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Disparities in State-Specific Adult Fruit and Vegetable Consumption — United States, 2015

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The *2015–2020 Dietary Guidelines for Americans* recommend that Americans consume more fruits and vegetables as part of an overall dietary pattern to reduce the risk for diet-related chronic diseases such as cardiovascular disease, type 2 diabetes, some cancers, and obesity (*1*). Adults should consume 1.5–2.0 cup equivalents of fruits and 2.0–3.0 cups of vegetables per day.* Overall, few adults in each state met intake recommendations according to 2013 Behavioral Risk Factor Surveillance System (BRFSS) data; however, sociodemographic characteristics known to be associated with fruit and vegetable consumption were not examined (*2*). CDC used data from the 2015 BRFSS to update the 2013 report and to estimate the percentage of each state's population meeting intake recommendations by age, sex, race/ethnicity, and income-to-poverty ratio (IPR) for the 50 states and District of Columbia (DC). Overall, 12.2% of adults met fruit recommendations ranging from 7.3% in West Virginia to 15.5% in DC, and 9.3% met vegetable recommendations, ranging from 5.8% in West Virginia to 12.0% in Alaska. Intake was low across all socioeconomic groups. Overall, the prevalence of meeting the fruit intake recommendation was highest among women (15.1%), adults aged 31–50 years (13.8%), and Hispanics (15.7%); the prevalence of meeting the vegetable intake recommendation was highest among women (10.9%), adults aged ≥51 years (10.9%), and persons in the highest income group (11.4%). Evidence-based strategies that address barriers to fruit and vegetable consumption such as cost or limited availability could improve consumption and help prevent diet-related chronic disease.

BRFSS conducts an annual, state-based, random-digit–dialed landline and cellular telephone household survey of noninstitutionalized, civilian U.S. adults aged ≥18 years to collect data on health and health risk behaviors related to chronic disease. BRFSS uses a complex multistage cluster sampling design and weights by iterative proportional fitting to adjust for nonresponse, noncoverage, and selection bias (*3*). In 2015, BRFSS asked six questions to assess how many times per day, week, or month the participants consumed 1) 100% fruit juice, 2) whole fruit, 3) dried beans, 4) dark green vegetables, 5) orange vegetables, and 6) other vegetables, during the previous month. Daily frequency of intake was calculated by dividing reported intake by 7 for intake reported by week, and by 30 for intake reported by month. To estimate the percentage of each state's population meeting fruit and vegetable intake recommendations by demographic characteristics, previously developed scoring algorithms derived from the National Health and Nutrition Examination Survey (NHANES) were used to predict whether a respondent met fruit and vegetable recommendations for their age and sex based on the number of times per day they reported consuming fruits and vegetables

* Appropriate for adults who engage in <30 minutes of moderate physical activity; more active adults might be able to consume more while staying within calorie needs. https://www.choosemyplate.gov/fruit; https://www.choosemyplate.gov/vegetables.

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separately, accounting for race/ethnicity and IPR (poverty defined according to federal poverty guidelines[†]), updated with 2015 Poverty Guidelines for the 48 contiguous states and DC. IPR was calculated following the previous study methods (*4*) using the midpoint of reported household income for persons who reported their household income; household size was assumed to equal one for participants who did not report the number of persons residing in the household. Individual predicted probabilities of meeting recommendations were averaged to obtain sociodemographic-specific estimates. Intake recommendations were based on the *2015–2020 Dietary Guidelines for Americans* (*1*) and used the age- and sex-specific recommendations for adults who engage in <30 minutes of moderate physical activity daily. BRFSS respondents' race/ethnicity (Hispanic, non-Hispanic black [black], non-Hispanic white [white], and all others) and IPR (<1.25, 1.25%–3.49%, and >3.49) were defined consistent with definitions in previous analyses (*5*). Estimates for the racial/ethnic group "other" are not presented because of the small sample sizes and difficulties in providing meaningful interpretation, but are included in overall estimates and those by age, sex, and IPR. Among 441,456 respondents, 122,041 (28%) were excluded, including 5,074 who did not reside in the 50 states or DC (because the scoring algorithm is derived from NHANES, which excluded territories), 58,949 who did not answer all six questions on fruit and vegetable intake, 127 who had implausible values of reported intake of fruit more than 16 times per day or vegetables more than 23 times per day (*4*), and 55,891 who had missing values for income, resulting in a final analytic sample of 319,415. The median response rate for 2015 BRFSS[§] was 47.2% for the 50 states and DC (range = 33.9%–61.1%). T-tests were used to compare differences by demographic groups. Statistical analyses were performed to account for the complex survey design and nonresponse. Balanced repeated replication technique, replicate weights, and Taylor linearization were used to calculate standard errors and confidence intervals, consistent with the previous study (*2*).

In 2015, the median frequency of reported intake among all respondents was one time per day for fruit and 1.7 times per day for vegetables (Table 1). Among all respondents, 12.2% met fruit intake recommendations, ranging from 7.3% in West Virginia to 15.5% in DC, and 9.3% met vegetable intake recommendations, ranging from 5.8% in West Virginia to 12.0% in Alaska (Table 1). Overall in 2015, the percentage of adults meeting fruit and vegetable recommendations varied by selected characteristics (Table 2) (Table 3). A higher proportion of women met both fruit and vegetable recommendations (15.1% and 10.9%, respectively) than did men (9.2% and 7.6%, respectively), and a higher proportion of women met recommendations in most states. By age group, young adults aged 18–30 years accounted for the lowest proportion of persons meeting recommendations for fruit and vegetable

[†] https://aspe.hhs.gov/2015-poverty-guidelines.

[§] https://www.cdc.gov/brfss/annual_data/2015/2015_responserates.html.

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TABLE 1. Median frequencies and percentages of adults meeting federal fruit and vegetable intake recommendations per day, by state — Behavioral Risk Factor Surveillance System, United States and District of Columbia, 2015

Jurisdiction	Sample size	Median daily intake frequency		% of respondents (95% CI) meeting recommendations	
		Fruit	Vegetable	Fruit intake	Vegetable intake
Overall	**319,415**	**1.0**	**1.7**	**12.2 (11.2-13.3)**	**9.3 (6.1-12.5)**
Alabama	5,630	1.0	1.5	8.8 (7.3-10.2)	6.1 (2.8–9.4)
Alaska	2,944	1.0	1.8	12.9 (10.5-15.2)	12.0 (6.6-17.4)
Arizona	5,490	1.0	1.7	13.2 (11.4-15.1)	10.5 (6.0-14.9)
Arkansas	3,631	0.9	1.5	9.5 (7.5-11.5)	7.8 (3.7-12.0)
California	9,443	1.1	1.8	13.6 (12.0-15.2)	11.2 (7.0-15.4)
Colorado	9,530	1.1	1.8	13.5 (11.7-15.3)	11.6 (7.6-15.6)
Connecticut	8,491	1.1	1.7	13.5 (11.8-15.1)	10.4 (6.8-13.9)
Delaware	2,859	1.0	1.7	12.5 (10.4-14.5)	8.6 (5.0-12.1)
District of Columbia	2,814	1.0	1.9	15.5 (12.5-18.6)	9.7 (4.7-14.8)
Florida	7,152	1.0	1.7	14.0 (12.2-15.8)	10.3 (6.7-13.8)
Georgia	3,342	1.0	1.6	12.0 (10.1-13.9)	8.5 (4.7-12.4)
Hawaii	5,900	1.0	1.7	12.4 (10.6-14.1)	11.5 (7.4-15.6)
Idaho	4,616	1.0	1.8	11.8 (9.9-13.6)	10.8 (6.9-14.6)
Illinois	4,585	1.0	1.6	14.0 (12.1-15.9)	9.7 (5.7-13.7)
Indiana	4,596	1.0	1.5	11.5 (9.6-13.4)	8.6 (4.5-12.6)
Iowa	4,706	1.0	1.5	10.7 (9.0-12.4)	7.0 (3.5-10.6)
Kansas	16,780	1.0	1.6	10.0 (8.8-11.2)	8.1 (4.8-11.5)
Kentucky	5,074	1.0	1.5	8.0 (6.6–9.5)	6.3 (2.4-10.2)
Louisiana	3,293	0.9	1.4	11.2 (9.3-13.0)	8.3 (4.6-12.1)
Maine	7,447	1.1	1.7	14.1 (12.2-16.0)	10.7 (7.3-14.1)
Maryland	8,800	1.1	1.7	14.0 (11.9-16.0)	9.0 (5.3-12.7)
Massachusetts	6,198	1.1	1.7	14.0 (12.2-15.7)	11.1 (7.3-14.8)
Michigan	6,835	1.0	1.6	11.9 (10.3-13.5)	7.7 (4.3-11.1)
Minnesota	12,789	1.0	1.6	11.6 (10.2-13.1)	8.1 (4.8-11.4)
Mississippi	4,416	0.9	1.4	8.7 (7.1-10.4)	6.2 (2.7–9.7)
Missouri	5,326	1.0	1.6	10.8 (9.1-12.4)	7.7 (3.9-11.5)
Montana	4,528	1.0	1.7	10.7 (8.8-12.5)	8.3 (4.5-12.1)
Nebraska	13,771	1.0	1.6	11.4 (9.9-12.9)	7.9 (4.2-11.6)
Nevada	2,133	1.0	1.8	13.1 (10.5-15.6)	11.5 (7.0-16.0)
New Hampshire	5,005	1.1	1.8	14.3 (12.2-16.4)	10.8 (7.2-14.4)
New Jersey	8,207	1.0	1.6	12.1 (10.5-13.8)	8.3 (4.7-11.8)
New Mexico	5,166	1.0	1.7	12.3 (10.5-14.0)	10.3 (6.1-14.6)
New York	9,145	1.0	1.7	14.0 (12.4-15.6)	9.6 (5.9-13.2)
North Carolina	4,737	1.0	1.7	10.4 (8.9-12.0)	8.1 (4.6-11.6)
North Dakota	3,911	1.0	1.5	11.9 (10.0-13.7)	7.9 (3.7-12.0)
Ohio	8,495	1.0	1.6	10.6 (9.0-12.2)	6.9 (3.3-10.5)
Oklahoma	5,177	1.0	1.6	8.0 (6.6–9.5)	6.1 (2.6–9.6)
Oregon	3,848	1.0	1.9	13.4 (11.4-15.4)	11.9 (8.0-15.8)
Pennsylvania	4,287	1.0	1.6	11.7 (9.9-13.5)	8.4 (4.6-12.1)
Rhode Island	4,249	1.0	1.6	13.7 (11.7-15.7)	9.7 (6.0-13.5)
South Carolina	8,485	1.0	1.6	10.1 (8.7-11.6)	8.1 (4.8-11.5)
South Dakota	5,511	1.0	1.5	8.8 (7.2-10.5)	5.9 (2.6–9.3)
Tennessee	4,115	1.0	1.6	11.1 (9.2-13.1)	9.6 (5.6-13.6)
Texas	10,433	1.0	1.7	12.1 (10.4-13.8)	10.9 (6.6-15.1)
Utah	8,737	1.0	1.7	12.5 (10.9-14.1)	9.4 (5.1-13.7)
Vermont	4,877	1.1	1.8	12.7 (10.9-14.5)	11.1 (7.5-14.6)
Virginia	6,593	1.0	1.6	10.9 (9.3-12.5)	7.6 (3.9-11.4)
Washington	12,247	1.0	1.8	12.6 (11.1-14.2)	10.9 (7.1-14.8)
West Virginia	4,200	1.0	1.5	7.3 (6.0–8.7)	5.8 (2.7–8.9)
Wisconsin	4,894	1.0	1.6	11.7 (10.0-13.5)	7.8 (4.0-11.5)
Wyoming	3,977	1.0	1.7	12.1 (9.9-14.2)	9.1 (4.8-13.5)

Abbreviation: CI = confidence interval.

intake (9.2% and 6.7%, respectively); this proportion was significantly different from the referent group of adults aged ≥51 years, 12.4% and 10.9% of whom met intake recommendations for fruit and vegetables, respectively. Findings varied by state; in 41 states, a significantly lower percentage of young adults met recommendations for vegetable intake than did older adults, whereas this pattern was only observed for fruit intake in 18 states. A significantly higher proportion of Hispanics and blacks met recommendations for fruit intake than did whites; however, these differences were only significant in 10 states (Table 2). There were no significant differences in meeting recommendations for vegetable intake

TABLE 2. State-specific percentages of respondents meeting federal fruit intake recommendations* by sex, age, race/ethnicity, and income-to-poverty ratio (IPR) — Behavioral Risk Factor Surveillance System, United States, 2015

	Sex		Age group (yrs)			Race/Ethnicity†			IPR		
	Male	Female (Ref)	18–30	31–50	≥51 (Ref)	Black	Hispanic	White (Ref)	<1.25	1.25–3.49	>3.49 (Ref)
Jurisdiction	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
National	**9.2 (5.8-12.7)**	**15.1¶ (11.8-18.7)**	**9.2¶ (7.1-11.4)**	**13.8 (11.9-15.9)**	**12.4 (11.0-13.8)**	**14.3¶ (12.5-16.2)**	**15.7¶ (13.5-17.8)**	**11.2 (10.1-12.3)**	**11.9 (10.6-13.6)**	**11.3 (9.9-12.8)**	**13.0 (11.6-14.3)**
Alabama	7.5 (4.0-11.0)	10.0 (6.4-13.5)	8.4 (4.8-12.1)	9.6 (6.9-12.3)	8.3 (6.6-10.0)	11.6¶ (8.6-14.6)	11.1 (4.6-17.5)	7.6 (6.1–9.1)	9.1 (6.4-11.9)	7.7 (5.7–9.7)	9.5 (7.5-11.4)
Alaska	10.0 (4.4-15.7)	16.1¶ (10.4-21.8)	9.5 (4.1-14.9)	15.4 (11.0-19.9)	12.8 (9.9-15.7)	—§	14.6 (6.5-22.6)	12.9 (10.2-15.5)	11.1 (6.1-16.1)	11.3 (8.0-14.6)	14.4 (11.1-17.7)
Arizona	10.4 (5.7-15.0)	16.2¶ (11.5-20.8)	10.4 (5.9-15.0)	15.9 (12.4-19.4)	12.5 (10.4-14.7)	19.2 (9.3-29.1)	15.9¶ (11.9-19.8)	12.1 (10.1-14.0)	13.6 (10.1-17.1)	11.0¶ (8.4-13.6)	15.0 (12.4-17.6)
Arkansas	7.3 (2.9-11.7)	11.7¶ (7.3-16.1)	9.6 (3.7-15.6)	10.4 (6.9-13.8)	8.7 (6.8-10.7)	11.5 (5.4-17.5)	16.4 (7.7-25.1)	8.6 (6.6-10.6)	10.0 (6.5-13.5)	9.1 (6.1-12.0)	9.6 (6.8-12.4)
California	10.4 (6.0-14.8)	16.8¶ (12.4-21.2)	9.3¶ (6.2-12.5)	16.0 (13.1-18.9)	13.8 (11.5-16.0)	14.1 (9.6-18.5)	15.9 (13.1-18.7)	12.4 (10.6-14.1)	13.9 (11.2-16.6)	13.0 (10.5-15.5)	13.8 (11.8-15.8)
Colorado	10.2 (6.0-14.4)	17.0¶ (12.8-21.1)	9.4 (5.4-13.4)	16.3 (12.7-19.8)	13.2 (10.9-15.2)	18.7 (10.2-27.1)	16.5 (12.4-20.6)	12.5 (10.6-14.4)	12.2 (8.9-15.5)	12.3 (9.6-15.1)	14.6 (12.3-17.0)
Connecticut	9.7 (5.9-13.4)	17.2¶ (13.4-20.9)	8.6¶ (4.7-12.5)	14.9 (11.8-18.1)	14.4 (12.3-16.5)	16.1 (11.8-20.4)	14.7 (10.6-18.8)	13.1 (11.3-14.9)	11.7 (8.9-14.4)	13.0 (10.4-15.5)	14.2 (12.1-16.3)
Delaware	8.9 (5.2-12.7)	15.9¶ (12.1-19.6)	7.3¶ (2.9-11.7)	14.3 (10.3-18.3)	13.0 (10.5-15.6)	16.9 (12.0-21.8)	14.4 (8.0-20.7)	11.1 (8.9-13.3)	9.8 (6.4-13.3)	11.0 (8.1-14.0)	14.1 (11.3-17.0)
District of Columbia	13.4 (8.1-18.8)	17.5 (12.2-22.8)	9.1 (2.8-15.5)	21.2¶ (15.4-26.9)	13.8 (11.0-16.5)	15.9 (11.4-20.4)	25.9 (13.1-38.7)	13.5 (9.7-17.3)	19.4 (12.3-26.5)	14.7 (8.3-21.2)	14.8 (11.2-18.3)
Florida	11.2 (7.4-14.9)	16.8¶ (13.0-20.5)	13.9 (8.6-19.2)	15.9 (12.6-19.2)	12.9 (10.9-14.8)	16.9 (12.4-21.4)	16.6 (12.5-20.7)	12.2 (10.3-14.1)	13.2 (10.2-16.1)	13.6 (10.7-16.5)	14.7 (12.4-17.1)
Georgia	8.9 (4.8-12.9)	14.8¶ (10.7-18.9)	9.1 (4.7-13.5)	14.4 (10.7-18.2)	11.2 (9.0-13.4)	12.5 (9.3-15.7)	18.1 (9.8-26.3)	10.8 (8.7-13.0)	11.2 (7.6-14.8)	11.8 (8.8-14.8)	12.5 (10.0-15.1)
Hawaii	9.8 (5.5-14.1)	14.9¶ (10.7-19.2)	9.9 (5.4-14.4)	12.5 (9.4-15.7)	13.3 (11.2-15.5)	—§	15.4 (10.2-20.5)	14.8 (11.8-17.8)	12.7 (9.4-16.1)	11.7 (9.0-14.5)	12.6 (10.4-14.8)
Idaho	8.4 (4.4-12.4)	15.1¶ (11.1-19.1)	8.3 (4.3-12.3)	13.2 (9.5-16.9)	12.1 (9.9-14.3)	—§	12.9 (7.8-18.0)	11.7 (9.7-13.6)	11.3 (7.7-15.0)	10.9 (8.3-13.5)	12.8 (10.4-15.2)
Illinois	11.1 (6.8-15.3)	16.9¶ (12.6-21.1)	10.7 (6.4-15.0)	15.8 (12.1-19.5)	14.4 (12.1-16.7)	14.7 (10.2-19.2)	19.8¶ (14.2-25.3)	12.8 (10.8-14.7)	13.3 (9.6-17.0)	13.1 (10.3-16.0)	14.9 (12.4-17.3)
Indiana	8.8 (4.5-13.1)	14.1¶ (9.8-18.4)	9.9 (5.2-14.7)	13.2 (9.4-17.0)	11.0 (8.9-13.1)	13.3 (7.6-19.0)	18.2 (9.5-26.9)	10.9 (8.9-12.9)	12.0 (7.6-16.4)	9.8 (7.3-12.3)	12.7 (10.0-15.4)
Iowa	7.0 (3.3-10.8)	14.3¶ (10.6-18.1)	7.3¶ (3.2-11.3)	11.1 (7.8-14.4)	11.9 (9.8-14.0)	7.9 (2.6-13.2)	15.6 (6.9-24.4)	10.4 (8.7-12.1)	9.4 (6.2-12.6)	10.0 (7.4-12.7)	11.4 (9.3-13.6)
Kansas	6.7 (3.1-10.3)	13.2¶ (9.6-16.8)	6.4¶ (4.1–8.8)	11.1 (8.7-13.4)	10.8 (9.2-12.4)	12.0 (8.2-15.7)	12.6 (9.5-15.6)	9.6 (8.3-10.9)	8.7 (6.7-10.7)	9.2 (7.5-10.9)	11.0 (9.5-12.6)
Kentucky	5.7 (1.5–9.9)	10.5¶ (6.4-14.7)	5.5 (2.3–8.7)	8.2 (5.5-10.8)	9.2 (7.1-11.3)	8.5 (4.7-12.4)	5.5 (1.7–9.3)	8.1 (6.5–9.7)	6.9 (4.7–9.1)	7.2 (4.8–9.5)	9.3 (7.3-11.4)
Louisiana	9.9 (5.9-13.9)	12.4¶ (8.4-16.4)	8.7 (4.7-12.7)	13.6 (9.9-17.3)	10.4 (8.2-12.5)	13.7 (10.3-17.1)	14.5 (6.1-23.0)	10.0 (7.8-12.1)	11.4 (8.0-14.7)	10.7 (7.8-13.6)	11.5 (8.8-14.1)
Maine	9.7 (6.1-13.2)	18.4¶ (14.8-22.0)	11.5 (6.6-16.4)	14.7 (10.7-18.7)	14.7 (12.5-16.9)	—§	20.0 (7.6-32.3)	14.1 (12.2-16.1)	10.7¶ (7.6-13.7)	13.9 (11.0-16.8)	15.5 (13.1-18.0)
Maryland	10.9 (6.9-14.8)	16.8¶ (12.8-20.7)	10.6 (5.5-15.6)	15.2 (11.4-19.1)	14.5 (12.0-17.0)	18.0¶ (13.7-22.2)	13.6 (7.1-20.1)	12.2 (10.2-14.3)	14.4 (9.4-19.4)	13.8 (10.3-17.3)	14.0 (11.6-16.4)
Massachusetts	10.3 (6.4-14.3)	17.4¶ (13.4-21.3)	8.8¶ (5.4-12.1)	15.8 (12.4-19.2)	14.9 (12.6-17.3)	18.3 (12.3-24.3)	17.8 (12.9-22.6)	13.5 (11.6-15.4)	12.5 (9.3-15.6)	13.3 (10.5-16.1)	14.6 (12.4-16.8)
Michigan	8.3 (4.6-11.9)	15.5¶ (11.9-19.2)	9.0¶ (5.3-12.6)	12.8 (9.7-15.9)	12.5 (10.4-14.5)	14.8 (11.0-18.6)	16.1 (10.1-22.1)	11.4 (9.7-13.1)	11.7 (8.6-14.9)	10.4 (8.2-12.6)	13.1 (11.0-15.2)
Minnesota	7.7 (4.2-11.2)	15.6¶ (12.1-19.1)	7.8¶ (4.9-10.7)	12.4 (9.6-15.1)	12.8 (10.9-14.7)	13.1 (8.8-17.4)	14.7 (9.6-19.8)	11.6 (10.1-13.1)	9.5¶ (7.0-12.1)	10.1¶ (8.1-12.0)	13.0 (11.2-14.8)
Mississippi	7.1 (3.3-10.8)	10.3 (6.5-14.1)	9.5 (5.3-13.7)	9.5 (6.7-12.4)	7.7 (5.9–9.4)	10.0 (7.2-12.8)	—	7.8 (6.1–9.6)	8.5 (5.9-11.1)	7.8 (5.5-10.2)	10.1 (7.7-12.5)
Missouri	7.9 (3.9-12.0)	13.6¶ (9.6-17.7)	8.2 (4.3-12.1)	11.3 (8.1-14.5)	11.6 (9.5-13.6)	15.1 (10.4-19.9)	11.9 (3.7-20.2)	10.1 (8.4-11.8)	9.4 (6.3-12.5)	10.1 (7.7-12.4)	11.8 (9.6-14.1)
Montana	7.3 (3.3-11.3)	14.1¶ (10.1-18.1)	8.1 (3.6-12.5)	11.2 (7.6-14.8)	11.3 (9.1-13.5)	—§	14.3 (5.8-22.8)	10.5 (8.6-12.4)	9.5 (6.3-12.7)	10.2 (7.4-13.0)	11.5 (9.2-13.8)
Nebraska	8.4 (4.5-12.3)	14.4¶ (10.5-18.3)	8.1¶ (4.9-11.3)	12.0 (9.1-14.9)	12.5 (10.6-14.5)	17.4¶ (10.7-24.2)	17.4¶ (12.2-22.5)	10.5 (9.0-12.0)	10.7 (8.0-13.3)	11.2 (9.0-13.5)	11.7 (9.9-13.6)
Nevada	11.2 (6.6-15.9)	15.0¶ (10.4-19.7)	13.6 (6.3-20.9)	13.8 (9.4-18.1)	12.2 (9.1-15.2)	18.2 (8.4-28.0)	11.5 (7.1-15.9)	12.8 (9.8-15.9)	18.3 (11.2-25.3)	10.3 (7.1-13.6)	13.1 (9.7-16.5)
New Hampshire	10.8 (7.0-14.6)	17.8¶ (14.0-21.6)	11.5 (5.2-17.7)	14.9 (10.9-18.9)	14.9 (12.5-17.3)	—§	—§	14.6 (12.4-16.8)	13.2 (8.6-17.8)	11.6¶ (8.7-14.5)	16.1 (13.4-18.7)
New Jersey	9.5 (5.7-13.2)	14.7¶ (10.9-18.5)	8.4¶ (4.6-12.1)	12.8 (9.9-15.7)	13.2 (10.9-15.5)	15.1 (11.2-19.1)	12.3 (9.0-15.7)	11.3 (9.5-13.2)	10.8 (7.7-13.9)	12.0 (9.4-14.6)	12.6 (10.5-14.7)
New Mexico	8.8 (4.4-13.2)	15.6¶ (11.2-20.0)	8.0 (4.5-11.5)	15.6 (12.0-19.1)	11.8 (9.5-14.1)	25.8¶ (12.3-39.3)	12.8 (10.0-15.6)	10.4 (8.5-12.3)	13.2 (10.2-16.2)	10.2 (7.9-12.6)	13.4 (10.8-16.1)
New York	10.6 (6.7-14.4)	17.2¶ (13.3-21.1)	9.4¶ (6.2-12.6)	15.8 (12.7-18.9)	14.8 (12.7-16.8)	17.0 (13.1-21.0)	17.0 (13.4-20.6)	13.3 (11.5-15.0)	13.8 (11.0-16.5)	13.3 (11.0-15.7)	14.5 (12.4-16.6)
North Carolina	7.8 (4.1-11.5)	12.9¶ (9.2-16.7)	7.7 (4.4-11.0)	12.5 (9.6-15.4)	9.8 (7.9-11.8)	13.4¶ (10.1-16.8)	16.4¶ (11.2-21.5)	8.9 (7.3-10.5)	10.1 (7.3-12.8)	9.9 (7.5-12.3)	11.0 (9.0-12.9)
North Dakota	8.3 (3.8-12.7)	15.7¶ (11.3-20.1)	7.1¶ (3.2-10.9)	12.5 (8.9-16.2)	14.0 (11.6-16.4)	—§	—§	11.1 (9.3-12.9)	9.2 (5.7-12.8)	11.6 (8.5-14.6)	12.6 (10.3-14.8)
Ohio	7.5 (3.7-11.3)	13.7¶ (9.9-17.6)	9.1 (5.0-13.2)	10.8 (7.8-13.8)	11.1 (9.2-13.0)	13.1 (8.3-17.9)	20.5 (9.8-31.2)	9.8 (8.2-11.4)	10.8 (7.4-14.1)	9.2 (7.0-11.4)	11.6 (9.5-13.8)
Oklahoma	5.6 (1.9–9.3)	10.3¶ (6.6-14.0)	4.8¶ (1.8–7.8)	9.5 (6.5-12.4)	8.3 (6.6-10.0)	11.1 (5.9-16.2)	11.4 (6.4-16.3)	7.4 (5.9–8.9)	6.7 (4.1–9.3)	8.2 (6.0-10.4)	8.5 (6.7-10.3)
Oregon	9.6 (5.6-13.7)	17.0¶ (13.0-21.1)	8.6¶ (4.2-12.9)	14.6 (10.7-18.4)	14.5 (12.0-17.0)	—§	16.1 (9.4-22.8)	13.2 (11.1-15.2)	11.0 (7.1-15.0)	12.8 (9.9-15.8)	14.6 (12.1-17.1)
Pennsylvania	8.6 (4.6-12.6)	14.7¶ (10.8-18.7)	8.3 (4.4-12.3)	12.8 (9.2-16.4)	12.4 (10.2-14.6)	15.7 (10.8-20.6)	14.1 (6.6-21.6)	11.2 (9.3-13.0)	11.8 (7.1-16.5)	10.3 (7.9-12.7)	12.7 (10.5-14.9)
Rhode Island	10.4 (6.5-14.4)	16.8¶ (12.9-20.7)	11.8 (6.3-17.3)	13.5 (9.9-17.1)	14.6 (12.2-17.1)	14.5 (6.8-22.3)	17.5 (11.1-24.0)	12.8 (10.8-14.8)	14.8 (10.5-19.1)	11.9 (8.9-15.0)	14.5 (11.9-17.1)
South Carolina	7.6 (4.0-11.2)	12.5¶ (8.9-16.1)	7.9 (4.7-11.1)	12.2 (9.4-14.9)	9.6 (7.9-11.4)	11.4 (8.9-13.8)	24.4¶ (15.6-33.2)	8.7 (7.3-10.2)	10.9 (8.2-13.7)	9.8 (7.7-11.8)	10.1 (8.3-11.9)
South Dakota	5.9 (2.3–9.6)	11.9¶ (8.3-15.5)	5.9 (2.2–9.7)	9.9 (6.7-13.2)	9.2 (7.3-11.2)	—§	13.5 (2.0-24.9)	8.8 (7.1-10.5)	8.2 (4.6-11.8)	8.3 (6.0-10.7)	9.4 (7.4-11.5)
Tennessee	8.4 (4.2-12.6)	13.9¶ (9.7-18.1)	9.5 (4.8-14.1)	12.9 (9.1-16.8)	10.5 (8.4-12.5)	14.4 (9.0-19.7)	16.4 (4.8-28.0)	10.3 (8.4-12.3)	10.1 (6.5-13.8)	10.5 (7.7-13.3)	12.4 (9.7-15.0)
Texas	9.3 (4.9-13.8)	14.9¶ (10.4-19.3)	8.4 (4.8-12.1)	14.8 (11.7-17.9)	11.6 (9.4-13.8)	13.1 (8.7-17.5)	14.2¶ (11.1-17.3)	10.4 (8.5-12.2)	12.9 (9.8-16.0)	11.6 (9.0-14.3)	12.1 (9.8-14.3)
Utah	9.1 (4.5-13.7)	15.9¶ (11.3-20.5)	8.0¶ (5.0-11.0)	14.3 (11.3-17.4)	13.8 (11.6-16.0)	—§	15.7 (11.7-19.7)	12.2 (10.4-13.9)	10.8 (7.8-13.9)	11.7 (9.2-14.2)	13.5 (11.5-15.5)
Vermont	8.7 (5.0-12.4)	16.7¶ (13.0-20.4)	8.1¶ (4.0-12.3)	12.5 (9.1-15.9)	14.6 (12.3-17.0)	—§	—§	12.7 (10.9-14.6)	9.2¶ (6.6-11.9)	10.9¶ (8.4-13.5)	14.9 (12.5-17.3)
Virginia	8.5 (4.5-12.5)	13.2¶ (9.2-17.2)	9.7 (6.0-13.3)	11.6 (8.8-14.4)	10.9 (8.9-13.0)	13.0 (9.7-16.3)	14.2 (8.9-19.5)	9.8 (8.2-11.5)	10.3 (7.1-13.5)	10.1 (7.7-12.5)	11.5 (9.6-13.5)
Washington	9.2 (5.1-13.2)	16.1¶ (12.0-20.1)	8.9¶ (5.7-12.1)	13.9 (10.9-16.9)	13.4 (11.4-15.4)	17.1 (10.6-23.6)	16.2 (12.0-20.4)	12.0 (10.4-13.6)	13.9 (10.7-17.1)	11.6 (9.3-14.0)	12.9 (11.1-14.7)
West Virginia	5.2 (1.8–8.5)	9.5¶ (6.2-12.9)	6.1 (2.8–9.3)	7.4 (4.9-10.0)	7.8 (6.1–9.5)	9.4 (3.7-15.2)	—§	7.2 (5.8–8.6)	5.8¶ (3.8–7.9)	6.5¶ (4.7–8.3)	9.2 (7.2-11.2)
Wisconsin	8.0 (4.0-11.9)	15.6¶ (11.6-19.6)	8.2¶ (4.4-12.0)	12.4 (9.1-15.7)	12.9 (10.6-15.2)	17.9 (9.7-26.1)	15.6 (8.5-22.6)	11.2 (9.5-13.0)	12.2 (8.4-16.0)	10.4 (8.0-12.7)	12.7 (10.4-15.0)
Wyoming	9.0 (4.5-13.6)	15.3¶ (11.8-18.7)	10.7 (5.1-16.4)	13.9 (10.0-17.9)	11.4 (11.0-13.8)	—§	17.4 (9.2-25.6)	10.6 (8.7-12.6)	13.6 (7.3-19.9)	11.0 (7.8-14.2)	12.6 (10.0-15.1)

Abbreviations: CI = confidence interval; Ref = referent group.

* Weighted percentages are presented.

† Blacks and whites are non-Hispanic; Hispanic persons could be of any race. Other racial/ethnic group not reported because of small sample sizes but included in overall estimates and estimates by other demographic characteristics.

§ Data where the sample sizes were <50 were considered unstable and were not reported.

¶ p<0.05 for t-test comparing differences by demographic groups to the referent group.

TABLE 3. State-specific percentages* of respondents meeting federal vegetable intake recommendations sex, age, race/ethnicity, and income-to-poverty ratio (IPR) — Behavioral Risk Factor Surveillance System, 2015

	Sex (n = 319,415)		Age group (yrs, n = 319,415)			Race/Ethnicity†			IPR (n = 319,415)		
	Men	Women (Ref)	18–30	31–50	≥51 (Ref)	Black	Hispanic	White (Ref)	<1.25	1.25–3.49	>3.49 (Ref)
State	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
National	**7.6 (5.6–9.6)**	**10.9¶ (9.0-13.0)**	**6.7¶ (4.7–8.7)**	**8.8¶ (6.9-10.9)**	**10.9 (8.9-12.9)**	**5.5 (0.0-11.1)**	**10.5 (5.0-16.1)**	**9.5 (3.9-15.1)**	**7.0¶ (3.9-10.4)**	**7.5¶ (4.3-10.8)**	**11.4 (8.2-14.7)**
Alabama	5.4 (3.3–7.5)	6.7 (4.6–8.8)	3.0¶ (0.7–5.3)	5.3¶ (3.0–7.7)	8.0 (5.7-10.3)	3.1 (0.0-11.3)	—§	7.0 (0.0-15.2)	3.4¶ (0.0–7.2)	4.9 (1.2–8.7)	8.4 (4.6-12.1)
Alaska	8.9 (4.2-13.5)	15.6¶ (10.9-20.2)	9.9 (6.1-13.7)	11.7 (7.9-15.5)	13.7 (9.8-17.5)	—§	13.2 (4.3-22.1)	12.9 (4.0-21.8)	11.7 (6.1-17.3)	9.4 (3.8-15.0)	13.9 (8.3-19.5)
Arizona	8.0 (4.7-11.2)	13.0¶ (9.8-16.3)	7.7¶ (4.8-10.5)	10.6 (7.7-13.4)	11.8 (9.0-14.7)	5.2 (0.0-14.9)	11.4 (1.7-21.1)	10.4 (0.7-20.1)	10.1 (5.8-14.4)	8.1¶ (3.8-12.3)	12.8 (8.5-17.0)
Arkansas	6.9 (4.2–9.6)	8.8 (6.1-11.5)	5.9¶ (3.1–8.8)	6.6¶ (3.8–9.5)	9.8 (6.9-12.6)	—§	9.9 (3.0-16.8)	8.4 (1.5-15.3)	6.3 (1.1-11.5)	6.6 (1.4-11.8)	10.2 (5.0-15.5)
California	9.3 (6.3-12.3)	13.0¶ (10.1-16.0)	7.5¶ (4.4-10.5)	11.2 (8.2-14.2)	13.3 (10.2-16.3)	6.6 (0.3-13.0)	10.6 (4.3-17.0)	11.8 (5.5-18.2)	9.3 (5.1-13.5)	9.1 (4.9-13.4)	13.1 (8.9-17.3)
Colorado	8.6 (5.3-11.8)	14.6¶ (11.4-17.9)	8.8¶ (5.9-11.8)	11.0 (8.0-13.9)	13.5 (10.5-16.4)	8.6 (0.2-17.1)	11.9 (3.5-20.3)	11.5 (3.1-20.0)	9.4 (5.3-13.4)	10.0 (6.0-14.1)	13.1 (9.1-17.2)
Connecticut	7.8 (4.7-10.8)	12.9¶ (9.8-15.9)	9.5 (6.9-12.1)	9.3 (6.7-11.9)	11.5 (8.9-14.1)	5.2 (0.0-13.8)	8.7 (0.2-17.3)	11.1 (2.6-19.7)	7.9¶ (4.0-11.8)	8.1¶ (4.2-12.0)	12.1 (8.2-16.0)
Delaware	6.4 (3.0–9.7)	10.6¶ (7.3-14.0)	5.7¶ (2.6–8.7)	7.5 (4.5-10.6)	10.4 (7.4-13.4)	6.3 (0.0-16.3)	5.6 (0.0-15.6)	9.1 (0.0-19.1)	4.6¶ (0.6–8.5)	6.2¶ (2.2-10.1)	11.1 (7.1-15.1)
District of Columbia	8.4 (3.9-12.9)	10.9 (6.4-15.4)	5.0¶ (1.6–8.3)	10.9 (7.5-14.3)	12.0 (8.6-15.3)	6.3 (0.0-17.0)	14.2 (3.4-24.9)	11.6 (0.8-22.3)	6.2 (0.3-12.1)	7.1 (1.2-13.0)	11.5 (5.6-17.5)
Florida	8.2 (5.4-11.1)	12.2¶ (9.4-15.1)	9.5 (7.0-12.0)	9.3 (6.8-11.8)	11.2 (8.7-13.7)	6.7 (0.0-16.1)	8.7 (0.0-18.1)	11.1 (1.7-20.5)	7.9¶ (3.7-12.1)	7.3¶ (3.2-11.5)	13.6 (9.4-17.8)
Georgia	6.4 (3.5–9.3)	10.5¶ (7.6-13.4)	6.8¶ (4.1–9.5)	8.1 (5.4-10.8)	9.8 (7.1-12.4)	5.4 (0.0-15.2)	7.1 (0.0-16.9)	10.1 (0.3-19.9)	4.5¶ (0.1–8.9)	7.6 (3.3-12.0)	11.2 (6.8-15.6)
Hawaii	9.7 (6.4-12.9)	13.5¶ (10.2-16.7)	7.9¶ (4.7-11.0)	10.2¶ (7.0-13.4)	14.2 (11.0-17.4)	—§	9.4 (4.6-14.3)	13.3 (8.5-18.2)	8.5¶ (4.5-12.5)	10.8 (6.8-14.7)	12.8 (8.9-16.8)
Idaho	8.7 (5.3-12.1)	12.9¶ (9.5-16.2)	8.4¶ (5.5-11.3)	11.4 (8.4-14.3)	11.4 (8.5-14.3)	—§	12.5 (3.7-21.3)	10.5 (1.7-19.3)	7.7¶ (3.8-11.7)	9.6 (5.7-13.6)	13.3 (9.3-17.2)
Illinois	8.0 (5.2-10.9)	11.3¶ (8.5-14.1)	7.5¶ (4.8-10.1)	9.0 (6.3-11.7)	11.5 (8.8-14.2)	6.1 (0.0-18.6)	14.1 (1.6-26.6)	9.4 (0.0-21.9)	9.6 (5.6-13.7)	7.9 (3.9-12.0)	10.9 (6.9-15.0)
Indiana	7.6 (4.9-10.3)	9.5¶ (6.8-12.2)	4.0¶ (1.4–6.6)	9.7 (7.1-12.3)	10.1 (7.5-12.7)	—§	9.6 (0.0-22.1)	8.9 (0.0-21.4)	4.4¶ (0.0–9.5)	7.2 (2.1-12.2)	11.5 (6.5-16.5)
Iowa	5.3 (2.7–7.9)	8.8¶ (6.2-11.3)	4.7¶ (2.2–7.1)	5.8¶ (3.3–8.2)	9.1 (6.7-11.6)	—§	11.7 (1.4-22.0)	6.9 (0.0-17.2)	6.2 (2.3-10.1)	5.9 (2.0–9.8)	8.1 (4.2-12.0)
Kansas	6.5 (4.3–8.7)	9.8¶ (7.5-12.0)	4.5¶ (2.3–6.8)	7.6¶ (5.3–9.8)	10.3 (8.0-12.5)	4.6 (0.0-10.4)	9.1 (3.4-14.9)	8.1 (2.4-13.9)	5.8¶ (2.5–9.1)	6.4¶ (3.2–9.7)	10.2 (6.9-13.4)
Kentucky	5.1 (2.4–7.8)	7.6¶ (4.9-10.3)	3.6¶ (0.9–6.4)	5.1¶ (2.4–7.8)	8.6 (5.8-11.3)	—§	—§	6.5 (0.0-16.3)	4.8 (0.2–9.4)	4.1¶ (0.0–8.7)	8.8 (4.2-13.3)
Louisiana	8.0 (5.4-10.7)	8.6 (5.9-11.2)	6.6 (4.1–9.1)	8.5 (6.0-11.0)	9.0 (6.5-11.5)	5.0 (0.0-13.9)	7.7 (0.0-16.6)	10.0 (1.1-18.9)	4.5¶ (0.0–9.0)	9.0 (4.4-13.6)	9.9 (5.3-14.5)
Maine	7.7 (4.7-10.8)	13.6¶ (10.5-16.6)	9.8 (7.1-12.5)	8.6¶ (5.9-11.3)	12.4 (9.7-15.0)	—§	—§	10.7 (0.0-21.5)	7.1¶ (3.4-10.8)	9.0¶ (5.3-12.7)	13.5 (9.8-17.2)
Maryland	6.9 (3.8-10.0)	10.9¶ (7.8-14.0)	5.8¶ (2.9–8.7)	8.0¶ (5.1-10.9)	11.3 (8.4-14.2)	5.4 (0.0-14.6)	11.2 (1.9-20.4)	9.6 (0.4-18.9)	5.9¶ (2.4–9.5)	6.8¶ (3.2-10.4)	11.0 (7.4-14.6)
Massachusetts	8.7 (5.7-11.8)	13.3¶ (10.2-16.3)	8.3¶ (5.3-11.3)	10.8 (7.8-13.8)	12.6 (9.6-15.6)	5.6 (0.0-13.7)	11.4 (3.3-19.5)	11.2 (3.1-19.3)	8.1¶ (4.0-12.1)	8.9 (4.9-13.0)	12.7 (8.7-16.8)
Michigan	5.6 (3.1–8.1)	9.8¶ (7.3-12.3)	4.4¶ (1.9–6.9)	6.8¶ (4.3–9.3)	9.7 (7.2-12.2)	5.5 (0.0-13.4)	7.9 (0.0-15.8)	8.0 (0.1-15.9)	5.5¶ (1.8–9.3)	5.7¶ (2.0–9.5)	9.9 (6.1-13.7)
Minnesota	6.1 (3.6–8.6)	10.2¶ (7.7-12.6)	5.6¶ (3.3–7.9)	7.7 (5.4-10.0)	9.7 (7.4-12.0)	4.3 (0.0-12.5)	12.3 (4.1-20.5)	8.1 (0.0-16.2)	5.6¶ (2.2–9.0)	5.9¶ (2.5–9.3)	10.0 (6.6-13.4)
Mississippi	5.3 (2.9–7.7)	7.0 (4.6–9.4)	5.8 (3.5–8.0)	4.6¶ (2.4–6.9)	7.7 (5.5–9.9)	3.1 (0.0-23.0)	—§	7.4 (0.0-27.3)	3.7¶ (0.0–8.6)	4.5¶ (0.0–9.3)	10.2 (5.4-15.1)
Missouri	6.0 (3.3–8.6)	9.4¶ (6.7-12.0)	5.8¶ (3.4–8.3)	6.6¶ (4.2–9.1)	9.4 (6.9-11.8)	5.2 (0.0-12.0)	5.1 (0.0-12.0)	8.0 (1.2-14.8)	3.9¶ (0.0–8.0)	6.8 (2.7-10.8)	9.8 (5.7-13.9)
Montana	5.6 (2.4–8.8)	11.0¶ (7.8-14.3)	5.6¶ (2.9–8.3)	7.5 (4.9-10.2)	9.8 (7.1-12.5)	—§	7.9 (1.1-14.6)	8.3 (1.5-15.0)	5.3¶ (1.4–9.1)	7.2 (3.3-11.0)	10.3 (6.5-14.2)
Nebraska	6.8 (4.4–9.1)	9.0 (6.7-11.4)	5.3¶ (2.9–7.6)	7.4 (5.0–9.7)	9.6 (7.2-11.9)	6.3 (0.0-14.5)	11.8 (3.5-20.0)	7.7 (0.0-16.0)	6.7 (2.7-10.6)	6.3 (2.3-10.3)	9.5 (5.5-13.5)
Nevada	9.8 (5.5-14.0)	13.3 (9.0-17.5)	14.3 (10.3-18.3)	9.2 (5.2-13.2)	12.4 (8.4-16.3)	—§	13.6 (6.2-21.0)	11.7 (4.3-19.1)	8.9¶ (3.4-14.3)	9.0¶ (3.5-14.4)	14.5 (9.0-19.9)
New Hampshire	8.5 (5.2-11.8)	13.1¶ (9.8-16.4)	5.5¶ (2.6–8.4)	11.2 (8.3-14.1)	12.4 (9.5-15.3)	—§	—§	10.9 (3.2-18.6)	5.9¶ (1.8-10.0)	9.6 (5.5-13.7)	12.3 (8.2-16.5)
New Jersey	6.2 (3.2–9.1)	10.3¶ (7.3-13.2)	5.4¶ (2.4–8.3)	6.8¶ (3.8–9.7)	10.6 (7.7-13.5)	4.8 (0.0-12.7)	8.8 (0.9-16.8)	8.4 (0.4-16.3)	6.8 (3.0-10.5)	5.9¶ (2.1–9.7)	10.1 (6.3-13.9)
New Mexico	9.1 (6.0-12.2)	11.5 (8.4-14.6)	9.1 (6.1-12.1)	9.0 (6.0-12.0)	11.9 (8.9-14.8)	—§	10.7 (2.9-18.4)	10.1 (2.3-17.8)	8.9 (4.0-13.8)	8.7 (3.8-13.6)	12.9 (8.0-17.8)
New York	7.7 (5.0-10.4)	11.4¶ (8.6-14.1)	6.9¶ (4.4–9.4)	9.5 (7.1-12.0)	10.9 (8.4-13.4)	7.0 (0.8-13.2)	9.8 (3.7-16.0)	10.2 (4.0-16.4)	7.1¶ (3.2-11.0)	7.9 (4.0-11.8)	11.7 (7.8-15.6)
North Carolina	7.3 (4.8–9.8)	8.9 (6.4-11.4)	4.4¶ (1.7–7.1)	7.6¶ (4.9-10.3)	10.3 (7.6-13.0)	3.9 (0.0-12.4)	9.7 (1.1-18.3)	8.8 (0.3-17.4)	5.3¶ (1.4–9.2)	6.6¶ (2.7-10.5)	10.5 (6.6-14.4)
North Dakota	6.4 (3.5–9.3)	9.5¶ (6.6-12.4)	5.6¶ (3.0–8.2)	7.4 (4.8-10.0)	9.6 (7.0-12.2)	—§	—§	7.7 (0.0-17.4)	5.0¶ (0.8–9.2)	6.5 (2.3-10.8)	9.3 (5.1-13.6)
Ohio	5.2 (2.6–7.8)	8.7¶ (6.1-11.3)	4.8¶ (2.4–7.1)	5.9¶ (3.6–8.2)	8.7 (6.4-11.0)	4.4 (0.0-12.2)	9.1 (1.3-16.9)	7.1 (0.0-14.9)	4.0¶ (0.0–8.3)	5.0¶ (0.7–9.2)	9.5 (5.3-13.8)
Oklahoma	5.4 (3.2–7.6)	6.8 (4.6–8.9)	3.0¶ (0.7–5.2)	5.9 (3.6–8.1)	7.7 (5.5-10.0)	2.3 (0.0–8.0)	5.5 (0.0-11.2)	6.5 (0.8-12.1)	3.2 (0.0–7.3)	5.2 (1.1–9.2)	8.3 (4.3-12.3)
Oregon	10.0 (6.5-13.5)	13.8¶ (10.3-17.3)	10.0¶ (6.9-13.0)	11.8 (8.7-14.9)	12.8 (9.7-15.9)	—§	13.6 (4.0-23.3)	12.0 (2.4-21.6)	8.3¶ (3.8-12.7)	10.6 (6.2-15.1)	14.1 (9.6-18.5)
Pennsylvania	6.9 (4.0–9.8)	9.8¶ (6.9-12.7)	3.7¶ (1.0–6.5)	8.7 (5.9-11.4)	10.1 (7.3-12.8)	6.6 (0.0-19.5)	—§	8.5 (0.0-21.4)	6.1 (1.7-10.5)	6.8 (2.4-11.2)	10.1 (5.7-14.5)
Rhode Island	8.2 (4.8-11.6)	11.2 (7.8-14.6)	9.6 (6.7-12.4)	8.3 (5.5-11.1)	10.9 (8.1-13.7)	—§	10.6 (0.2-20.9)	9.7 (0.0-20.0)	7.5¶ (3.1-11.8)	7.5¶ (3.2-11.9)	12.0 (7.6-16.3)
South Carolina	6.6 (4.2–9.1)	9.5¶ (7.1-12.0)	6.0¶ (3.6–8.3)	8.0 (5.7-10.4)	9.2 (6.9-11.6)	3.1 (0.0-11.2)	20.5¶ (12.4-28.6)	9.0 (0.9-17.1)	5.7¶ (1.9–9.5)	6.1¶ (2.3–9.9)	11.0 (7.2-14.8)
South Dakota	4.5 (2.0–6.9)	7.5¶ (5.0-10.0)	2.2¶ (0.0–4.6)	5.4¶ (3.0–7.9)	7.9 (5.5-10.3)	—§	—§	6.3 (0.6-11.9)	3.6¶ (0.0–7.2)	4.9 (1.3–8.5)	7.4 (3.8-11.0)
Tennessee	9.9 (6.8-12.9)	9.4 (6.4-12.4)	9.3 (6.5-12.1)	9.2 (6.4-12.0)	10.2 (7.4-13.0)	—§	9.7 (0.0-25.6)	10.1 (0.0-26.0)	7.6¶ (3.0-12.3)	7.6¶ (3.0-12.3)	12.7 (8.1-17.4)
Texas	9.7 (6.6-12.7)	12.0 (9.0-15.1)	8.0¶ (4.9-11.1)	10.6 (7.5-13.7)	12.7 (9.6-15.9)	7.2 (0.0-15.6)	11.7 (3.2-20.1)	11.2 (2.8-19.6)	8.8 (4.1-13.5)	10.3 (5.6-14.9)	12.4 (7.7-17.1)
Utah	7.8 (5.1-10.6)	11.0¶ (8.3-13.8)	6.6¶ (3.8–9.4)	9.4 (6.6-12.2)	11.6 (8.8-14.4)	—§	11.3 (0.6-22.1)	9.3 (0.0-20.0)	7.5 (3.3-11.7)	8.4 (4.2-12.6)	10.6 (6.4-14.9)
Vermont	7.7 (4.3-11.1)	14.4¶ (11.0-17.8)	8.4¶ (5.4-11.4)	9.8¶ (6.8-12.7)	12.9 (10.0-15.9)	—§	—§	11.1 (2.6-19.6)	6.5¶ (2.4-10.5)	7.7¶ (3.7-11.8)	14.6 (10.5-18.6)
Virginia	6.0 (3.5–8.6)	9.2¶ (6.6-11.8)	5.2¶ (2.6–7.8)	6.7¶ (4.1–9.3)	9.7 (7.0-12.3)	4.0 (0.0-13.1)	9.1 (0.1-18.2)	8.4 (0.0-17.4)	4.5¶ (0.7–8.2)	5.8 (2.0–9.6)	9.5 (5.7-13.3)
Washington	8.1 (5.1-11.0)	13.8¶ (10.8-16.8)	7.1¶ (4.3–9.9)	10.7 (7.9-13.5)	13.0 (10.2-15.8)	9.8 (3.1-16.5)	10.8 (4.1-17.5)	11.0 (4.3-17.7)	8.9¶ (5.3-12.5)	8.7¶ (5.1-12.3)	12.8 (9.2-16.4)
West Virginia	4.7 (2.4–6.9)	7.0¶ (4.8–9.2)	3.5¶ (1.3–5.7)	4.7¶ (2.4–6.9)	7.5 (5.3–9.7)	—§	—§	6.0 (0.0-15.0)	3.5¶ (0.0–7.2)	4.9 (1.2–8.6)	8.2 (4.6-11.9)
Wisconsin	6.2 (3.5–8.9)	9.4¶ (6.7-12.1)	5.7¶ (3.1–8.2)	7.2 (4.7–9.8)	9.1 (6.6-11.7)	—§	7.9 (0.0-20.3)	7.7 (0.0-20.1)	5.0¶ (0.9–9.0)	6.8 (2.7-10.9)	9.2 (5.2-13.3)
Wyoming	8.4 (5.3-11.5)	9.9 (6.8-13.0)	7.8¶ (4.9-10.7)	7.6¶ (4.7-10.5)	11.0 (8.1-13.9)	—§	11.0 (2.8-19.3)	9.0 (0.7-17.3)	6.1¶ (1.7-10.5)	6.5 (2.1-10.9)	11.7 (7.4-16.1)

Abbreviations: CI = confidence interval; Ref = referent group.

* Weighted percentages are presented.

† Blacks and whites are non-Hispanic; Hispanic persons could be of any race. Other racial/ethnic group not reported because of small sample sizes but included in overall estimates and estimates by other demographic characteristics.

§ Data where the sample sizes were <50 were considered unstable and were not reported.

¶ p<0.05 for t-test comparing differences by demographic groups to the referent group.

by race/ethnicity. In general, by state, lower percentages of blacks met recommendation for vegetable intake than did whites and Hispanics. Overall, a significantly higher percentage of persons with IPR >3.49 met recommendations for vegetable intake than did those with IPR ≤3.49, although no significant differences for meeting recommendations for fruit intake by IPR were observed. By state, a higher percentage of persons living in households with incomes in the highest category (IPR >3.49) met the recommendation for vegetable intake than did persons living below or close to the poverty level (IPR <1.25); these differences were significant in four states for fruits and 35 states for vegetables.

Discussion

Overall, the proportion of adults meeting fruit and vegetable intake recommendations remained low in 2015, with more persons meeting recommendations for fruit intake than vegetable intake, and with substantial variations by state, age, sex, race/ethnicity, and IPR. Consistent with earlier studies of BRFSS data (*5*,*6*), a higher percentage of women than men and a higher percentage of adults aged ≥51 years than persons aged 18–30 years met recommendations for fruit and vegetable intake. Findings are also consistent with earlier work demonstrating larger IPR-related disparities in vegetable than fruit intake as well as a significantly higher prevalence of meeting recommendations for fruit intake among blacks and Hispanics than among whites (*5*). However, this analysis did not observe previously reported significantly lower prevalences of meeting recommendations for vegetable intake among Hispanics and blacks compared with whites; that study measured the percentage of respondents who consumed vegetables more than three times per day rather than the age- and sex-specific cup-equivalent measure used in the current analysis.

Because fruit and vegetable consumption affects multiple health outcomes, including cardiovascular disease, type 2 diabetes, some cancers, and obesity (*1*) and is currently low among adults in all states and demographic subgroups, continued efforts are needed to identify and address barriers to fruit and vegetable consumption. A recent review identified several barriers, including high cost, limited availability and access, and perceived lack of preparation time (*7*,*8*). The CDC Guide to Strategies to Increase the Consumption of Fruits and Vegetables[¶] identifies 10 strategies to increase access to and improve the availability of fruits and vegetables. Examples include starting or expanding farm-to-institution programs in childcare, schools, hospitals, workplaces, and other institutions; improving access to retail stores and markets that sell high quality fruits and vegetables; and ensuring access to fruits and vegetables in cafeterias and other food service venues in worksites, hospitals, and universities. To address cost, the U.S. Department of Agriculture Food Insecurity Nutrition Incentive (FINI) grant program[**] supports projects to increase the purchase of fruits and vegetables among low-income consumers participating in the Supplemental Nutrition Assistance Program, by providing incentives at the point of purchase; FINI projects are currently underway in 26 states.[††]

The findings in this report are subject to at least six limitations. First, estimates did not include non-100% fruit juice or fried potatoes because the BRFSS questionnaire instructs respondents to exclude them. These foods were excluded from BRFSS because federal dietary guidelines recommend limiting foods and beverages with added sugars and solid fats such as these (*1*); estimates therefore represent intake from healthier sources. Including these additional sources of fruits and vegetables results in 4%–6% higher estimates for fruit intake and 30%–44% higher estimates for vegetable intake (*4*). Second, because the data are self-reported, they are subject to biases that might result in either overestimates or underestimates of actual fruit and vegetable consumption, and different demographic groups might differentially misreport intake.[§§] Third, the BRFSS survey excludes persons living in nursing homes, long-term care facilities, military installations, and correctional institutions, and thus these data are not generalizable to the entire U.S. population. Moreover, territories were excluded from this analysis because the scoring algorithms were derived from NHANES, which excludes territories. Fourth, using the scoring algorithms to estimate intake might have resulted in measurement error. However, previous analyses showed that applying prediction equations to 2011 BRFSS frequency data yielded estimates comparable to 2007–2010 national estimates that used more accurate 24-hour recalls (*4*). Fifth, approximately 13% of participants had fruit and vegetable data missing (58,949 participants). These respondents included a higher proportion of older adults and persons with IPR <1.25, similar to a previous study (*4*). A sensitivity analysis demonstrated that estimates did not change when persons with complete data for fruit intake, but not vegetables, or when persons with complete data for vegetable intake but not fruit were included. Finally, among the 375,306 eligible participants who had complete information for fruit and vegetable intakes and resided in the study area, 13% (55,891 participants) were excluded because they did not report household income. Estimated percentages of persons meeting recommendations were similar when

[¶] https://www.cdc.gov/obesity/downloads/fandv_2011_web_tag508.pdf.

[**] https://nifa.usda.gov/program/food-insecurity-nutrition-incentive-fini-grant-program.

[††] https://nifa.usda.gov/program/food-insecurity-nutrition-incentive-fini-grant-program.

[§§] https://dietassessmentprimer.cancer.gov/concepts/.

Summary

What is already known about this topic?

Consuming enough fruits and vegetables as part of an overall healthy diet reduces the risk of many chronic diseases, including cardiovascular disease, type 2 diabetes, some cancers, and obesity. However, the percentage of the adult population meeting fruit and vegetable intake recommendation is low. In 2013, 13.1% of respondents met fruit intake recommendations and 8.9% met vegetable recommendations.

What is added by this report?

Recent data show adults continue to consume too few fruits and vegetables; overall, 12.2% met fruit intake recommendations and 9.3% met vegetable intake recommendations during 2015. Consumption was lower among men, young adults, and adults with greater poverty, and varied by state. Among subgroups, the largest disparities in meeting the recommendation for fruit intake was by sex (15.1% among women compared with 9.2% among men), while the largest disparities in meeting the recommendation for vegetable intake was by poverty (11.4% among adults in the highest household income category compared with 7.0% among adults below or close to the poverty level).

What are the implications for public health practice?

States can use this information to inform the development of policies and programs that help all adults regardless of sociodemographic groups to consume more fruits and vegetables and thus help to prevent costly chronic diseases.

income was imputed for persons with missing household income based on age, sex, and race/ethnicity. The estimates without imputation are presented to be consistent with previous studies (*2*,*4*) which allow states to compare estimates for surveillance purposes.

Despite the positive health benefits of consuming fruits and vegetables, the findings from this study corroborate data showing that the vast majority of adults consume insufficient amounts, with lower intakes among men, young adults, and adults living in poverty. For most states, the only source of state-level nutritional data for adults is fruit and vegetable intake data from BRFSS. States can use this information to inform the development of policies and programs that help all adults regardless of sociodemographic group to consume more fruits and vegetables and thus help prevent costly chronic diseases.

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Conflict of Interest

No conflicts of interest were reported.

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CDC Grand Rounds: Improving Medication Adherence for Chronic Disease Management — Innovations and Opportunities

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Adherence to prescribed medications is associated with improved clinical outcomes for chronic disease management and reduced mortality from chronic conditions (*1*). Conversely, nonadherence is associated with higher rates of hospital admissions, suboptimal health outcomes, increased morbidity and mortality, and increased health care costs (*2*). In the United States, 3.8 billion prescriptions are written annually (*3*). Approximately one in five new prescriptions are never filled, and among those filled, approximately 50% are taken incorrectly, particularly with regard to timing, dosage, frequency, and duration (*4*). Whereas rates of nonadherence across the United States have remained relatively stable, direct health care costs associated with nonadherence have grown to approximately $100–$300 billion of U.S. health care dollars spent annually (*5*,*6*). Improving medication adherence is a public health priority and could reduce the economic and health burdens of many diseases and chronic conditions (*7*).

Understanding Medication Nonadherence

Medication adherence is a complex behavior influenced by factors along the continuum of care, relating to the patient, providers, and health systems (*8*). Patient-related factors include unintentional factors, which often worsen with increasingly complex medication regimens (e.g., forgetting to take medication or obtain refills, or inadequate understanding of dose or schedules); and intentional factors (e.g., active decision to stop or modify a treatment regimen based on ability to pay, beliefs and attitudes about their disease, medication side effects, and expectations for improvement) (*9*) (Figure). Additional patient-related barriers include lack of engagement in treatment decisions, impaired cognition (e.g., related to aging or disease), substance abuse, depression, and other mental health conditions. Provider-related factors include barriers to communicating with patients and their caregivers, complex dosing regimens, and limited coordination of care among multiple providers. Health care system and service delivery factors include limited access to an appropriate provider for prescriptions or refills, restricted drug coverage, high costs and copayments, unclear medication labeling and instructions, limited availability of culturally appropriate patient education materials, and inadequate provider time to review benefits, risks, and alternatives to prescribed medications.

Innovative Strategies to Improve Medication Adherence for Chronic Disease Management

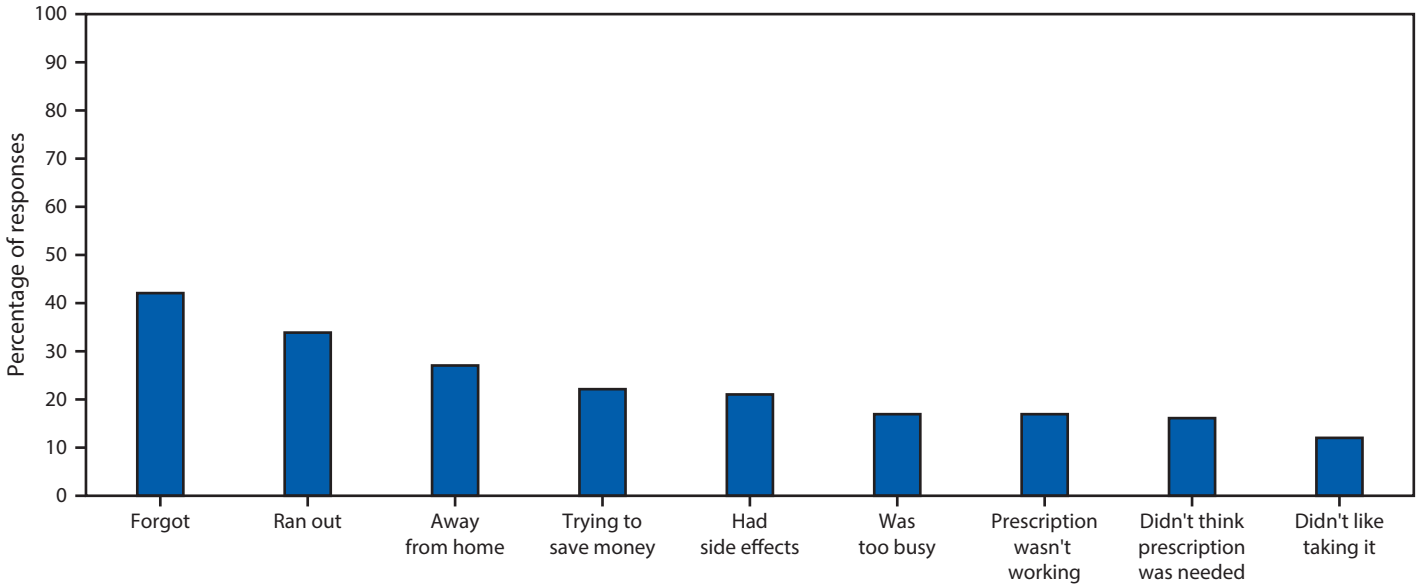
Successful efforts to improve rates of adherence often incorporate multiple strategies across the continuum of care. A proven cost-effective strategy to reducing unintentional nonadherence is the use of pillboxes and blister packs to organize medication regimens in clear and simple ways (*10*). Combining the ease of packaging with effective behavioral prompts, such as electronic pill monitors that can remind patients to take their medication and provide messages to health care providers when a scheduled drug-dose is missed, supports increased medication adherence (*11*).

Interventions that include team-based or coordinated care have been shown to increase adherence rates. In a recent study, patients assigned to team-based care, including pharmacist-led medication reconciliation and tailoring; pharmacist-led patient education; collaborative care between pharmacist and primary care provider or cardiologist; and two types of voice messaging (educational and medication refill reminder calls) were significantly more adherent with their medication regimen 12 months after hospital discharge (89%) compared with patients not receiving team-based care (74%). Patients reported that team-based care improved their comfort in asking clarifying questions, raising concerns about their medication regimen, and collaborating in developing their treatment plan (*12*,*13*).

Lowering economic barriers to prescribed medications also improves adherence rates. In 2007, Pitney-Bowes Corporation employees and beneficiaries with diabetes or vascular disease increased their medication adherence rates increased by 3%–4% after the company eliminated or reduced health plan copays for cholesterol-lowering statins and the antiplatelet medication, clopidogrel (used to prevent heart attacks and strokes), compared with beneficiaries insured by another health plan with the same third-party prescription drugs administrator that did not reduce or eliminate copays for the same medications. These improvements, while modest, could result in significant cost savings in the prevention of acute events (e.g., hospitalizations) and progression of major chronic conditions if scaled to larger populations (*14*).

System-based strategies that address health disparities can improve clinical goals or reduce disease burden. For example, medication adherence is crucial for persons infected with human immunodeficiency virus (HIV), because treatment

FIGURE. Self-reported reasons* for nonadherence to recommended medication regimens — United States, 2013



Source: Medication Adherence in America: A National Report Card, 2013. Adapted with permission. https://www.ncpanet.org/pdf/reportcard/AdherenceReportCard_Abridged.pdf.
* Participants could provide more than one response, and as such, categories are not mutually exclusive.

lowers the amount of virus circulating in the blood, which improves the patient's health and reduces the risk of transmitting HIV to others by >90% (*15*). Interventions, such as CDC's *Data to Care* (*16*) strategy, that identify and re-engage nonadherent patients in care by linking them through the health department, their care providers, or both, improve the health of the individual and achieve the public health benefit of reducing HIV transmission (*17*).

Advances in health information technology can also improve medication adherence. In a 2011 study, providers using electronic prescribing (e-prescribing) increased first-fill medication adherence by 10% compared with those using paper prescriptions (*18*). Some e-prescribing software can monitor prescriptions dispensed or unfilled in near real-time, as well as send patients prompts when a new or refill prescription is available. These data allow providers to review current medication use with patients during office visits, identify gaps or barriers to adherence, and discuss workable solutions.

Health information technology can also be used to show real-time impact of medication use on chronic conditions. Reliant Medical Group, a multispecialty group practice in Massachusetts, provided home blood pressure monitors to 200 of its patients. Patients uploaded blood pressure readings into their electronic health record. At office visits, providers were able to display trends of patients' blood pressure, discuss barriers if blood pressure was not controlled and patients were not adherent, or add alternative drugs or lifestyle changes if pharmacy data indicated patients were adherent but their blood pressure was still poorly controlled. In addition, health information technology systems enabled providers to view medication coverage by insurer and choose lower cost medications. Reliant also made complex prescribing algorithms easier to follow by establishing and incorporating treatment protocols for hypertension into the electronic health record. Using these and other strategies (Box), Reliant improved its hypertension control rate from 68% in 2011 to 79% in 2014 and was recognized as a Million Hearts Hypertension Control Champion in 2015 (*19*).

Opportunities in Medication Adherence Outcomes

Although a range of interventions have demonstrated improved medication adherence and health outcomes during the study period, few studies have shown that these benefits were maintained over time (*20*). Interventions that can sustain patient medication adherence are needed. One priority for developing sustainable strategies to improve medication adherence includes standardizing research methodology for both clinic and research settings. Currently, studies use a variety of measurement methods. Varying study methodologies prevents comparability across interventions, hinders wide application into clinical practice, and limits efforts that focus on patients with the greatest burden and need. Standardization might also help to understand both the dose-response and effectiveness of interventions over a longer time, increasing sustainability and reducing a waning effect at follow-up time points (*21*).

BOX. Strategies used by Reliant Medical Group (Massachusetts) to improve adherence to blood pressure medication and increase hypertension control rates

Ensure that patient understands the benefits

- Educate about harms of uncontrolled hypertension and benefits of controlling hypertension
- Make culturally appropriate education materials available
- Automatically print educational information in the After-Visit Summary if patient has diagnosis of hypertension
- Show patients graphs of their blood pressure trends during office visits and online electronic health record (EHR) portal. Use graphs to demonstrate challenges and successes with treatment regimens

Choose lower cost medications

- Use step-therapy protocols that are developed by a multidisciplinary team and are standardized across the organization
- Control access to pharmaceutical marketing
- Make the patient's payer-specific formulary available in the EHR to inform medication selection
- Use generic medication substitution
- Provide assistance in paying for medications (e.g., RxAssist.org)
- Consult social workers to assist with adherence barriers

Minimize medication complexity

- Choose once-a-day and combination medications
- Engage in dialogue about costs versus convenience (e.g., pill-splitting can reduce cost but increase inconvenience)

Monitor side effects

- Be creative in addressing concerns
  - e.g., if concerned about swollen feet, use a diuretic, if appropriate
  - e.g., if concerned about medication causing abnormal potassium level, use a combined angiotensin-converting enzyme (ACE) inhibitor and a diuretic to normalize potassium
- When to monitor side effects
  - At visits
  - At prescription renewals, using a standard documentation template
  - After hospital discharge: automated alerts for new medications
- Consult pharmacists
  - For complex medication regimens or side effects
  - After hospital discharge regarding patients who are on high-risk medications

Show effectiveness of the medications in lowering blood pressure

- Empower patient to record blood pressure readings at home
- Provide booklets to record readings
- For patients with financial hardships, provide free home blood pressure monitors
- Offer free blood pressure clinics
- Automatically upload blood pressure readings into the EHR

Monitor medication adherence

- Encourage patients to document their medication-taking behavior
- Use EHR systems that can show medication fill history
- Automate adherence monitoring using payer medication claims
- Review adherence information during visits. Patients' knowing that a clinician is monitoring adherence is at least as important as a patient seeing the results

In addition, patient-specific tailored approaches to identifying reasons for nonadherence and aligning intervention efforts to address identified needs are needed. Outcomes might also be improved by recognizing populations at increased risk for nonadherence and addressing the broader reasons for their nonadherence, such as low health literacy. Health literacy is lower among the elderly, racial and ethnic minorities, and persons living in poverty (*22*). Interventions to improve medication adherence could be more effective if patient's health literacy, cultural background, and language preference and proficiency are taken into account when designing communication and patient education materials.

Conclusion and Comments

Medication adherence is critical to improving chronic disease outcomes and reducing health care costs. Successful strategies to improve medication adherence include 1) ensuring access to providers across the continuum of care and implementing

team-based care; 2) educating and empowering patients to understand the treatment regimen and its benefits; 3) reducing barriers to obtaining medication, including cost reduction and efforts to retain or re-engage patients in care; and 4) use of health information technology tools to improve decision-making and communication during and after office visits. Understanding root causes of medication nonadherence and cost-effective approaches that are applicable in diverse patient populations is essential to increasing adherence and improving long-term health impact.

Conflict of Interest

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Global Routine Vaccination Coverage, 2016

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The *Global Vaccine Action Plan 2011–2020* (GVAP) (*1*), endorsed by the World Health Assembly in 2012, calls on all countries to reach ≥90% national coverage for all vaccines in the country's routine immunization schedule by 2020. CDC and the World Health Organization (WHO) evaluated the WHO and United Nations Children's Fund (UNICEF) global vaccination coverage estimates to describe changes in global and regional coverage as of 2016. Global coverage estimates for the third dose of diphtheria and tetanus toxoids and pertussis–containing vaccine (DTP3), the third dose of polio vaccine, and the first dose of measles-containing vaccine (MCV1) have ranged from 84% to 86% since 2010. The dropout rate (the proportion of children who started but did not complete a vaccination series), an indicator of immunization program performance, was estimated to be 5% in 2016 for the 3-dose DTP series, with dropout highest in the African Region (11%) and lowest in the Western Pacific Region (0.4%). During 2010–2016, estimated global coverage with the second MCV dose (MCV2) increased from 21% to 46% by the end of the second year of life and from 39% to 64% when older age groups (3–14 years) were included (*2*). Improvements in national immunization program performance are necessary to reach and sustain high vaccination coverage to increase protection from vaccine-preventable diseases for all persons.

In 1974, the World Health Organization (WHO) established the Expanded Program on Immunization to ensure that all children have access to four routinely recommended vaccines that protect against six diseases (*3*): bacillus Calmette-Guérin vaccine (to protect against tuberculosis), polio, MCV, and DTP. WHO and UNICEF derive national coverage estimates through an annual country-by-country review of all available data, including administrative and survey-based coverage (*4*,*5*). Typically, only doses administered through routine immunization visits are counted.* This report updates a previous report (*6*) and presents global, regional, and national vaccination coverage estimates and trends as of 2016. It also estimates the proportion of surviving infants who did not receive any DTP doses (referred to as 'left-out') and the proportion that received 1 or 2 doses of DTP, but did not receive the third dose of DTP (dropped out), using the DTP 3-dose series as an indicator of overall program performance (*3*,*4*).

Globally, 116.5 million children received DTP3 in 2016 compared with 24.2 million in 1980 (Figure), a 300% increase in global DTP3 coverage from 21% to 86%. In 2016, DTP3 coverage ranged from 74% in the WHO African Region to 97% in the Western Pacific Region (Table 1). In all regions, DTP3 coverage has remained stable or increased during 2015–2016. National DTP3 coverage estimates varied from 19% to 99%. Overall, 130 (67%) of 194 countries achieved ≥90% national DTP3 coverage in 2016, an increase from 128 (66%) countries the previous year (*2*). National DTP3 coverage was 80%–89% in 29 countries, 70%–79% in 15 countries and <70% in 20 countries. Among the 19.5 million children worldwide who did not receive 3 DTP doses during the first year of life, 11.8 million (61%) lived in 10 countries: Nigeria (18%), India (16%), Pakistan (7%), Indonesia (6%), Ethiopia (4%), the Democratic Republic of the Congo (3%), Iraq (3%), Angola (2%), Brazil (1%), and South Africa (1%).

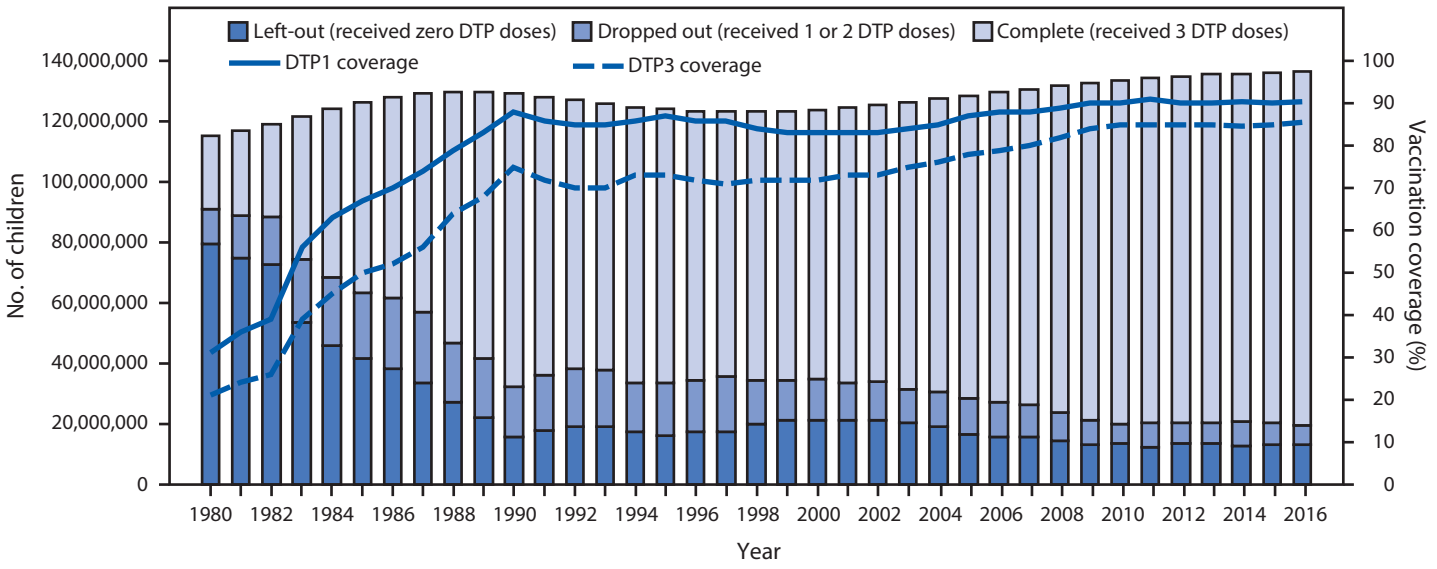
Among approximately 20 million children who did not complete the 3-dose DTP series in 2016, 12.9 million (66%) did not receive any DTP doses, a decrease from 79.4 million in 1980, and 6.6 million (34%) started, but dropped out and did not complete the DTP series (Figure). The largest proportions of infants who were left out were in the WHO African (17%) and Eastern Mediterranean (15%) Regions (Table 2). National DTP1 to DTP3 dropout rates varied from 0% to 55%, with highest dropout in the African Region (11%) and lowest in the Western Pacific Region (0.4%) (Table 2).

MCV1 coverage in 2016 ranged from 72% in the African Region to 96% in the Western Pacific Region (Table 1) and from 20% to 99% by country. During 2015–2016, MCV1 coverage has remained stable or increased in all regions. Globally, 123 (63%) countries achieved the GVAP 2020 target of ≥90% national MCV1 coverage (*7*).

MCV2 coverage by WHO region varied from 24% (African Region) to 93% (Western Pacific Region), including countries that have not yet introduced MCV2 (Table 1). In four of six WHO regions (African, Region of the Americas, Eastern

* For a given vaccine, the administrative coverage is the number of vaccine doses administered to persons in a specified target group divided by the estimated target population. Doses administered through routine immunization visits are counted, but doses administered through supplemental immunization activities (mass campaigns), usually are not. During vaccination coverage surveys, a representative sample of households is visited, and caregivers of children in a specified target age group (e.g., aged 12–23 months) are interviewed. Dates of vaccination are transcribed from the child's home-based record, recorded based on caregiver recall, or transcribed from health facility records. Survey-based vaccination coverage is calculated as the proportion of persons in a target age group who received a vaccine dose.

FIGURE. Coverage with the first and third doses of diphtheria and tetanus toxoids and pertussis–containing vaccine (DTP1 and DTP3) and the number of children who were left out (received no DTP doses), dropped out (received 1 or 2 DTP doses), or completed 3 DTP doses — worldwide, 1980–2016



Mediterranean, and South-East Asia), MCV2 coverage increased in 2016 compared with 2015, because of both an increase in coverage in multiple countries, as well as an increase in the number of countries introducing MCV2. Globally, MCV1 coverage was 85% and MCV2 coverage was 64% in 2016 (estimated dropout = 21%). MCV1 to MCV2 difference was highest in the African Region (48%) and lowest in the Western Pacific Region (3%) (Table 2). This difference represents both lack of MCV2 introduction (34 countries not yet introduced) and differences in program performance.

Among new and underused vaccines, global coverage increased during 2010–2016 for completed series[†] of rotavirus vaccine (8% to 25%), pneumococcal conjugate vaccine (PCV) to prevent infections with *Streptococcus pneumoniae* (11% to 42%), rubella vaccine (35% to 47%), *Haemophilus influenzae* type b (Hib) vaccine (42% to 70%), and hepatitis B vaccine (74% to 84%) (Table 1), as a result of improvements in national coverages rates and new country introductions.

Discussion

Substantial progress in global routine vaccination coverage has been made since 1974, even as the population of surviving infants has increased. As a result, approximately 123 million children, 91% of the global population of surviving infants, received at least 1 dose of DTP vaccine during their first year of life in 2016, and nearly 117 million (86%) completed the DTP series. However, 64 (33%) countries still have not met the GVAP target of ≥90% national DTP3 coverage, and 71 countries (37%) have not reached the 2012–2020 *Global Measles and Rubella Strategic Plan* target of ≥90% national MCV1 coverage (*7*). Moreover, DTP3 and MCV1 coverage rates have remained stagnant since 2010 (*2*). Among the eight countries with DTP3 coverage <50% in 2016 (Central African Republic, Chad, Equatorial Guinea, Nigeria, Somalia, South Sudan, Syria, and Ukraine), nearly all are in conflict or facing serious economic turmoil. Consequently, maintaining coverage with existing vaccines and introducing new vaccines in these countries is particularly challenging.

In light of these challenges, improving initiation of vaccination and completion of the series for all recommended vaccines is an integral step toward improving vaccination coverage globally, particularly in the WHO African, Eastern Mediterranean, and South-East Asia Regions. In these three regions in 2016, 11 million infants did not receive their first dose of DTP vaccine, and 18 million did not receive their first dose of MCV. Six million infants started the DTP series but did not complete it, and 22 million started, but did not complete the MCV series (Table 2). Ensuring that these infants receive the full number of doses of recommended vaccines will be critical to preventing early childhood mortality and morbidity during adolescence and adulthood, and it will provide indirect protection to the whole community.

The findings in this report are subject to at least two limitations. First, numerator and denominator biases might be present because of outdated national census and limited vaccination coverage reporting capabilities at lower administrative levels, which might result in overestimates or underestimates of

[†] Two rotavirus vaccines are currently licensed; the monovalent vaccine is administered as a 2-dose series, and the pentavalent vaccine is administered as a 3-dose series.

TABLE 1. Vaccination coverage, by vaccine and World Health Organization region — worldwide, 2016

Vaccine	No. (%) countries with vaccine in schedule	% Coverage,* by region						
		Global (all regions)	African	Americas	Eastern Mediterranean	European	South-East Asia	Western Pacific
BCG	158 (81)	**88**	81	95	87	91	89	95
HepB BD	84 (43)	**39**	10	66	22	39	34	83
HepB3	185 (95)	**84**	74	89	80	81	88	92
DTP3	194 (100)	**86**	74	91	80	92	88	97
Hib3	191(98)	**70**	74	90	80	77	80	28
Pol3	194(100)	**85**	73	92	80	94	87	95
Rota last	84 (43)	**25**	43	74	23	23	3	2
PCV3	129 (66)	**42**	65	84	48	62	9	14
MCV1	194 (100)	**85**	72	92	77	93	87	96
RCV1	151(78)	**47**	13	92	46	93	15	96
MCV2	160 (82)	**64**	24	54	69	88	75	93

Abbreviations: BCG = Bacillus Calmette-Guérin vaccine; DTP3 = third dose of diphtheria and tetanus toxoids and pertussis vaccine; HepB BD = birth dose of hepatitis B vaccine; HepB3 = third dose of hepatitis B vaccine; Hib3 = third dose of *Haemophilus influenzae* type b vaccine; MCV1 = first dose of measles-containing vaccine ; MCV2 = second dose of MCV; PCV3 = 3 doses of pneumococcal conjugate vaccine; Pol3 = third dose of polio vaccine; RCV1 = first dose of rubella-containing vaccine; Rota last = final dose of rotavirus vaccination series.

* BCG coverage based on 158 countries with BCG in the national schedule; coverage for all other vaccines based on 194 countries (global) or all countries in the specified region.

TABLE 2. Vaccination coverage and dropout proportions for diphtheria and tetanus toxoids and pertussis–containing vaccine and measles-containing vaccine, by World Health Organization (WHO) region — worldwide, 2016

WHO region	DTP1 coverage %	DTP1 left-out* % (No.)	DTP3 coverage %	DTP1 to DTP3 dropout† % (No.)	MCV1 coverage %	MCV1 left-out* % (No.)	MCV2 coverage§ %	MCV1 to MCV2 difference¶ % (No.)
Global (all regions)	91	9 (12.9M)	86	5 (6.6M)	85	15 (20.8M)	64	21 (29.1M)
African	83	17 (5.9M)	74	11 (3.1M)	72	28 (9.6M)	24	48 (16.2M)
Americas	95	5 (0.7M)	91	4 (0.6M)	92	8 (1.2M)	54	38 (6.0M)
Eastern Mediterranean	85	15 (2.5M)	80	6 (0.8M)	77	24 (3.9M)	69	8 (1.4M)
European	95	5 (0.5M)	92	3 (0.3M)	93	7 (0.8M)	88	5 (0.5M)
South-East Asia	93	7 (2.6M)	88	5 (1.6M)	87	13 (4.5M)	75	12 (4.3M)
Western Pacific	97	3 (0.7M)	97	0.4 (0.08M)	96	4 (0.9M)	93	3 (4.3M)

Abbreviations: DTP1 = first dose of diphtheria and tetanus toxoids and pertussis vaccine; DTP3 = third dose of DTP; MCV1 = first dose of measles-containing vaccine; MCV2 = second dose of MCV; M = million.

* Left-out = the proportion of surviving infants who did not receive any doses of the specified vaccine.

† Dropout = those who received 1 or 2 DTP doses but not the third dose of DTP.

§ Includes 34 countries that either have not introduced MCV2 or that do not report MCV2 coverage; 65% of these countries are located in the African Region.

¶ Difference = children who received MCV1 but not MCV2.

administrative vaccination coverage. Second, survey data might suffer from recall bias and the data might not be generalizable to the larger population (*4*).

Demographic barriers (minority ethnicity, parents' lack of education, and low socioeconomic status), populations living in difficult-to-reach areas, programmatic challenges such as vaccine stock-outs, and conflict continue to prevent certain children from receiving the benefits of being fully vaccinated (*8*). At district or country levels, program costs and insufficient political will also contribute to problems with vaccine access and completion of vaccination series (*9*). Strategies to improve vaccine accessibility (i.e., reducing the number of left-out children) might be different from those used to minimize dropout. To improve accessibility, steps are needed to ensure that hard-to-reach populations are identified and that vaccination sessions are made consistently accessible. Program managers need to use effective vaccine management practices to avoid stock-outs, and health workers need to be available and well trained to provide acceptable services to the community (*10*). To minimize dropouts, interventions might include promoting demand for vaccination, particularly in culturally hard-to-reach populations; provider communication to caregivers about the benefits of vaccines and addressing any vaccine safety concerns; reminder or recall strategies to ensure that caregivers return for future vaccinations, and defaulter tracking strategies to identify children who have failed to return for a recommended vaccination. Improving both initiation of vaccination and completion of the series is essential for establishing sustainable national immunization programs and to eliminating preventable diseases and deaths among children.

Summary

What is already known about this topic?

In 1974, the World Health Organization (WHO) established the Expanded Program on Immunization to ensure that all children have access to routinely recommended vaccines. Since then, global coverage with vaccines to prevent tuberculosis, diphtheria, tetanus, pertussis, poliomyelitis, and measles has increased from <5% to ≥85% and additional vaccines against hepatitis B, *Haemophilus influenzae* type B, *Streptococcus pneumoniae*, rotavirus, and rubella have been included in vaccine recommendations introduced in multiple countries.

What is added by this report?

Global coverage with the third dose of diphtheria and tetanus toxoids and pertussis–containing vaccine, the third dose of polio vaccine, and first dose of measles-containing vaccine coverage has remained unchanged at 84%–86% since 2010. Among new or underused vaccines, global coverage increased during 2010–2016 for completed vaccine series against rotavirus (8% to 25%), *Streptococcus pneumoniae* (11% to 42%), rubella (35% to 47%), *Haemophilus influenzae* type B (42% to 70%) and hepatitis B vaccine (74% to 84%). Vaccination coverage varies widely across WHO regions, countries, and districts, with decreased access to vaccination and completion of vaccination series in low-income countries and conflict areas compared with that in other countries.

What are the implications for public health practice?

Since 1974, there has been substantial progress in global vaccination; however, in recent years, coverage rates have remained static. This indicates the need to move beyond existing practices to improve access to vaccinations for hard-to-reach populations. Interventions include strengthening caregiver demand for vaccination, provider communication to caregivers about the benefits of vaccines and addressing any vaccine safety concerns; reminder or recall strategies to ensure caregivers return for future vaccinations, and defaulter tracking strategies to identify children who have failed to return for a recommended vaccination.

Conflict of Interest

No conflicts of interest were reported.

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Progress in Rubella and Congenital Rubella Syndrome Control and Elimination — Worldwide, 2000–2016

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Although rubella virus infection usually causes a mild fever and rash illness in children and adults, infection during pregnancy, especially during the first trimester, can result in miscarriage, fetal death, stillbirth, or infants with a constellation of congenital malformations known as congenital rubella syndrome (CRS) (*1*). Rubella is a leading vaccine-preventable cause of birth defects. Preventing these adverse pregnancy outcomes is the focus of rubella vaccination programs. In 2011, the World Health Organization (WHO) updated guidance on the preferred strategy for introduction of rubella-containing vaccine (RCV) into national immunization schedules and recommended an initial vaccination campaign, usually targeting children aged 9 months–14 years (*1*). The *Global Vaccine Action Plan 2011–2020* (GVAP), endorsed by the World Health Assembly in 2012, includes goals to eliminate rubella in at least five of the six WHO regions by 2020 (*2*). This report updates a previous report (*3*) and summarizes global progress toward rubella and CRS control and elimination from 2000 to 2016. As of December 2016, 152 (78%) of 194 countries had introduced RCV into the national immunization schedule, representing an increase of 53 countries since 2000, including 20 countries that introduced RCV after 2012.

Reported rubella cases declined 97%, from 2000 (670,894 cases in 102 countries) to 2016 (22,361 cases in 165 countries). The Region of the Americas has achieved rubella and CRS elimination (verified in 2015). Rubella and CRS elimination goals have been set by the European Region (target date: 2015) and Western Pacific Region (target date to be determined), whereas the South-East Asia Region has a rubella and CRS control target. Neither the African Region nor the Eastern Mediterranean Region has set regional rubella goals or targets. To achieve the 2020 GVAP rubella elimination goals, RCV introduction needs to continue when country criteria indicating readiness for introduction are met, and rubella and CRS surveillance needs to be strengthened to ensure that progress toward elimination targets are measured. Because rubella cases are detected through measles surveillance, and because rubella vaccine is usually delivered as a combined measles-rubella vaccine, elimination activities for both diseases are programmatically linked, and measles elimination activities can be leveraged to support rubella elimination.

Rubella and CRS surveillance are necessary to assess disease burden before RCV introduction, to monitor disease burden and epidemiology after introduction, to identify pregnant women infected with rubella virus who require follow-up to assess pregnancy outcomes, and to identify, diagnose, and manage CRS-affected infants. Countries report information on immunization schedules, vaccination campaigns, number of vaccine doses administered through routine immunization services, and other WHO monitoring data (*4*) to WHO and the United Nations Children's Fund (UNICEF) each year using the Joint Reporting Form (JRF). Surveillance data, including number of cases of rubella and CRS, are also reported to WHO and UNICEF through the JRF using standard case definitions (*5*). For this report, JRF data from the period 2000–2016 were analyzed; analyses focused on data from 2000 (initiation of accelerated measles control activities), 2012 (the new phase of rubella elimination), 2014 (the last worldwide update), and 2016 (the most recent data available).

Immunization Activities

Global coverage with RCV increased from 21% in 2000 to 40% in 2012 and to 47% in 2016. In 2000, just over half (99, 51%) of countries had introduced RCV into their immunization schedule; by the end of 2012, more than two thirds (132, 68%) of countries were using RCV. By 2014, at the time of the last worldwide update (*3*), eight additional countries introduced RCV, bringing the total number of countries using RCV to 140 (72%). At that time, 44 of the 54 countries that had not yet introduced RCV were eligible for support from Gavi, the Vaccine Alliance (Gavi).* During 2015–2016, 12 of these 54 countries introduced RCV, so that by the end of 2016, RCV had been introduced into the routine immunization schedule in 152 (78%) countries, including 13 (28%) in the African Region, 16 (76%) in the Eastern Mediterranean Region, eight (73%) in the South-East Asia Region, and all 115 countries in the Region of the Americas, European Region, and Western Pacific Region (Table 1). Among the 12 countries that introduced RCV during 2015–2016, six received Gavi support for the introduction, and six (among the 10 countries not eligible for Gavi support) introduced the vaccine using other support (Figure) (Table 2).

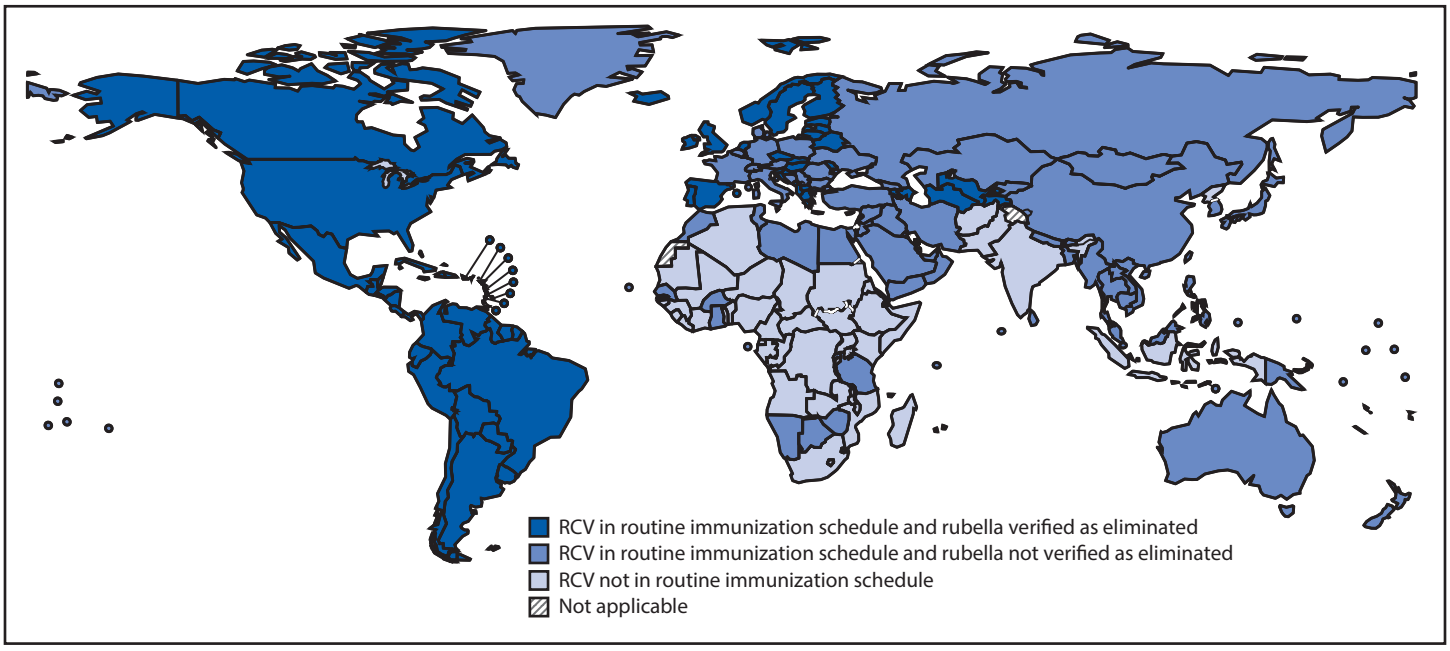
*Four countries that had recently increased income levels above the support threshold applied and were accepted for Gavi immunization services support, but did not introduce RCV by the end of 2016.

TABLE 1. Global progress in rubella and congenital rubella syndrome (CRS) control and elimination — World Health Organization (WHO) Regions, 2000, 2012, and 2016

Characteristic	WHO region (No. of countries)						
	AFR (47)	AMR (35)	EMR (21)	EUR (53)	SEAR (11)	WPR (27)	Worldwide (194)
Regional rubella/CRS target	None	Elimination	None	Elimination	Control	Elimination	None
No. of countries with RCV in schedule							
2000	2	31	12	40	2	12	99
2012	3	35	14	53	5	22	132
2016	13	35	16	53	8	27	152
Regional rubella vaccination coverage (%)							
2000	0	85	23	60	3	11	21
2012	0	94	38	95	5	86	40
2016	13	92	46	93	15	96	47
No. of countries reporting rubella cases							
2000	7	25	11	41	3	15	102
2012	41	35	19	47	11	23	176
2016	44	30	18	45	11	17	165
No. of reported rubella cases							
2000	865	39,228	3,122	621,039	1,165	5,475	670,894
2012	10,850	15	1,681	30,579	6,877	44,275	94,277
2016	4,157	1	2,037	359	10,361	5,446	22,361
No. of countries reporting CRS cases							
2000	3	18	6	34	2	12	75
2012	20	35	9	43	6	17	130
2016	21	30	10	42	10	12	125
No. of reported CRS cases							
2000	0	80	0	47	26	3	156
2012	69	3	20	62	14	134	302
2016	14	0	9	6	319	19	367

Abbreviations: AFR = African Region; AMR = Region of the Americas; CRS = congenital rubella syndrome; EMR = Eastern Mediterranean Region; EUR = European Region; RCV = rubella-containing vaccine; SEAR = South-East Asia Region; WPR = Western Pacific Region.

FIGURE. Rubella-containing vaccine (RCV) introduction and status of rubella elimination,* by country — World Health Organization, 2016



* Only the European Region and the Region of the Americas had established a process for verifying rubella elimination by July 2017.

TABLE 2. Characteristics of rubella-containing vaccine introduction by 12 countries that introduced the vaccine during 2015–2016 — World Health Organization (WHO)

Country	WHO region	Year RCV introduced into routine schedule*	Introductory vaccination campaign*					Gavi support status for introduction
			Year	Target age group	Target population	% vaccination coverage by report	% vaccination coverage by survey	
Botswana	AFR	2016	2016	9 mos–14 yrs	706,504	95	97	No
Burkina Faso	AFR	2015	2014	9 mos–14 yrs	8,481,625	106†	Not reported	Yes
Burma	SEAR	2015	2015	9mos–14 yrs	13,160,764	94	Not done	Yes
Namibia	AFR	2016	2016	9 mos–39 yrs	1,859,857	103†	Not done	No
Papua New Guinea	WPR	2015	2015–2016	9 mos–14 yrs	1,976,335	63	Not done	Yes
Sao Tome and Principe	AFR	2016	2016	9 mos–14 yrs	72,449	107†	Not done	No
Swaziland	AFR	2016	2016	9 mos–14 yrs	412,874	90	94	No
Timor-Leste	SEAR	2016	2015	6 mos–14 yrs	501,832	97	95	No
Vanuatu	WPR	2015	2015	1–14 yrs	103,676	98	Not done	No
Vietnam	WPR	2015	2014–2015	1–14 yrs	19,740,181	98	Not done	Yes
Yemen	EMR	2015	2014	9 mos–14 yrs	11,368,968	85	Not done	Yes
Zimbabwe	AFR	2015	2015	9 mos–14 yrs	5,203,976	103†	Not done	Yes

Abbreviations: AFR = African Region; EMR = Eastern Mediterranean Region; Gavi = Gavi, the Vaccine Alliance; RCV = Rubella-containing vaccine; SEAR = South-East Asia Region; WHO = World Health Organization; WPR = Western Pacific Region.

* Introductory campaigns and introduction of the vaccine into the routine schedule can occur in different years, with introduction recommended to occur immediately following the campaign.

† Values >100% indicate that the intervention reached more persons than the estimated target population.

Routine administration of RCV is recommended with the first routine dose of measles-containing vaccine (MCV1) (i.e., as a combination vaccine or simultaneously, at the same visit); this recommendation has been implemented in 144 (95%) of the 152 countries that have introduced the vaccine. Based on individual countries' MCV vaccination schedules, the first RCV dose is scheduled at age 8–11 months in 27 (18%) countries and at age 12–18 months in 125 (83%) countries. RCV is provided as a combination vaccine with measles vaccine in 30 (20%) countries and combined with measles and mumps vaccine (with or without varicella vaccine) in 122 (80%) countries; one country administers rubella vaccine simultaneously with combined measles and mumps vaccine.

Surveillance Activities

During 2000–2016, the number of countries reporting rubella cases (including those reporting zero cases) increased 42%, from 102 in 2000 to 176 in 2012, but the number of reporting countries declined 6%, to 165 in 2016 (Table 1). The number of countries reporting CRS cases increased 42%, from 2000 (75 countries) to 2012 (130), then decreased 4% to 125 countries in 2016. The number of reported CRS cases reported increased, especially in the South-East Asia Region, with the establishment of CRS surveillance systems. Among all 152 countries where RCV had been introduced by December 2016, 126 (83%) reported rubella data, and 110 (72%) reported CRS data.

In 2016, 22,361 rubella cases were reported to WHO, a 97% decrease from 670,894 cases reported in 2000, and a 76% decrease from 94,277 cases reported in 2012 (Table 1). Two regions (Region of the Americas and European Region) have regional verification commissions to verify rubella elimination. In the Region of the Americas, the last endemic rubella and CRS cases were reported in 2009, and the region was verified free of endemic rubella virus transmission in April 2015 (*6*). In the European Region, 33 (62%) of 53 countries were declared free of endemic rubella virus transmission in 2016.

The number of rubella virus genotype sequences identified globally from reported rubella cases increased from 33 sequences submitted by six countries in 2000, to 137 sequences submitted by 21 countries in 2012, to 188 sequences submitted by 16 countries in 2016. Of the 13 known genotypes of rubella virus, three genotypes were detected circulating in 2016.

Discussion

In 2011, a new phase of accelerated rubella control and CRS prevention began, with updated WHO guidance for RCV introduction, Gavi funding for RCV introduction in eligible countries, and establishment of rubella elimination goals in the GVAP. Taking advantage of these opportunities and leveraging measles elimination activities, RCV has been introduced into the national immunization schedules in 53 countries since 2000; 20 (37%) of these countries introduced the vaccine during 2013–2016. By the end of 2016, with technical and financial support from partners, 78% of all countries globally had introduced RCV into their national immunization schedules, advancing progress toward elimination. Although more than three fourths of countries have introduced RCV, because of differences in country population sizes, less than half (47%) of infants worldwide are vaccinated against rubella.

Among the 42 countries that have not yet introduced RCV, nine have not achieved >80% coverage with MCV through routine immunization services or vaccination campaigns, which is a prerequisite to ensure safe RCV introduction (*1*);

therefore, these nine countries need to improve routine immunization services and vaccination campaign quality. Among countries that have achieved at least 80% MCV1 coverage and are deciding whether to introduce RCV, country-specific data on CRS burden is often requested by national advisory groups or program managers to provide justification for long-term sustainable financing of RCV. Among middle-income countries that do not receive significant donor support, the financial sustainability of inclusion of RCV in the national immunization schedule is especially important to determine before embarking on introduction. Once RCV is introduced, optimizing its use is essential to reaching regional and national rubella and CRS control or elimination targets. Among the 152 countries that have introduced RCV, the vaccine was administered with MCV1 in 144 (95%) countries, facilitating the highest possible RCV coverage. In resource-limited settings, identification of the appropriate target age groups is critical to ensure reaching rubella and measles elimination goals, beginning with an introductory RCV mass vaccination campaign.

Progress toward achieving the GVAP goal of rubella elimination in five of the six WHO regions by 2020 is not on track. To achieve this goal, the three regions with elimination targets need to interrupt transmission (European and Western Pacific regions) and maintain elimination (Region of the Americas), and two of three regions will need to establish and achieve the elimination target (African, Eastern Mediterranean, and South-East Asia regions). Challenges to achieving rubella elimination goals include civil unrest that limits vaccine delivery, transmission in older populations, vaccine hesitancy in subpopulations, and weak health care service delivery with low routine vaccination coverage (*7*).

Optimal surveillance for rubella and CRS is essential to monitor the impact of rubella vaccine introduction and to verify progress toward rubella and CRS elimination goals (*8*). This requires case-based surveillance, with all cases of febrile rash illness having serum specimens tested to determine if they are measles, rubella, or neither, as well as collecting oropharyngeal specimens to identify the rubella genotypes circulating worldwide. Outbreak investigations can identify immunity gaps, and responses can be targeted to interrupt transmission and achieve and maintain elimination. Surveillance for rubella and CRS and findings from outbreak investigations guide program managers to monitor progress, focus resources to address gaps, and document elimination.

The findings in this report are subject to at least one limitation. The quality of surveillance for rubella is suboptimal. Although rubella and measles surveillance are integrated, rubella generally is a milder disease than measles, and infection is subclinical in 30%–50% of cases (*1*); therefore surveillance is much less likely to detect rubella than measles. Despite use of standard case definitions, surveillance quality varies among countries, limiting comparisons of surveillance data. Because integrated surveillance for measles and rubella is less sensitive for rubella, surveillance for CRS serves to complement the data to improve the monitoring of rubella disease.

The increase in the number of countries introducing RCV into national immunization schedules and eliminating endemic rubella virus transmission and the achievement of rubella elimination in the Region of the Americas, demonstrate progress toward global rubella control and elimination goals. Rubella and measles elimination efforts are synergistic; for example, RCV introduction catch-up campaigns, using a combined measles-rubella vaccine, also address measles immunity gaps. The path forward to reach regional rubella elimination goals is highlighted in recommendations from the Measles and Rubella Global Strategic Plan 2012–2020 Midterm Review (*7*) and requires continued improvement of routine immunization services, vaccination campaign quality, and rubella and CRS surveillance.

Summary

What is already known about this topic?

Rubella virus infection is a leading vaccine-preventable cause of birth defects. In 2011, the World Health Organization (WHO) updated guidance on the preferred strategy for introduction of rubella-containing vaccine into national routine immunization schedules, including an initial vaccination campaign for children aged 9 months–14 years. Global immunization partners have set targets to eliminate rubella and congenital rubella syndrome in at least five of the six WHO regions by 2020.

What is added by this report?

During 2000–2106, rubella-containing vaccine was introduced in 53 countries, including 20 introductions after 2012. By December 2016, 152 (78%) of 194 countries were using the vaccine. These introductions and increased rubella vaccine coverage globally resulted in a decrease in reported rubella cases from 670,894 cases in 2000, to 94,277 cases in 2012, to 22,361 cases in 2016. Elimination of rubella and congenital rubella syndrome was verified in the WHO Region of the Americas in 2015, and 33 (62%) of 53 countries in the European Region have now eliminated endemic rubella and congenital rubella syndrome.

What are the implications for public health practice?

To accelerate rubella elimination and control goals, a strong commitment to introduce rubella-containing vaccine and to achieve high rubella vaccination coverage in routine immunization services is needed in all countries. Countries and international partners should use the opportunity of measles elimination activities to achieve rubella elimination, through continued improvement of routine immunization services, vaccination campaign quality, and rubella and congenital rubella syndrome surveillance.

Conflict of Interest

No conflicts of interest were reported.

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Announcement

World Day of Remembrance for Road Traffic Victims — November 19, 2017

In October 2005, the United Nations General Assembly adopted a resolution to mark the third Sunday in November each year as World Day of Remembrance for Road Traffic Victims to honor persons killed or injured in road crashes, recognize their families and communities, and pay tribute to the emergency crews, police, and medical professionals who deal with the traumatic aftermath of road deaths and injuries.*

Road traffic injuries are the ninth leading cause of death worldwide and the leading cause of death among persons aged 15–29 years (*1*). Approximately 1.25 million persons die each year on the world's roads, and 20 million to 50 million sustain nonfatal injuries (*1*). Although 90% of road traffic deaths occur in low-income and middle-income countries (*1*), approximately 100 persons die and thousands more are injured in motor vehicle crashes every day in the United States (*2*).

A 2016 CDC study found that, among 19 high-income countries, the United States had the most motor vehicle crash deaths per 100,000 persons and per 10,000 registered vehicles, the second highest percentage of deaths involving alcohol-impaired driving, and the third lowest use of front seat belts (*3*). Recent trends do not show evidence of improvement. In 2016, a total of 37,461 persons were killed in road traffic crashes in the United States, a 5.6% increase from 2015 (*2*).

The U.S. Department of Transportation and the National Safety Council have joined with partners, including CDC, to launch the Road to Zero Coalition, with the goal of eliminating U.S. traffic deaths by 2050 (*4*). In the United States alone, implementing proven effective strategies to prevent road traffic deaths can save thousands of lives and hundreds of millions of dollars (*3*). A new Road Safety Annual Report released by the Organisation for Economic Co-operation and Development provides a global perspective. It outlines specific recommendations, potential numbers of lives saved, and potential economic losses prevented in International Road Traffic and Accident Database member and observer countries (*5*).

CDC supports United Nations and World Health Organization measures to dedicate 2011–2020 as the Decade of Action for Road Safety. The program was launched in May 2011 in approximately 100 countries, with the goal of preventing 5 million road traffic deaths globally by 2020. The United Nations is committed to measures to halve the number of global road traffic deaths and injuries by 2020 as one of its Sustainable Development Goals (http://www.un.org/sustainabledevelopment/sustainable-development-goals/). Strategies to support victims and survivors and a guide for nongovernmental organizations are available at http://www.who.int/violence_injury_prevention/publications/road_traffic/ngo_guide/en/.

* https://www.worlddayofremembrance.org.

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Errata

Vol. 66, No. SS-19

In the Surveillance Summary "Illicit Drug Use, Illicit Drug Use Disorders, and Drug Overdose Deaths in Metropolitan and Nonmetropolitan Areas — United States," on page 8, the title of Table 2 should have read "**TABLE 2. Number and age-adjusted rate per 100,000 persons for drug overdose deaths, by sex, race/ethnicity, intent of death, and age group, for metropolitan and nonmetropolitan counties of residence — National Vital Statistics System, United States, 1999–2015.***"

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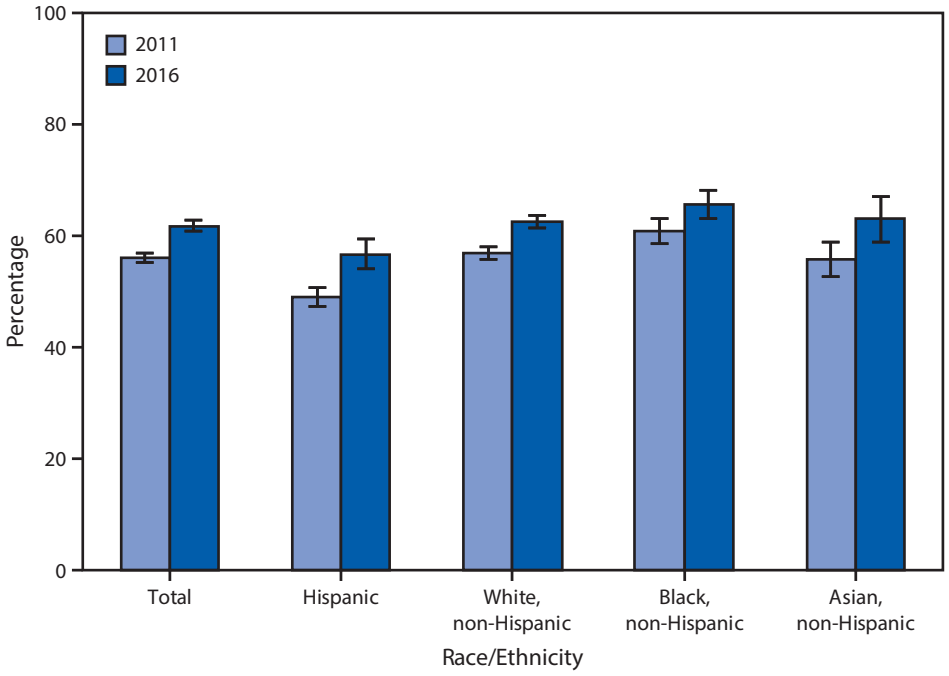
In the report "Rapid Laboratory Identification of *Neisseria meningitidis* Serogroup C as the Cause of an Outbreak — Liberia, 2017," on page 1145, the figure title was not included in the printed version of this report. The figure title should have read "**FIGURE. Date of onset of outbreak cases (N = 31), by laboratory and outcome status — Liberia, 2017.***"

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults Aged 20–64 Years Whose Blood Cholesterol Was Checked by a Health Professional in the Past 12 Months,† by Race/Ethnicity§ — National Health Interview Survey,¶ United States, 2011 and 2016



* With 95% confidence intervals shown with error bars.
† Based on a positive response to the question "During the past 12 months, have you had your blood cholesterol checked by a doctor, nurse, or other health professional?"
§ Categories shown are for non-Hispanic respondents who selected one racial group; respondents had the option to select more than one racial group. Hispanic origin refers to persons who are of Hispanic ethnicity and might be of any race or combination of races. Only selected individual groups shown in graph. Total bar based on all adults aged 20–64 years.
¶ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population and are derived from the National Health Interview Survey Sample Adult component.

The percentage of adults aged 20–64 years who had a blood cholesterol check by a health professional in the past 12 months increased from 56.0% in 2011 to 61.7% in 2016. From 2011 to 2016, there was an increase in the percentage of adults with a blood cholesterol check among Hispanic (49.0% to 56.7%), non-Hispanic white (56.8% to 62.5%), non-Hispanic black (60.8% to 65.6%), and non-Hispanic Asian (55.8% to 63.0%) persons. In both years, non-Hispanic black adults were more likely than non-Hispanic white adults to have had a blood cholesterol check, and Hispanic adults were the least likely to have had a blood cholesterol check.

Source: National Health Interview Survey, 2011 and 2016 data. https://www.cdc.gov/nchs/nhis.htm.

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