancer, screening for hypertension and hypercholesterolemia, and for women additionally included screening for breast and cervical cancers. In 2000, routine vaccination against influenza was recommended for the first time for adults in this age group.[1] Persons aged 50–64 comprise a significant group for whom these services are recommended, and more than 10% of persons in this age range do not have adequate health insurance coverage.[2]

National targets for delivering clinical preventive services were established in 1980 by the *Healthy People* initiative and have been regularly updated.[3] An extensive academic research effort continually evaluates the effectiveness of such measures, and the findings form the basis of recommendations by the U.S. Preventive Services Task Force (USPSTF).[4] Population-based rates for the delivery of specific vaccinations or screenings are typically tracked by the Behavioral Risk Factor Surveillance System (BRFSS). However, the current approach does not yield information regarding how many U.S. adults receive the full complement of routine preventive services.

In this report, we build on a cross-sectional study in which we developed a composite measure to assess the percentage of older men and women who were up to date with routine clinical preventive services in 2002.[5] To better understand changes in the levels of delivery, we now compare the percentage of men and women aged 50–64 years who were up to date with these measures in 1997, 2002, and 2004. Where BRFSS data are available, all routinely recommended clinical preventive services are included in the composite measure.

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MATERIALS AND METHODS

Data

We examined data from the 1997, 2002, and 2004 BRFSS surveys. The BRFSS, coordinated by the Centers for Disease Control and Prevention (CDC), conducts annual state-based telephone surveys of noninstitutionalized U.S. adults aged 18 or older concerning health practices that are related to the leading causes of death and disability. Detailed descriptions of the methodology, questionnaires, and other technical details for each state are available from the CDC BRFSS web site.[6] Median survey response rates for the 50 states and the District of Columbia, calculated as completed interviews divided by eligible respondents, were 71.7% (range 49.0% to 86.7%) in 1997,[7] 76.6% (62.5–99.8%) in 2002,[8] and 74.3% (59.5–91.8%) in 2004.[9]

We limited our analysis to data from respondents aged 50–64 years in the 50 states and the District of Columbia who participated in the BRFSS in the years selected (which excluded Hawaii in 2004). We did not use results from Illinois for 2002 because the state used a separate BRFSS protocol in that year. All results are based on weighted data that account for different probabilities of selection and are adjusted to reflect the population distribution in each state by age and sex or by age, race, and sex.

Measures

We analyzed responses to BRFSS questions on the use of routine clinical preventive services recommended by the USPSTF for adults aged 50–64 years (Table 1). Our analysis includes screening for colorectal cancer, mammography, and Papanicolaou (Pap) testing; after a change in the recommendations in 2000, we incorporated annual vaccination against influenza (2002 and 2004). Questions about the receipt of these services were asked in all states and territories in 1997, 2002, and 2004 (with the exceptions noted).

All measures were dichotomized as "yes" or "no" based on recollection of receiving the service within the recommended period. People who had never had the test or received it outside the designated schedule were included in the "no" group.

Because colorectal cancer screening recommendations involve receiving either endoscopy or fecal occult blood testing (FOBT), we did not exclude respondents with missing values for 1 test if they had the other test within the recommended interval. We used a 1-year interval for FOBT and a 10-year interval for either sigmoidoscopy or colonoscopy (screening for colorectal cancer) because the BRFSS question did not distinguish between the 2 interventions and a 10-year interval is the recommendation for colonoscopy.

For men, screening for colorectal cancer was the only recommended measure we included for 1997. In 2000, the USPSTF and other professional organizations recommended the delivery of an annual vaccination against influenza for the first time for adults aged 50 years and older. We therefore included this intervention in the 2002 and 2004 composite measures. For women, the up-to-date measure in 1997 included screening for 3 kinds of cancer (colorectal, breast, and cervical); vaccination against influenza was likewise added to the composite measure for 2002 and 2004.

The BRFSS measure for Pap testing is usually reported only for women with an intact cervix.[6] Approximately 35% of the women in this study reported they had a hysterectomy, and we wished to avoid excluding such a large proportion of the sample. To understand the implications of including women with hysterectomies in the analysis, we compared 2 different approaches in calculating the up-to-date measure. We calculated an up-to-date rate for all women in which we categorized women who had had a hysterectomy as having met the recommendations and compared this rate with the up-to-date rate for women who had not had a hysterectomy. All results in the tables use the first approach. When reporting the Pap test measure alone, we followed the BRFSS convention of reporting the measure only for women with an intact cervix.

Questions about screening for hypercholesterolemia during the past 5 years or hypertension screening were not asked in all states during 2002 and 2004 and were not included in the composite measures. Nonetheless, using 2004 data from the 6 states (Louisiana, Minnesota, Ohio, Oklahoma, Tennessee, and Virginia) that did ask cholesterol-screening questions, we calculated the up-to-date measure in those states to determine whether omitting cholesterol screening rates would likely have significantly changed the results of the analysis. The BRFSS has not asked questions about hypertension screening since 1999 at which time 95% of adults age 50–64 reported they had

Table 1. Clinical Preventive Services Recommended for Adults Aged 50–64 by the U.S. Preventive Services Task Force (USPSTF), 1997, 2002, and 2004[a]

Measure	Frequency	Groups for which services are recommended					
		Men age 50–64			Women age 50–64		
		1997	2002	2004	1997	2002	2004
Influenza vaccination	Received in past 12 months	X*	√	√	X	√	√
Mammogram	Received in past 2 years	N/A†	N/A	N/A	√	√	√
Pap test	Received in past 3 years	N/A	N/A	N/A	√	√	√
Colorectal cancer screening‡	Received FOBT in past 12 months or endoscopy in past 10 years	√	√	√	√	√	√
High blood pressure screening§	Received in past 2 years	√	√	√	√	√	√
Cholesterol screening§	Every 5 years	√	√	√	√	√	√

X indicates that the service was not included in recommendations for that group

†*N/A indicates that the service does not apply*

‡*Includes receiving FOBT or endoscopy (sigmoidoscopy or colonoscopy) within recommended time frames*

§*These services are recommended by the USPSTF, but data were not collected by all states in the BRFSS, 1997, 2002, and 2004 and were not analyzed as part of this study*

Table 2. Receipt of Individual Clinical Preventive Services and Measures of Being Up To Date, Men age 50–64, 1997, 2002, and 2004 BRFSS

	Men 50–64		
	1997	2002	2004
	Percent (95% CI)	Percent (95% CI)	Percent (95% CI)
Components			
Flu shot	30.4 (29.1–31.7)	34.9 (33.8–36.0)	37.3 (36.3–38.3)
FOBT	15.1 (14.1–16.1)	19.3 (18.4–20.2)	15.9 (15.2–16.6)
Proc/endoscopy	30.0 (28.7–31.4)	39.5 (39.3–40.7)	44.2 (43.2–45.3)
Any colon screening	37.6 (36.2–39.1)	48.1 (46.9–49.2)	50.5 (49.4–51.6)
Number of CPS recommended*	1	2	2
Up-to-date measures			
UTD†	37.6 (36.2–39.1)	21.4 (20.5–22.3)	23.4 (22.5–24.3)
% Recommended CPS received (score)‡	37.6 (36.2–39.1)	41.6 (40.7–42.4)	44.0 (43.1–44.8)
% with 0 CPS	63.4 (60.9–63.8)	38.3 (37.1–39.5)	35.4 (34.4–36.5)
N for up-to-date measures	10,587	22,959	31,217

*Number of Clinical Preventive Services recommended for that age and gender group and year. Up-to-date data did not include flu shot for 50–64 year olds in 1997 but did for 2002 and 2004

†Percent of persons who have received all the recommended CPS for their gender

‡The score is the mean of the number of services received divided by the number recommended, for each person, multiplied by 100

their blood pressure checked in the past 2 years.[10] Questions about the delivery of tetanus booster have never been part of the BRFSS survey and are not included in the composite measure (tetanus is rare in the United States with 0.16 cases per million population in 2000[11]). Delivery rates of pneumococcal vaccination and osteoporosis screening for women are not included in the measure because they are not recommended on a routine basis for adults in this age range. Because smoking cessation counseling is given only to smokers, it is not included either.

To calculate the up-to-date measure, each respondent was assigned a value of 1 for each test or immunization that the respondent had received within the recommended interval. Respondents who had unknown values for any of the separate services were dropped from the analysis (except for women with hysterectomies). The number of respondents with missing values for any of the component questions of the composite measure was 946 (3.7%) in 1997, 1,591 (2.8%) in 2002, and 2,377 (3.0%) for 2004; the final sample sizes were, respectively, 24,917, 55,366, and 77,244. Once the number of services was determined for each person, a variable was created for each gender based on whether a person had received the set of recommended services or not. This dichotomized measure is reported as the percentage up to date with routinely recommended preventive services.

A second composite measure of delivery, referred to as the "score," is presented in Tables 2 and 3. This is the percent of recommended measures received by men and by women: It is similar to a test score, where 100% represents being fully up to date. The score was calculated by dividing the number of preventive services received by the number of services recommended (from 1 to 4 depending on gender and year). A weighted mean of that value was determined for both men and women.

Table 3. Receipt of Individual Clinical Preventive Services and Measures of Being Up To Date, Women age 50–64, 1997, 2002, and 2004 BRFSS

	Women 50–64		
	1997	2002	2004
	Percent (95% CI)	Percent (95% CI)	Percent (95% CI)
Components			
Flu shot	35.6 (34.5–36.8)	38.7 (37.8–39.7)	41.7 (40.9–42.5)
Mammography	77.8 (76.8–78.9)	81.5 (80.7–82.3)	79.8 (79.0–80.5)
Pap (women w/ intact cervix)	84.6 (83.3–85.8)	87.5 (86.6–88.4)	86.7 (85.9–87.5)
FOBT	18.6 (17.6–19.6)	18.8 (18.1–19.5)	15.4 (14.9–16.0)
Proc/endoscopy	22.0 (21.0–23.1)	38.4 (37.4–39.3)	43.0 (42.1–43.8)
Any colon screening	33.6 (32.4–34.8)	47.8 (46.8–48.8)	49.9 (49.1–50.8)
Number of CPS recommended*	3	4	4
Up-to-date measures			
UTD†	30.5 (29.4–31.7)	21.1 (20.3–21.9)	23.0 (22.4–23.7)
% Recommended CPS received (score)‡	67.5 (66.8–68.2)	65.2 (64.7–65.7)	65.9 (65.4–66.3)
% with 0 CPS	7.2 (6.5–7.9)	4.7 (4.3–5.1)	4.8 (4.4–5.2)
N for up to date measures	14,330	32,407	46,027

*Number of Clinical Preventive Services recommended for that age and gender group and year. Up-to-date data did not include flu shot for 50–64 year olds in 1997 but did for 2002 and 2004

†Percent of persons who have received all the recommended CPS for their gender

‡The score is the mean of the number of services received divided by the number recommended, for each person, multiplied by 100

We divided respondents into 4 racial/ethnic categories: white (non-Hispanic), black (non-Hispanic), Hispanic of any race, and "Other races," which included American Indians, Asians, Pacific Islanders, and persons of other or multiple racial categories. Respondents were stratified into 4 education categories: less than high school, high school graduate or recipient of a general equivalency diploma, some college, and college graduate. Three health insurance categories were used in 1997 and 2004 (these categories were not available in 2002): uninsured, fully insured, and underinsured (this last group stated they were insured but also indicated they had needed to see a doctor within the previous 12 months and could not afford to). We also dichotomized respondents by the following criteria: whether they reported their health status as fair/poor or as good/very good/excellent; by whether they were married or not married; and for 2002 and 2004, by whether they reported having 1 or more regular doctors vs. none (not asked in 1997). We did not divide respondents by household income, as data on income for roughly 20% of respondents was missing.

Statistical Analysis

We used Stata Version 8.0 (Stata, College Station, TX, USA, 2003) in all statistical analyses to account for the complex sample design of the BRFSS, and we used Pearson chi-square tests to determine whether selected demographic factors were associated with being up to date on all recommended services. Multiple logistic regression analysis of this outcome measure was used to control for the following independent variables: age (as a continuous variable), education, race/ethnicity, marital status, insurance coverage, having a regular doctor, and health status, the same variables used in a similar analysis for adults age 65 and older.[12] We computed odds ratios and 95% confidence intervals for each variable in the model.

Table 4. Prevalence of Being Up-to-Date by Demographic Characteristics: 1997, 2002 and 2004 Behavioral Risk Factor Surveillance System, (BRFSS) 50 States Plus the District of Columbia (except as noted)*; Men Ages 50–64†

	Up-to-date		
	1997	2002	2004
	Percent (95% CI)	Percent (95% CI)	Percent (95% CI)
Race/ethnicity			
White	38.2 (36.7–39.7)	22.7 (21.8–23.7)	24.8 (23.9–25.8)
Black	38.9 (33.7–44.3)	18.6 (15.2–22.6)	17.9 (15.3–20.8)
Hispanic	32.6 (25.7–40.4)	13.3 (9.8–17.8)	14.1 (10.5–18.7)
Other‡	30.8 (22.4–40.6)	17.9 (13.8–22.9)	26.3 (20.9–32.5)
P value	.19	<.001	<.001
Education			
<High school	34.0 (30.0–38.3)	12.4 (10.1–15.0)	13.9 (11.2–17.1)
High school	33.9 (31.6–36.4)	18.8 (17.3–20.4)	19.4 (17.9–21.0)
Some college	36.5 (33.8–39.4)	22.0 (20.2–24.0)	23.0 (21.1–24.9)
College grad	44.0 (41.3–46.6)	25.4 (23.8–27.0)	28.4 (27.0–29.9)
P value	<.001	<.001	<.001
Insured			
Yes	39.4 (37.9–40.9)	23.3 (22.3–24.3)	25.2 (24.2–26.2)
No	23.1 (19.2–27.6)	7.9 (6.6–9.5)	10.0 (8.5–11.7)
P value	<.001	<.001	<.001
Insurance level			
Fully insured	39.9 (38.3–41.1)	N/A	25.7 (24.7–26.7)
Underinsured	30.7 (25.2–36.7)	N/A	19.0 (15.3–23.3)
Uninsured	23.1 (19.2–27.6)		10.0 (8.5–11.7)
P value	<.001		<.001
Have a MD			
No	N/A	8.0 (6.7–9.6)	7.4 (5.9–9.1)
Yes	N/A	24.0 (22.9–24.9)	26.0 (25.0–27.0)
P value		<.001	<.001
Married			
Yes	38.8 (37.1–40.5)	22.5 (21.4–23.6)	24.9 (23.8–26.0)
No	33.6 (31.0–36.4)	18.2 (16.7–19.8)	18.7 (17.4–20.2)
P value	.002	<.001	<.001
Health status			
Fair/poor	40.8 (37.4–44.4)	26.2(24.0–28.6)	25.7 (23.5–28.0)
Good–excellent	36.9 (35.4–38.5)	20.4 (19.4–21.4)	22.8 (21.8–23.8)
P value	.04	<.001	.02
Total for group	37.7 (36.2–39.1)	21.4 (20.5–22.3)	23.4 (22.5–24.3)
N	10,587	22,959	31,217

**In 2002, Illinois data are excluded because they used a split sample and not all women were asked the core Pap and mammography questions. In 2004, Hawaii data were not collected*

†Male respondents 50–64 years were considered to be up to date on preventive services for 1997 if they had either FOBT in the past year or endoscopy (proctoscopy or sigmoidoscopy) within the past 5 years. For 2002 and 2004, FOBT in the past year or endoscopy (colonoscopy or sigmoidoscopy) in the past 10 years plus a flu shot in the past year were required to be up to date

‡Other race includes American Indian, Asian, Pacific Islander, and persons of other or multiple race categories

RESULTS

The percentage of men who were up to date with routinely recommended clinical preventive services was 37.6 in 1997 and 23.4% in 2004. For women, the percentage up to date was 30.5% in 1997 compared to 23.0% in 2004 (Tables 2 and 3). The 2004 but not the 1997 levels incorporate the recommendation for influenza vaccination delivery. However, the mean percentage of recommended services received by men, the "score," increased between 1997 and 2004 from 37.6% to 44.0%; for women, this measure decreased from 67.5% to 65.9%. The largest proportion of the increase is accounted by improvements in the provision of colorectal cancer screening. For both men and women, the percentage who had not received any of the selected services decreased between 1997 and 2004, from 63.4% to 35.4% for men and from 7.2% to 4.8% for women. The delivery of individual clinical preventive services all increased between 1997 and 2002; significant improvements were not seen between 2002 and 2004.

In Tables 4 and 5, the prevalence of being up to date (1997, 2002, and 2004) is listed by demographic characteristic. Receipt of an influenza vaccination is included in the composite measure in 2002 and 2004. With the exception of the relatively small group of persons in the "Other race" group, the percentage up to date decreased significantly between 1997 and 2004 for every demographic subgroup examined for both men and women. Results of logistic regression are shown in Table 6 for 2004. Among men, being up to date was less frequent among blacks than whites and more frequent among men who were relatively older, better educated, married, insured, had a personal doctor, and were in fair or poor health. Results for women followed a similar pattern with the following exceptions: Hispanic women and those categorized by "Other races" were less likely to be up to date, as were the underin-

Table 5. Prevalence of Being Up-to-Date by Demographic Characteristics: 1997, 2002 and 2004 Behavioral Risk Factor Surveillance System, (BRFSS) 50 States Plus the District of Columbia (except as noted)*; Women Ages 50–64†

	Up-to-date		
	1997	2002	2004
	Percent (95% CI)	Percent (95% CI)	Percent (95% CI)
Race/ethnicity			
White	31.0 (29.8–32.3)	22.2 (21.4–23.0)	25.2 (24.5–25.9)
Black	31.7 (27.8–35.9)	16.5 (14.1–19.3)	19.3 (17.1–21.6)
Hispanic	26.2 (21.0–32.1)	17.9 (14.3–22.1)	11.8 (9.4–14.6)
Other‡	23.0 (15.5–32.6)	19.6 (14.9–25.3)	17.2 (13.6–21.4)
P value	.11	.007	<.001
Education			
<High school	23.6 (20.8–26.6)	15.5 (13.2–18.1)	15.0 (12.9–17.3)
High school	29.0 (27.2–30.9)	18.5 (17.4–19.8)	20.2 (19.1–21.3)
Some college	31.9 (29.6–34.4)	21.9 (20.5–23.4)	23.1 (21.9–24.4)
College grad	35.5 (33.0–38.2)	25.4 (23.9–27.1)	28.1 (26.8–29.5)
P value	<.001	<.001	<.001
Insured			
Yes	32.5 (31.2–33.8)	23.1 (22.3–24.0)	25.1 (24.4–25.9)
No	15.8 (13.1–18.9)	7.8 (6.4–9.5)	7.8 (6.6–9.1)
P value	<.001	<.001	<.001
Insurance level			
Fully insured	33.1 (31.8–34.4)	N/A	26.0 (25.2–26.8)
Underinsured	24.9 (20.9–29.4)	N/A	16.6 (14.7–18.8)
Uninsured	15.8 (13.1–18.9)		7.8 (6.6–9.1)
P value	<.001		<.001
Have a MD			
No	N/A	6.6 (5.0–8.5)	6.9 (5.7–8.3)
Yes	N/A	22.7 (21.9–23.6)	24.7 (24.0–25.5)
P value		<.001	<.001
Married			
Yes	32.8 (31.3–34.3)	22.4 (21.4–23.5)	24.9 (24.0–25.8)
No	25.6 (23.8–27.4)	18.5 (17.4–19.7)	19.6 (18.6–20.6)
P value	<.001	<.001	<.001
Health status			
Fair/poor	29.1 (26.5–31.9)	22.0 (20.3–23.8)	22.2 (20.7–23.8)
Good–excellent	30.8 (29.6–32.2)	20.9 (20.0–21.8)	23.3 (22.5–24.0)
P value	.26	.27	.23
Total for group	30.5 (29.4–31.7)	21.1 (20.3–21.9)	23.0 (22.4–23.7)
N	14,330	32,407	46,027

**In 2002, Illinois data are excluded because they used a split sample and not all women were asked the core Pap and mammography questions. In 2004, Hawaii data were not collected*

†Women 50–64 years were considered to be up-to-date on preventive services for 1997 if they met screening recommendations for breast cancer (mammogram within 2 years), cervical cancer (Pap test in the past 3 years, unless the respondent had a hysterectomy and a Pap test was not needed), and colorectal cancer screening, as defined for men 50–64 for 1997. For 2002 and 2004, a flu shot in the past year was required in addition to Pap, mammography, and colon cancer screening as defined for men ages 50–64

‡Other race includes American Indian, Asian, Pacific Islander, and persons of other or multiple race categories.

Table 6. Results of Multiple Logistic Regression Modeling* for Being Up-to-Date†,‡ for Cancer Screening and Adult Immunization by Age/Sex Group and Demographic Characteristics: 2004 Behavioral Risk Factor Surveillance System, (BRFSS), Adults Aged 50–64

	Men age 50–64 years		Women age 50–64 years	
	Adj. OR (95% CI)	*P* value	Adj. OR (95% CI)	*P* value
Race/ethnicity				
White	1.00		1.00	
Black	0.80 (0.64–0.99)	.04	0.89 (0.76–1.04)	.13
Hispanic	0.74 (0.52–1.06)	.101	0.60 (0.47–0.78)	<.001
Other races§	1.20 (0.87–1.65)	.27	0.67 (0.51–0.87)	.004
Age (continuous)	1.10 (1.08–1.11)	<.001	1.10 (1.09–1.11)	<.001
Education				
<High school	1.00		1.00	
High school	1.42 (1.08–1.86)	.01	1.12 (0.93–1.35)	.24
Some college	1.86 (1.41–2.45)	<.001	1.40 (1.16–1.69)	.001
College grad	2.36 (1.81–3.09)	<.001	1.81 (1.50–2.19)	<.001
Married				
No	1.00		1.00	
Yes	1.17 (1.03–1.31)	.01	1.25 (1.15–1.36)	<.001
Insured				
Not insured	1.00		1.00	
Underinsured	1.62 (1.16–2.28)	.005	1.90 (1.50–2.40)	<.001
Fully insured	1.93 (1.57–2.37)	<.001	2.92 (2.44–3.49)	<.001
Have personal doctor				
No	1.00		1.00	
Yes	3.12 (2.42–4.01)	<.001	2.88 (2.32–3.57)	<.001
Health status				
Good/very good	1.00		1.00	
Fair/poor	1.56 (1.35–1.80)	<.001	1.26 (1.13–1.41)	<.001
N	30,631		45,311	

95% confidence intervals

**N*=75,942, 49 *states plus the District of Columbia (Hawaii data not collected). Excludes 1,302 values that have missing values for 1 or more measures*

†*Men 50–64 years and older were considered to be up to date on preventive services if they had met colorectal cancer screening recommendations (either FOBT in the past year or endoscopy [sigmoidoscopy or colonoscopy] within the past 10 years) and had an influenza vaccination in the past year*

‡*Women 50–64 years and older were considered to be up to date on preventive services if they met screening recommendations for breast cancer (mammogram within 2 years), cervical cancer (Pap test in the past 3 years, unless the respondent had a hysterectomy and a Pap test was not needed), and colorectal cancer screening and had an influenza vaccination in the past year*

§*Other race includes American Indian, Asian, Pacific Islander, and persons of other or multiple race categories*

sured (versus the fully insured). State-by-state results showed wide variation in up-to-date rates (Online Appendix Tables 1 and 2) ranging from a low of 11.8% for Nevada women in 2002 to a high of 50.2% for New Hampshire men in 1997 before influenza vaccination was included in the measure. In 2004, the up-to-date rates were below 20% in 9 states for men and in 7 states for women, and the highest rates were 32.3% for men (in Rhode Island) and 38.4% for women (in Minnesota).

To assess the effect of including women who had had a hysterectomy and "crediting" them with a completed Pap test, for 2004, we compared the up-to-date rate using this approach with an up-to-date rate in which women with a hysterectomy were excluded from the analysis. We found that limiting the composite measure to women with an intact cervix yielded an even lower up-to-date rate of 20.0% versus 23.0% if women with a hysterectomy are assumed to not need a Pap.

For the 6 states that addressed cholesterol screening in 2004, the self-reported data indicated that 87.2% of men and 90.1% of women aged 50–64 had been screened for high cholesterol in the past 5 years (data not shown). With the inclusion of these cholesterol-screening rates in the composite measure, there was little difference in the results: 25.2% of men in the 6 states were up to date on all services versus 25.8% in the 6 states when cholesterol screening was excluded. The corresponding figures for women were 27.3% versus 27.9%.

To assess and exclude the potential effect of the 2004 influenza vaccination shortage on the up-to-date rate, results were also calculated for the first 10 months of 2004 before the shortage occurred. That 10-month rate was modestly higher than the full year rate reported in these results (26.2% for men and 25.5% for women).

DISCUSSION

The key finding of this analysis is that a composite measure of the receipt of routinely recommended clinical preventive services to adults aged 50–64 decreased between 1997 and 2004 to a strikingly low level. With the inclusion of the recommendation for influenza vaccination after 2000, the percentage of persons up to date fell from 37.6% to 23.4% for men and from 30.5% to 23.0% for women. If there had been no new recommendation for influenza vaccination in 2000, the percentage of up-to-date adults aged 50–64 would have risen from 37.6% to 50.5% among men and from 30.5% to 44.7% among women.

We found significant disparities in the composite rates by race and ethnic group, level of education, and insurance status. The results in 1997 and 2004 are consistent with our 2002 finding of differences in the up-to-date levels for specific demographic groupings and are consistent with studies of the delivery of individual clinical preventive services.[13–15] The logistic regression modeling is also consistent with these findings. An up-to-date rate of less than 11% for the 12.1% of

uninsured Americans in the 50–64 age range indicates there is a very large population of adults who have not received all of these screenings and vaccinations—approximately 5 million in 2004 (Unpublished results from 2004 BRFSS data).

Our results for 2004 among the 6 states that included cholesterol testing on the BRFSS suggest that the impact on the composite measure of adding this measure would have been minor. A similar result could be expected if blood pressure screening was added to the composite measure because that rate is apparently very high among this age group.[10]

We believe that the use of a composite measure is advantageous because it highlights the fact that the same individual should receive multiple interventions. Furthermore, the composite measure obliges medical and public health practitioners to consider how to improve clinical preventive service delivery in several disease categories. In addition, because the measure only includes services recommended on demographic criteria (age and gender) rather than on clinical conditions, it covers a set of interventions that can be promoted inside and outside the clinical setting.[16] New knowledge and advancing technologies ensure continuing evolution of criteria and the inclusion of new measures necessary for being up to date with preventive services. Such definitional changes are not unique to the period under study, nor are they unusual for other composite measures including those for coverage of children's immunizations.[17]

Earlier research has identified several factors that impede the delivery of preventive services.[18,19] Progress has been tied to the characteristics of the specific preventive service, including the strength of the evidence for its cost effectiveness and to levels of insurance reimbursement. Efforts to increase the percentage of Americans who are up to date on multiple preventive services face particular challenges because the provision of cancer screenings and vaccinations usually involve several health care specialists, often working in different parts of the medical care system.

Our findings are limited in several ways. Because the BRFSS relies on self-reports from its participants, our results are subject to various biases, including "telescoping,"[20] the tendency of people to remember events as having occurred more recently than they actually did.[21] Moreover, because BRFSS surveys exclude people in households without telephones (who are more likely to be poor and thus also less likely to receive preventive services), our estimates may be slightly higher than the true rates.[22] An additional limitation is that variations in sample sizes, sampling methods, and the wording or inclusion of some questions over the 3 specific years and different states selected for analysis limited our ability to compare results from year to year. Furthermore, because of the wording change from "sigmoidoscopy/proctoscopy" in 1997 to "sigmoidoscopy/colonoscopy" beginning in 1999, comparisons of the percentage of older Americans who were up to date on endoscopic procedures in 1997 with percentages from 2002 or 2004 must be interpreted with caution. Some tests reported as sigmoidoscopy/proctoscopy in 1997 probably were colonoscopies because respondents may not have understood differences between the tests.[23] The influenza vaccine shortage in the fall of 2004 did appear to affect these results, as indicated by slightly lower up-to-date rates in November and December of that year.

In conclusion, this study reports changes between 1997 and 2004 in a composite measure for routine clinical preventive services for adults aged 50 to 64. More than 75% of Americans in this age range are without the full protection that would be conferred by these services. We believe that the composite measure provides a way not only to assess needed progress in achieving population-wide prevention but also to monitor and improve the effectiveness of the nation's health care system in providing such services.

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