Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Weekly / Vol. 64 / No. 26
July 10, 2015

Adults Meeting Fruit and Vegetable Intake Recommendations — United States, 2013

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Eating more fruits and vegetables adds nutrients to diets, reduces the risk for heart disease, stroke, and some cancers, and helps manage body weight when consumed in place of more energy-dense foods (*1*). Adults who engage in <30 minutes of moderate physical activity daily should consume 1.5–2.0 cup equivalents of fruit and 2–3 cups of vegetables daily.* However, during 2007–2010, half of the total U.S. population consumed <1 cup of fruit and <1.5 cups of vegetables daily; 76% did not meet fruit intake recommendations, and 87% did not meet vegetable intake recommendations (*2*). Although national estimates indicate low fruit and vegetable consumption, substantial variation by state has been observed (*3*). Fruit and vegetable intake information from the Behavioral Risk Factor Surveillance System (BRFSS) is the sole source of dietary surveillance information for most states, but frequency of intake captured by BRFSS is not directly comparable to federal intake recommendations, which are expressed in cup equivalents. CDC analyzed median daily frequency of fruit and vegetable intake based on 2013 BRFSS data for the 50 states and the District of Columbia (DC) and applied newly developed prediction equations to BRFSS to calculate the percentage of each state's population meeting fruit and vegetable intake recommendations. Overall, 13.1% of respondents met fruit intake recommendations, ranging from 7.5% in Tennessee to 17.7% in California, and 8.9% met vegetable recommendations, ranging from 5.5% in Mississippi to 13.0% in California. Substantial new efforts are needed to build consumer demand for fruits and vegetables through competitive pricing, placement, and promotion in child care, schools, grocery stores, communities, and worksites.

BRFSS is an ongoing state-based random-digit–dialed telephone survey of noninstitutionalized, civilian adults aged ≥18 years residing in the United States. BRFSS collects data on health risk behaviors and conditions, chronic diseases and conditions, access to health care, and use of preventive health services and practices related to the leading causes of death and disabilities in the United States (*4*). BRFSS asks respondents how many times per day, week, or month they consumed 100% fruit juice, whole fruit, dried beans, dark green vegetables, orange vegetables, and other vegetables over the previous month as part of the rotating core questionnaire administered every other year. For these analyses, respondents were excluded if they did not reside in the 50 states or DC, were missing responses to one or more questions, or had implausible reports of fruit or vegetable intake (reported eating fruit >16 times per day or vegetables >23 times per day) (*5*); after excluding these 118,193 (24%) respondents, the resulting analytic sample size was 373,580. The 2013 median American Association of Public Opinion Research response rate across the 50 states and DC was 45.9%.

*Those who are more physically active might be able to consume more while staying within calorie needs. Additional information available at http://www.choosemyplate.gov/printpages/MyPlateFoodGroups/Fruits/food-groups.fruits-amount.pdf and http://www.choosemyplate.gov/printpages/MyPlateFoodGroups/Vegetables/food-groups.vegetables-amount.pdf.

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Intake recommendations appropriate for adults who engage in <30 minutes of moderate physical activity daily are based on the *Dietary Guidelines for Americans* (*1*) and are expressed in cup equivalents, whereas BRFSS captures frequency of intake. To estimate the percentage of each state's population meeting fruit and vegetable intake recommendations, previously developed prediction equations were applied to the frequency of intake data from BRFSS (*6*); these analyses are fully described elsewhere (*6*). In summary, 24-hour dietary recall data from the National Health and Nutrition Examination Survey (NHANES) for the period 2007–2010 were used to fit age- and sex-specific logistic regression models that estimate probabilities of meeting recommendations as functions of reported daily frequency of consumption, race/ethnicity, and income-to-poverty ratio, adjusting for day-to-day dietary variation. Reported daily frequencies of fruit and vegetable intake from BRFSS were calculated by dividing weekly frequencies by seven, monthly frequencies by 30, and yearly frequencies by 365. BRFSS respondents' race/ethnicity (Hispanic, non-Hispanic black, and all others) and income-to-poverty ratio (<125%, 125%–349%, and ≥349%) were defined consistent with previous analyses (*6*). For income-to-poverty ratio, poverty was defined according to federal poverty guidelines.[†] Respondents' reported daily frequencies of fruit juice and whole fruit intake, race/ethnicity, and income-to-poverty ratio were used as predictors in the models to estimate each respondent's predicted probability of meeting the fruit intake recommendations. Reported daily intake frequencies of dried beans, dark green vegetables, orange vegetables, and other vegetables, along with demographic information, were used as predictors in the models to estimate probabilities of meeting vegetable intake recommendations. Predicted probabilities were weighted and averaged across all respondents and in each state to obtain the percentage of each state's population meeting recommendations, using statistical software to account for the complex survey design. Balanced repeated replication technique, replicate weights, and Taylor linearization were used to compute standard errors and confidence intervals accounting for variation in the prediction models and BRFSS.

Median frequency of reported fruit intake across all respondents was once per day, ranging from 0.9 in Arkansas to 1.3 times per day in California (Table). Median frequency of reported vegetable intake was 1.7 times per day, ranging from 1.4 in Louisiana, Mississippi, and North Dakota to 1.9 times per day in California and Oregon. Based on prediction equations, 13.1% of respondents met fruit recommendations, and 8.9% met vegetable recommendations. The percentage of state populations meeting recommendations for fruits ranged from 7.5% in Tennessee to 17.7% in California, and for vegetables, from 5.5% in Mississippi to 13.0% in California.

[†] Additional information available at http://aspe.hhs.gov/poverty/13poverty.cfm.

The *MMWR* series of publications is published by the Center for Surveillance, Epidemiology, and Laboratory Services, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30329-4027.

Suggested citation: [Author names; first three, then et al., if more than six.] [Report title]. MMWR Morb Mortal Wkly Rep 2015;64:[inclusive page numbers].

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TABLE. State-specific frequency of fruit and vegetable intake among adults aged ≥18 years and percentage of respondents meeting federal fruit and vegetable intake recommendations — Behavioral Risk Factor Surveillance System, United States, 2013*

State†	No. in sample§	Median times consumed daily		% of respondents meeting recommendations¶			
				Fruit		Vegetables	
		Fruit	Vegetables	%	(95% CI)	%	(95% CI)
Overall	373,580	1.0	1.7	13.1	(12.0–14.2)	8.9	(5.8–12.0)
Alabama	4,613	1.0	1.6	9.5	(7.8–11.2)	7.1	(3.8–10.4)
Alaska	3,825	1.0	1.8	13.5	(11.4–15.6)	10.5	(6.2–14.8)
Arizona	3,269	1.0	1.6	12.5	(10.2–14.8)	9.8	(5.3–14.3)
Arkansas	3,914	0.9	1.5	9.4	(7.7–11.1)	7.5	(4.0–11.0)
California	9,011	1.3	1.9	17.7	(15.9–19.5)	13.0	(8.9–17.1)
Colorado	10,583	1.1	1.8	14.1	(12.5–15.7)	10.1	(6.4–13.8)
Connecticut	5,956	1.1	1.6	14.8	(12.9–16.7)	8.7	(5.1–12.3)
Delaware	4,015	1.0	1.5	12.8	(11.0–14.6)	7.5	(3.9–11.1)
District of Columbia	3,719	1.1	1.8	15.2	(12.9–17.5)	9.2	(4.7–13.7)
Florida	25,902	1.1	1.7	14.8	(13.2–16.4)	9.6	(6.3–12.9)
Georgia	5,993	1.0	1.6	11.7	(10.1–13.3)	8.1	(4.7–11.5)
Hawaii	6,549	1.0	1.7	12.4	(10.7–14.1)	10.2	(6.6–13.8)
Idaho	4,518	1.0	1.7	12.3	(10.3–14.3)	8.9	(4.9–12.9)
Illinois	5,016	1.1	1.6	14.6	(12.6–16.6)	8.7	(4.9–12.5)
Indiana	7,821	1.0	1.5	11.4	(9.9–12.9)	7.3	(4.0–10.6)
Iowa	6,500	1.0	1.5	11.3	(9.8–12.8)	6.6	(3.2–10.0)
Kansas	18,535	1.0	1.6	10.4	(9.2–11.6)	8.3	(5.0–11.6)
Kentucky	6,959	1.0	1.6	9.5	(8.0–11.0)	7.1	(3.7–10.5)
Louisiana	3,839	1.0	1.4	9.8	(8.0–11.6)	6.9	(3.3–10.5)
Maine	6,697	1.1	1.8	14.5	(12.7–16.3)	9.6	(6.4–12.8)
Maryland	9,817	1.1	1.7	13.2	(11.6–14.8)	8.4	(4.9–11.9)
Massachusetts	11,295	1.1	1.7	14.2	(12.6–15.8)	9.4	(5.9–12.9)
Michigan	10,263	1.0	1.6	12.7	(11.2–14.2)	7.7	(4.4–11.0)
Minnesota	11,491	1.0	1.6	12.5	(10.8–14.2)	7.9	(4.4–11.4)
Mississippi	5,567	1.0	1.4	9.9	(8.3–11.5)	5.5	(2.3–8.7)
Missouri	5,435	1.0	1.6	10.5	(8.9–12.1)	7.8	(4.2–11.4)
Montana	8,023	1.0	1.7	12.2	(10.6–13.8)	9.2	(5.6–12.8)
Nebraska	14,004	1.0	1.6	12.3	(10.7–13.9)	8.3	(4.8–11.8)
Nevada	3,957	1.0	1.7	14.0	(11.7–16.3)	10.3	(6.0–14.6)
New Hampshire	5,040	1.1	1.7	14.8	(12.8–16.8)	9.9	(6.3–13.5)
New Jersey	9,812	1.1	1.7	13.4	(11.9–14.9)	8.3	(5.0–11.6)
New Mexico	7,326	1.0	1.7	12.1	(10.5–13.7)	10.0	(6.0–14.0)
New York	6,796	1.1	1.7	15.5	(13.7–17.3)	8.8	(5.1–12.5)
North Carolina	6,396	1.0	1.7	10.3	(8.8–11.8)	7.2	(3.9–10.5)
North Dakota	6,206	1.0	1.4	11.4	(9.7–13.1)	6.4	(2.4–10.4)
Ohio	9,285	1.0	1.5	11.3	(9.8–12.8)	7.1	(3.9–10.3)
Oklahoma	6,594	1.0	1.5	8.2	(6.9–9.5)	5.8	(2.4–9.2)
Oregon	4,556	1.1	1.9	14.5	(12.5–16.5)	11.0	(7.1–14.9)
Pennsylvania	8,756	1.0	1.6	12.7	(11.1–14.3)	7.5	(4.3–10.7)
Rhode Island	4,878	1.1	1.7	13.9	(12.0–15.8)	8.7	(5.0–12.4)
South Carolina	8,224	1.0	1.6	11.6	(10.1–13.1)	6.8	(3.5–10.1)
South Dakota	5,398	1.0	1.6	10.3	(8.5–12.1)	6.8	(3.1–10.5)
Tennessee	3,522	1.0	1.6	7.5	(6.0–9.0)	6.2	(2.7–9.7)
Texas	7,925	1.0	1.7	11.0	(9.5–12.5)	8.4	(4.2–12.6)
Utah	10,167	1.1	1.7	13.8	(12.1–15.5)	9.4	(5.2–13.6)
Vermont	5,136	1.1	1.8	14.5	(12.6–16.4)	10.8	(7.3–14.3)
Virginia	6,571	1.1	1.7	13.4	(11.7–15.1)	8.8	(5.2–12.4)
Washington	9,084	1.0	1.8	12.3	(10.8–13.8)	9.9	(6.3–13.5)
West Virginia	4,629	1.0	1.6	7.7	(6.4–9.0)	6.6	(3.6–9.6)
Wisconsin	5,212	1.1	1.5	12.7	(10.8–14.6)	7.5	(3.6–11.4)
Wyoming	4,981	1.0	1.7	11.9	(10.1–13.7)	9.4	(5.5–13.3)

Abbreviation: CI = confidence interval.

* Estimates are weighted to account for complex sampling using statistical software except where noted. Fruit consists of 100% fruit juice and whole fruit. Vegetables include dried beans, dark green vegetables, orange vegetables, and other vegetables.

† Includes the District of Columbia.

§ Number of respondents (unweighted) with complete data for fruit and vegetable intake and demographic information.

¶ Recommendations are age- and sex-specific and are appropriate for adults who engage in <30 minutes of moderate physical activity daily, beyond normal daily activities. Percentages are derived from age- and sex-specific models that account for the usual intake of foods, race/ethnicity, and income-to-poverty ratio. Additional information available at http://www.choosemyplate.gov/printpages/MyPlateFoodGroups/Fruits/food-groups.fruits-amount.pdf and http://www.choosemyplate.gov/printpages/MyPlateFoodGroups/Vegetables/food-groups.vegetables-amount.pdf.

Discussion

In 2013, most adults consumed too few fruits and vegetables, with substantial variation by state. This analysis enhances current surveillance efforts by enabling the comparison of fruit and vegetable intake from the BRFSS survey module with federal recommendations. Ongoing collection of relevant state-level nutritional status and program data help identify public health nutrition problems in each state and support the design, evaluation, and management of nutrition intervention programs, in addition to catalyzing local interest in nutrition programs and policies (*7*).

Because fruit and vegetable consumption affects multiple health outcomes (*1*) and is currently low across all states, continued efforts are needed to increase demand and consumption. Improving fruit and vegetable consumption for adults might start with improving intake during childhood. During 2007–2010, 60% of children consumed fewer cup equivalents of fruit than recommended, and 93% consumed fewer vegetables than recommended (*2*). Better dietary practices earlier in life might lead to better practices later in life, and places where children learn and play can have an integral role in improving intake. For example, school districts, schools, and early care and education providers can help increase children's fruit and vegetable consumption by meeting or exceeding current federal nutrition standards for meals and snacks, serving fruit and vegetables whenever food is offered, and training staff to make fruit and vegetables more appealing and accessible.[§] Improving fruit and vegetable accessibility, placement, and promotion in grocery stores, restaurants, worksites, and other community settings might improve intake in adults (*8*,*9*). For example, work sites can make it easier for employees to make healthy food choices and create social norms that support healthy eating by creating policies to ensure that fruits and vegetables are provided at work-site gatherings, including meetings, conferences, and other events (*8*). CDC funds state, local, tribal, and territorial health departments to improve environments in worksites, schools, child care, and community settings to expand access to fruits and vegetables and other healthy food and beverage choices for persons of all ages.[¶]

The findings in this report are subject to at least five limitations. First, self-reports of intake are based on a limited set of questions and are prone to measurement error and recall bias (*10*). Self-reported intake might overestimate intake in some populations and underestimate intake in others (*10*). Second, these results might not be generalizable to the entire U.S. adult population (*4*). BRFSS excludes those living in nursing homes, long-term care facilities, military installations, and correctional institutions (*4*), but the overall effect this would have on the estimation of intake is unclear. Moreover, territories were excluded because prediction models were derived from NHANES, which excludes territories.[**] Third, estimates do not include non-100% fruit juice or fried potatoes because BRFSS respondents are instructed not to include them. Including these sources results in 4%–6% higher estimates for fruit and 30%–44% higher estimates for vegetables (*6*) but federal dietary guidelines recommend limiting foods and beverages with added sugars and solid fats (*1*). Fourth, relatively low response rates for BRFSS might have biased the sample. Finally, using prediction equations 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 (*6*).

Summary

What is already known about this topic?

Although national estimates indicate low fruit and vegetable intake, substantial variation by state has been observed. Fruit and vegetable intake information from the Behavioral Risk Factor Surveillance System (BRFSS) is the sole source of dietary information for most states, but the frequency of fruit and vegetable intake it captures cannot be directly compared to federal intake recommendations, which are expressed in cup equivalents.

What is added by this report?

CDC analyzed the percentage of each state's population meeting fruit and vegetable intake recommendations from the most recent BRFSS survey for the 50 states and the District of Columbia, using a new scoring procedure. In 2013, 13.1% of respondents met fruit intake recommendations, ranging from 7.5% in Tennessee to 17.7% in California, and 8.9% met vegetable recommendations, ranging from 5.5% in Mississippi to 13.0% in California.

What are the implications for public health practice?

Substantial new efforts are needed to build consumer demand for fruits and vegetables through competitive pricing, placement, and promotion in child care, schools, grocery stores, communities, and worksites.

[§] Additional information available at http://www.cdc.gov/vitalsigns/fruit-vegetables.

[¶] Additional information available at http://www.cdc.gov/chronicdisease/about/state-public-health-actions.htm, http://www.cdc.gov/chronicdisease/about/foa/2014foa/index.htm, http://www.cdc.gov/nccdphp/dch/programs/index.htm, and http://www.cdc.gov/nccdphp/dnpao/state-local-programs/index.html.

[**] Guam and Puerto Rico were the only two territories to collect fruit and vegetable intake data in BRFSS in 2013. If NHANES is representative of territorial populations, 14% and 11% of the population met fruit intake recommendations in Guam and Puerto Rico, respectively, and 11% and 4% met vegetable intake recommendations.

These results indicate that <18% of adults in each state consumed the recommended amount of fruit and <14% consumed the recommended amount of vegetables. Increased attention to food environments in multiple settings, including child care, schools, communities, and worksites, might help improve fruit and vegetable intake, and thus help prevent chronic disease.

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Community Knowledge, Attitudes, and Practices Regarding Ebola Virus Disease — Five Counties, Liberia, September–October, 2014

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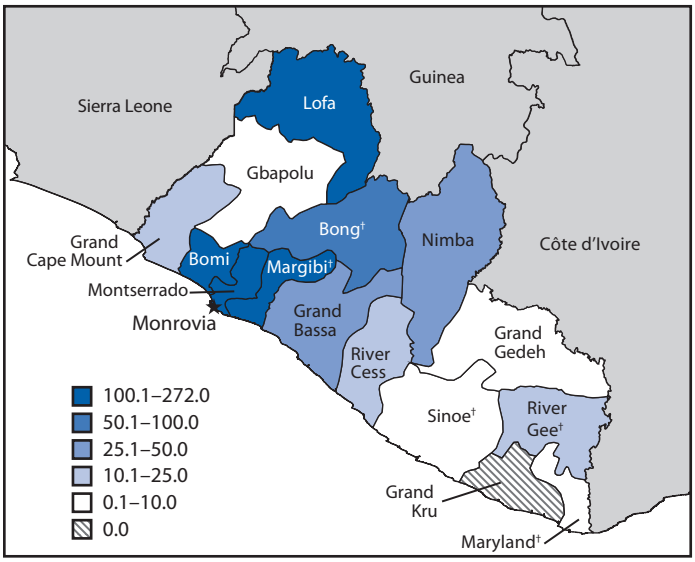
As of July 1, 2015, Guinea, Liberia, and Sierra Leone have reported a total of 27,443 confirmed, probable, and suspected Ebola virus disease (Ebola) cases and 11,220 deaths (*1*). Guinea and Sierra Leone have yet to interrupt transmission of Ebola virus. In May, 2015, Liberia successfully achieved Ebola transmission-free status (*2*), with no new Ebola cases occurring during a 42-day period; however, new Ebola cases were reported beginning June 29, 2015 (*1*). Local cultural practices and beliefs have posed challenges to disease control (*3*), and therefore, targeted, timely health messages are needed to address practices and misperceptions that might hinder efforts to stop the spread of Ebola. As early as September 2014, Ebola spread to most counties in Liberia. To assess Ebola-related knowledge, attitudes, and practices (KAP) in the community, CDC epidemiologists who were deployed to the counties (field team), carried out a survey conducted by local trained interviewers. The survey was conducted in September and October 2014 in five counties in Liberia with varying cumulative incidence of Ebola cases. Survey results indicated several findings. First, basic awareness of Ebola was high across all surveyed populations (median correct responses = 16 of 17 questions on knowledge of Ebola transmission; range = 2–17). Second, knowledge and understanding of Ebola symptoms were incomplete (e.g., 61% of respondents said they would know if they had Ebola symptoms). Finally, certain fears about the disease were present: >90% of respondents indicated a fear of Ebola patients, >40% a fear of cured patients, and >50% a fear of treatment units (expressions of this last fear were greater in counties with lower Ebola incidence). This survey, which was conducted at a time when case counts were rapidly increasing in Liberia, indicated limited knowledge of Ebola symptoms and widespread fear of Ebola treatment units despite awareness of communication messages. Continued efforts are needed to address cultural practices and beliefs to interrupt Ebola transmission.

From September 17 through October 11, 2014, a field team of CDC epidemiologists, in partnership with local trained volunteers, conducted an Ebola KAP survey in five counties in Liberia (Bong, Margibi, Maryland, River Gee, and Sinoe) with varying cumulative incidence of Ebola cases per 100,000 population (Figure). Two of the five counties, Bong and Margibi, had high cumulative incidence and three southeastern counties, Maryland, River Gee, and Sinoe, had low cumulative incidence. Bong and Margibi reported Ebola cases early in the outbreak (March 2014), and as of September 17 had reported 482 (Bong) and 229 (Margibi) total (confirmed, probable, and suspected) cumulative cases (*4*). Both counties already had implemented Ebola-response activities, such as case investigation, contact tracing, and safe burial procedures. An Ebola treatment unit opened in Bong shortly before the survey was conducted. In contrast, Maryland, River Gee, and Sinoe counties, which reported their first Ebola cases in August 2014, had reported cumulative counts of eight, 12, and six Ebola cases, respectively (*4*). These three counties had limited experience with outbreak response (*5*). The KAP survey took place as response and preparedness efforts were scaling up rapidly in the southeast (*5*). Survey areas were selected from three community categories: 1) population centers, such as county capitals and commercial districts; 2) communities with high Ebola incident cases within the county, such as communities reporting the highest number of persons in whom Ebola was newly diagnosed, or those in southeastern counties where cases were being reported; or 3) communities that were at risk for receiving Ebola cases, such as those located along main roads.

Across all five counties, more than 50 survey areas were selected. The goal was to survey 60–100 persons per county. Survey respondents were members of the general public from the communities, including Ebola survivors. The field team trained literate volunteers among local students or county health office staff members to be surveyors. The volunteer surveyor group then recruited participants and administered survey questionnaires using a standardized form across all sites. Subject matter experts reviewed the survey's content before it was administered and local surveyors pilot-tested the surveys. Surveyors were instructed to share accurate information about Ebola after the survey. Surveyors approached community members in public areas, including residential and commercial zones, to solicit participation in the KAP survey. From a central point in populated areas in each district, surveyors randomly chose a direction to approach community members, resulting in a non-probability sample of persons encountered in each county. Surveys were identical for all survey areas, and administered orally, in English. Whenever possible, individual surveys were conducted away from other persons.

FIGURE. Cumulative incidence* of Ebola virus disease, by county — Liberia, as of September 20, 2014



Sources: Liberia Ministry of Health.
* Number of reported cases per 100,000 population.
† Counties surveyed were Bong, Margibi, Maryland, River Gee, and Sinoe.

Interviewers collected demographic data on sex, age, highest level of education, and occupation. Respondents were asked whether they agreed or disagreed with a total of 38 statements. The statements were divided into scored and non-scored sections. The scored section contained statements (N = 33) with responses scored using the contents of local health messages as a reference. The other statements (N = 5) were placed in the non-scored section. The scored section was further divided into three KAP categories: 1) Ebola knowledge (17 questions designed to gauge respondents' understanding of Ebola transmission), 2) Ebola attitudes (nine questions on perceptions about Ebola, Ebola patients, and treatment centers), and 3) Ebola practices (seven questions used to assess respondents' anticipated practices if they or an acquaintance were to become symptomatic). Statements were scored "correct" if they were consistent with Liberia's Ministry of Health (MOH) health messaging at the time of the survey. The five non-scored statements were designed to assess respondents' subjective fears regarding Ebola, Ebola patients, or treatment centers. All responses were handwritten by surveyors in printed forms, and collected information was entered electronically into Excel by the CDC field team.

Responses were summarized by county groups, based on Ebola incidence (high [Margibi and Bong] versus low [Maryland, River Gee, and Sinoe]). Univariate analyses were performed to assess differences in knowledge, attitudes, and practices among participants. Wilcoxon rank-sum tests were used for ordinal data and Chi-square tests or Fisher's exact tests were used for categorical data.

Overall, there were 609 respondents from the five counties (Bong [n = 212], Margibi [n = 126], Maryland [n = 106], River Gee [n = 97], and Sinoe [n = 68]).* Although no official records were kept, the average response rate was estimated at >90%, based on the survey teams' experience with the refusal rate of persons approached. Among all respondents, 291 (48.2%) were women, and the median age was 32 years (range = 12–99). A majority (58.4%) of respondents had completed middle school education or higher. Of the 33 scored statements, overall, respondents answered correctly a median of 16 (range = 2–17) of 17 Ebola knowledge questions. The correct responses for attitudes (median = 7 of 9 questions correct; range = 1–9) and anticipated practices (median = 7 of 7 questions correct; range = 1–7) also were high, and did not differ by county (Table 1).

The knowledge areas where low-incidence counties scored lower were related to the questions on Ebola transmission, such as eating bush meat and attending burials (where persons might come in contact with the body) of Ebola patients (Table 2). In addition, more respondents from low-incidence counties believed that a curse or spell could result in Ebola transmission, compared with those from high-incidence counties (34.8% versus 7.4%; p<0.01). Among respondents from all five counties, >30% agreed that a person can get Ebola from a healthy (asymptomatic) person. Scores were lower in a few key areas: respondents across all counties were not confident in their ability to identify Ebola symptoms, were fearful of survivors, and were afraid that if they went to an Ebola treatment unit, they

* Variations in numbers are related to factors such as community acceptance, weather conditions, and road access (the survey was conducted during the rainy season).

TABLE 1. Summary results of the scored section, Knowledge, Attitudes and Practices survey — Liberia, September 17–October 11, 2014

	Median score						
	All respondents		High-incidence counties*		Low-incidence counties†		
Categories/No.	Score	(Range)	Score	(Range)	Score	(Range)	p-value
Knowledge about Ebola transmission/17	16	(2–17)	16	(4–17)	15	(2–17)	<0.01
Attitudes/9	7	(1–9)	8	(3–9)	7	(1–9)	0.05
Anticipated practices/7	7	(1–7)	7	(3–7)	7	(1–7)	0.07

* High-incidence counties = Bong and Margibi.
† Low-incidence counties = Maryland, River Gee, and Sinoe.

TABLE 2. Questions, preferred responses, and participants' responses, for the scored section of the Knowledge, Attitudes, and Practices survey — Liberia, September 17–October 11, 2014

Questions	MOHSW preferred response	Agreed among all respondents (N = 609)		Agreed in high-incidence counties* (n = 338)		Agreed in low-incidence counties† (n = 271)		p-value
		No.	(%)	No.	(%)	No.	(%)	
Knowledge about transmission								
I can get Ebola from a healthy (asymptomatic) person	Disagree	243	(40.0)	123	(36.5)	120	(44.3)	0.05
I can get Ebola from kissing a symptomatic person	Agree	593	(97.5)	328	(97.3)	265	(97.8)	0.72
I can get Ebola from sharing a spoon/fork with a symptomatic person	Agree	589	(96.7)	328	(97.0)	261	(96.3)	0.61
I can get Ebola from sleeping in the same bed as a symptomatic person	Agree	585	(96.5)	334	(98.8)	251	(93.7)	<0.01
I can get Ebola from cleaning up vomit from a symptomatic person	Agree	591	(97.2)	331	(98.2)	260	(95.9)	0.09
I can get Ebola from having sex with a symptomatic person, even if I wear a condom	Agree	591	(97.0)	333	(98.5)	258	(95.2)	0.02
I can get Ebola from cleaning up pee or poop from a symptomatic person	Agree	596	(97.9)	334	(98.8)	262	(96.7)	0.07
I can get Ebola from touching a dead person	Agree	569	(93.4)	321	(95.0)	248	(91.5)	0.09
I can get Ebola from washing a dead person	Agree	573	(94.1)	325	(96.2)	248	(91.5)	0.02
I can get Ebola from cleaning the sheets from a funeral of an Ebola patient	Agree	590	(96.9)	332	(98.2)	258	(95.2)	0.03
I can get Ebola from eating bush meat	Agree	492	(80.8)	290	(85.8)	202	(74.5)	<0.01
I can get Ebola from attending a burial of an Ebola patient	Agree	519	(85.5)	305	(90.5)	214	(79.3)	<0.01
A baby can get Ebola from breastfeeding from a symptomatic mother	Agree	591	(97.0)	336	(99.4)	255	(94.1)	<0.01
Fever is a symptom of Ebola	Agree	494	(81.5)	286	(84.9)	208	(77.3)	0.02
Hand washing can prevent transmission of Ebola	Agree	579	(95.2)	328	(97.3)	251	(92.6)	<0.01
Anyone can get Ebola (even healthy people)	Agree	574	(94.6)	328	(97.0)	246	(91.5)	<0.01
I can get Ebola if someone puts a curse/spell on me	Disagree	118	(19.5)	25	(7.4)	93	(34.8)	<0.01

See table footnotes on page 717.

would not be allowed to see their family. One statistically significant difference in attitude between high- and low-incidence counties was a fear of cured patients (34.6% [high-incidence] and 47.8% [low-incidence], p<0.01) and a fear that a person would not be allowed to see their family if they were admitted to an Ebola treatment unit (37.9% [high-incidence] and 61.6% [low-incidence], p<0.01) (Table 2).

Responses to the five non-scored statements on Ebola-related fears showed that a large proportion (>90%) of respondents feared Ebola patients and persons who live with Ebola patients (Table 3). Respondents in high-incidence counties were more fearful of these groups than those in low-incidence counties. Similarly, fear of Ebola treatment units was reported by more than half of respondents in both low- and high-incidence county groups; however, a significantly larger proportion from the low-incidence group reported fear of seeking care, and thought they would die if they sought care.

Discussion

Overall, Ebola awareness was high, based on the median correct responses for the 33 statements in the scored section of the KAP survey. At the same time, this survey revealed several important areas of concern as Liberia sought to contain the Ebola epidemic. Across all counties, respondents were somewhat less able to correctly recognize Ebola symptoms or the transmission risk from asymptomatic persons; fear of Ebola patients and Ebola treatment units was prevalent. The fear of cured patients might partially be explained by the fact that community acceptance of survivors was not part of the initial set of Ebola health messages in Liberia. Targeted educational messages about Ebola virus transmission modes, how to protect oneself against Ebola, and the purpose of Ebola treatment units might help to alleviate some of these fears. In addition, recurrence of Ebola transmission in Liberia reinforces the need for ongoing vigilance and early detection of symptomatic persons.

TABLE 2. (*Continued*) Questions, preferred responses, and participants' responses, for the scored section of the Knowledge, Attitudes, and Practices survey — Liberia, September 17–October 11, 2014

Questions	MOH preferred response	Agreed among all respondents (N = 609)		Agreed in high-incidence counties* (n = 338)		Agreed in low-incidence counties† (n = 271)		p-value
		No.	(%)	No.	(%)	No.	(%)	
Attitudes								
Ebola is a real disease	Agree	596	(97.9)	333	(98.5)	263	(97.1)	0.21
Ebola is a serious disease	Agree	596	(98.0)	335	(99.1)	261	(96.7)	0.03
I am worried about getting Ebola	Agree	536	(88.0)	302	(89.4)	234	(86.4)	0.26
I am at risk for getting Ebola	Agree	524	(86.5)	298	(88.7)	226	(83.7)	0.07
I am afraid of people who have been cured of Ebola	Disagree	246	(40.5)	117	(34.6)	129	(47.8)	<0.01
I would know if I had Ebola symptoms	Agree	367	(61.0)	203	(60.8)	164	(61.2)	0.92
I know how to protect myself from getting Ebola	Agree	543	(89.5)	296	(87.6)	247	(91.8)	0.09
If I go to a treatment center, I will not be allowed to see my family	Disagree	293	(48.4)	128	(37.9)	165	(61.6)	<0.01
White people brought Ebola here	Disagree	73	(12.1)	37	(11.0)	36	(13.4)	0.37
Anticipated Practices								
If I got Ebola symptoms, I would seek treatment	Agree	587	(96.6)	337	(99.7)	250	(92.6)	<0.01
If I got Ebola symptoms, I know where to go for treatment	Agree	492	(80.9)	284	(84.0)	208	(77.0)	0.03
If I got Ebola symptoms, I would go to a traditional healer	Disagree	28	(4.6)	7	(2.1)	21	(7.8)	<0.01
If I got Ebola symptoms, I would hide away in my house	Disagree	57	(9.4)	8	(2.4)	49	(18.3)	<0.01
If a friend or family member gets Ebola, I would take them to a treatment center	Agree	447	(74.0)	241	(71.5)	206	(77.2)	0.12
If a friend or family member gets Ebola, I would take them to a traditional healer	Disagree	26	(4.3)	6	(1.8)	20	(7.5)	<0.01
If a friend or family member gets Ebola, I would keep them in my house	Disagree	29	(4.8)	6	(1.8)	23	(8.5)	<0.01

Abbreviation: MOHSW = Ministry of Health, Liberia.
* High-incidence counties = Bong and Margibi.
† Low-incidence counties = Maryland, River Gee, and Sinoe.

TABLE 3. Non-scored section and summary results, Knowledge, Attitudes and Practices survey — Liberia, September 17–October 11, 2014

Section/Question	Agreed among all respondents (N = 609)		Agreed in high-incidence counties* (n = 338)		Agreed in low-incidence counties† (n = 271)		p-value
	No.	(%)	No	(%)	No.	(%)	
Fear of individuals							
I am afraid of people with Ebola	582	(96.5)	328	(98.2)	254	(94.2)	0.01
I am afraid of people who live with Ebola patients	584	(96.1)	331	(97.9)	253	(93.7)	0.01
Fear of Ebola treatment centers							
I am afraid of treatment centers	342	(56.6)	184	(54.6)	158	(59.2)	0.26
If I got Ebola symptoms, I would be afraid of going to a treatment center	154	(25.5)	59	(17.6)	95	(35.6)	<0.01
If I go to a treatment center, I will die	110	(18.1)	37	(11.0)	73	(26.9)	<0.01

* High-incidence counties = Bong and Margibi.
† Low-incidence counties = Maryland, River Gee, and Sinoe.

The findings in this report are subject to at least two main limitations. First, the selection of communities within the counties was non-random. However, counties were selected in consultation with MOH, on the basis of priority for intervention at the time. As a result, the survey covered areas with varying levels of Ebola incidence. Second, a standardized form was used for the survey, but none of the responses was open-ended. Therefore, limited information was available beyond the binary agree or disagree responses.

The Ebola KAP is believed to be the first survey that was conducted during this Ebola outbreak to assess the effectiveness of initial Ebola messaging at the community level across a wide geographical area in Liberia. The recent recurrence of Ebola cases in Liberia highlights the continued risk for transmission in the region. Future health awareness activities, especially in Guinea and Sierra Leone where the epidemic is not fully contained, might benefit from emphasizing the signs and symptoms of Ebola, addressing fears about seeking treatment and placing additional focus on counties and communities where incidence of Ebola is low as a preparedness measure. A follow-up survey might be needed to assess the current Ebola awareness among the public more than a year after this Ebola outbreak began. Continued efforts are needed to address cultural practices and beliefs to interrupt Ebola transmission.

Acknowledgments

Friday Crusor, Ruth M. Jallah, Oliver K. Mondoi, Joe Kamon, Abigail Y. Komah, Moore W. Zinnah, Olivia Bohlen, Augustine Wallace, D. Dylyenyenoh Weah, Bee-Gee Karweaye, Samson Wiah, Sampson Dolo, David Vourjoloh, Dorothy Tooman, Hilary Collins, Patience Copeland, Peter Koffa, Iona Thomas-Connor, Elizabeth Enanoria-Carbajosa; the social mobilization team from Development Education Network-Liberia; Liberian Ministry of Health; Carl Kinkade, Anna Newton, Rupa Narra, Pierre Rollin, Jana Telfer, CDC Liberia Ebola Response Team.

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Summary

What is already known on this topic?

Local cultural practices and beliefs related to Ebola have presented challenges to controlling the current outbreak in West Africa. Community engagement is an important component of Ebola control.

What is added by this report?

Early in the epidemic, Ebola awareness was widespread within communities in Liberia, based on a knowledge, attitudes, and practices (KAP) survey. However, differences were observed between counties based on Ebola incidence. Areas of concerns include large numbers of participants not being confident with Ebola symptom identification, and existing fears of Ebola survivors and of Ebola treatment units.

What are the implications for public health practice?

Survey findings could be used to inform ongoing health awareness and messaging to address specific fears, misperceptions, and practices regarding Ebola. This study might offer useful insight for countries during Ebola containment efforts.

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Vital Signs: Demographic and Substance Use Trends Among Heroin Users — United States, 2002–2013

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On July 7, 2015, this report was posted as an MMWR *Early Release on the* MMWR *website (http://www.cdc.gov/mmwr).*

Abstract

Background: Heroin use and overdose deaths have increased significantly in the United States. Assessing trends in heroin use among demographic and particular substance-using groups can inform prevention efforts.

Methods: FDA and CDC analyzed data from the National Survey on Drug Use and Health and National Vital Statistics System reported during 2002–2013. Trends in heroin use among demographic and substance using groups were compared for 2002–2004, 2005–2007, 2008–2010, and 2011–2013. A multivariable logistic regression model was used to identify characteristics associated with heroin abuse or dependence.

Results: Annual average rates of past-year heroin use increased from 1.6 per 1,000 persons aged ≥12 years in 2002–2004 to 2.6 per 1,000 in 2011–2013. Rates of heroin abuse or dependence were strongly positively correlated with rates of heroin-related overdose deaths over time. For the combined data years 2011–2013, the odds of past-year heroin abuse or dependence were highest among those with past-year cocaine or opioid pain reliever abuse or dependence.

Conclusions: Heroin use has increased significantly across most demographic groups. The increase in heroin abuse or dependence parallels the increase in heroin-related overdose deaths. Heroin use is occurring in the context of broader poly-substance use.

Implications for Public Health Practice: Further implementation of a comprehensive response that targets the wider range of demographic groups using heroin and addresses the key risk factors for heroin abuse and dependence is needed. Specific response needs include reducing inappropriate prescribing and use of opioids through early identification of persons demonstrating problematic use, stronger prescription drug monitoring programs, and other clinical measures; improving access to, and insurance coverage for, evidence-based substance abuse treatment, including medication-assisted treatment for opioid use disorders; and expanding overdose recognition and response training and access to naloxone to treat opioid pain reliever and heroin overdoses.

Introduction

During 2002–2013, heroin overdose death rates nearly quadrupled in the United States, from 0.7 deaths to 2.7 deaths per 100,000 population, with a near doubling of the rates from 2011–2013 (*1*). Data from the National Survey on Drug Use and Health (NSDUH) indicate heroin use, abuse, and dependence have increased in recent years. In 2013, an estimated 517,000 persons reported past-year heroin abuse or dependence, a nearly 150% increase since 2007 (*2*).

During 2002–2011, rates of heroin initiation were reported to be highest among males, persons aged 18–25 years, non-Hispanic whites, those with an annual household income <$20,000, and those residing in the Northeast (*3*). However, during this period heroin initiation rates generally increased across most demographic subgroups (*3*). Most heroin users have a history of nonmedical use of prescription opioid pain relievers (*3*–*5*), and an increase in the rate of heroin overdose deaths has occurred concurrently with an epidemic of prescription opioid overdoses.

Although it has been postulated that efforts to curb opioid prescribing, resulting in restricted prescription opioid access, have fueled heroin use and overdose, a recent analysis of 2010–2012 drug overdose deaths in 28 states found that decreases in prescription opioid death rates within a state were not associated with increases in heroin death rates; in fact, increases in heroin overdose death rates were associated with increases in prescription opioid overdose death rates (*6*). In addition, a study examining trends in opioid pain reliever overdose hospitalizations and heroin overdose hospitalizations between 1993 and 2009 found that increases in opioid pain reliever hospitalizations predicted an increase in heroin

overdose hospitalizations in subsequent years (*7*). Thus, the changing patterns of heroin use and overdose deaths are most likely the result of multiple, and possibly interacting, factors. Moreover, there is a lack of research examining recent trends in the prevalence of other substance use among persons using heroin, especially among the high-risk population of heroin users who meet diagnostic criteria for heroin abuse or dependence.

To improve understanding of current heroin use, abuse, and dependence trends and to identify individual-level risk factors that could help tailor prevention efforts, the Food and Drug Administration (FDA) and CDC examined demographic and substance use, abuse, and dependence trends among heroin users in the United States during 2002–2013.

Methods

Substance use data are derived from the 2002–2013 NSDUH surveys. The NSDUH is conducted annually by the Substance Abuse and Mental Health Services Administration and provides national- and state-level estimates of the use of illicit drugs, including nonmedical use of certain prescription drugs, alcohol, and tobacco among the civilian, noninstitutionalized population aged ≥12 years (*2*). NSDUH employs a state-based design with an independent, multistage area probability sample within each state and the District of Columbia (*2*). For this study, the 2002–2013 NSDUH public use files were combined in four, 3-year time intervals: 1) 2002–2004; 2) 2005–2007; 3) 2008–2010; and 4) 2011–2013.

Past-year nonmedical use of prescription drugs is defined as using prescription drugs without having a prescription, or using prescription drugs only for the experience or feeling it causes, during the 12 months preceding the survey interview. Past-year use of marijuana, cocaine, or heroin is defined as use of the substance in the 12 months preceding the survey interview. Past-year abuse or dependence of specific substances (commonly referred to as addiction) was based on diagnostic criteria contained in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (*8*).

Mortality data from the 2002–2013 Multiple Cause of Death Files from the National Vital Statistics System were analyzed to identify heroin-related drug overdose deaths (*9*). Heroin-related drug overdose deaths were those assigned an underlying cause of death code of X40-X44 (unintentional), X60-X64 (suicide), X85 (homicide), or Y10-Y14 (undetermined intent) with a contributing cause of death ICD-10 code T40.1 (heroin poisoning) using the *International Classification of Diseases, Tenth Revision* (ICD-10).

First, to assess trends in heroin use in the United States, rates of past-year heroin use per 1,000 persons aged ≥12 years were calculated overall and stratified by sex, age, race/ethnicity, place of residence, annual household income, insurance coverage, and substance use (past-year use of marijuana, cocaine, opioid pain relievers, other psychotherapeutics [tranquilizers, sedatives, and stimulants], and past-month binge drinking) for each study time interval. In addition, the percentage of past-year heroin users who also used at least one other drug in the past year were calculated.

Second, to assess high-risk use of other substances among past-year heroin users, the percentages of past-year heroin users who met diagnostic criteria for past-year alcohol, marijuana, cocaine, or opioid pain reliever abuse or dependence were calculated. All rates are based on U.S Census Bureau population estimates. Two-sided t-tests were used to assess statistically significant differences between 2011–2013 rates and earlier survey year groups. To assess trends, bivariate logistic regression models were applied to test p-values of beta coefficients of the year variable.

Third, to identify individual-level risk factors associated with the subset of past-year heroin users who met diagnostic criteria for heroin abuse or dependence, a multivariable logistic regression model incorporating sex, age group, race/ethnicity group, place of residence, annual household income categories, insurance coverage, and the presence or absence of past-year alcohol, marijuana, cocaine, opioid pain relievers, or other psychotherapeutic abuse or dependence was estimated using the 2011–2013 NSDUH data. Associations were reported as adjusted odds ratios with 95% confidence intervals.

Finally, Pearson's correlation coefficient (r) was used to assess correlation between the trend in rates of heroin abuse or dependence and heroin-related drug overdose deaths during 2002–2013.

Results

The weighted interview response rate for the NSDUH during the study period (2002–2013) ranged from 72% to 79% each year. The annual average rate of past-year heroin use in 2011–2013 was 2.6 per 1,000 persons aged ≥12 years (Table 1). This rate was significantly higher than the rates for 2002–2004 (1.6) and 2005–2007 (1.8), and represents a 62.5% increase since 2002–2004. Similarly, the overall rate of people meeting diagnostic criteria for past-year heroin abuse or dependence increased significantly during the study period, from 1.0 per 1,000 to 1.9 per 1,000, which represents a 90.0% increase overall and a 35.7% increase since 2008–2010.

Rates of past-year heroin use were higher among men than women for all time intervals; the rate in 2011–2013 for men was 3.6 per 1,000 compared with 1.6 per 1,000 for women; the gap in rates between men and women narrowed between 2002–2004 and 2011–2013. Both men and women experienced significantly higher heroin use rates during 2011–2013

TABLE 1. Annual average rates* of past-year heroin use† by demographic and substance use characteristics, by time period — United States, 2002–2013

Characteristic	Annual average rate								% change	
	2002–2004		2005–2007		2008–2010		2011–2013		2008–2010 to 2011–2013	2002–2004 to 2011–2013
	Rate	(95% CI)	Rate	(95% CI)	Rate	(95% CI)	Rate	(95% CI)		
Overall past-year heroin use	1.6§§§	(1.4–1.9)	1.8§§	(1.4–2.1)	2.3	(2.0–2.7)	2.6	(2.2–2.9)	13.0	62.5¶
Overall past-year heroin abuse or dependence	1.0§§§	(0.8–1.2)	1.0§§§	(0.8–1.3)	1.4§	(1.2–1.7)	1.9	(1.6–2.2)	35.7	90.0¶
Sex										
Male	2.4§§	(1.9–2.9)	2.6§	(2.0–3.2)	3.3	(2.6–4.1)	3.6	(3.0–4.3)	9.1	50.0¶
Female	0.8§§	(0.6–1.1)	1.0§	(0.8–1.3)	1.5	(1.2–1.9)	1.6	(1.2–1.9)	6.7	100.0¶
Age (yrs)										
12–17	1.8	(1.3–2.5)	1.3	(1.0–1.7)	1.4	(1.0–2.0)	1.6	(1.2–2.2)	14.3	-11.1
18–25	3.5§§§	(2.9–4.3)	4.9§§§	(4.0–5.9)	5.3§	(4.7–6.1)	7.3	(6.4–8.3)	37.7	108.6¶
≥26	1.2§	(1.0–1.6)	1.3	(0.9–1.8)	1.9	(1.6–2.4)	1.9	(1.4–2.4)	0.0	58.3¶
Race/Ethnicity										
Non-Hispanic white	1.4§§§	(1.2–1.7)	1.6§§§	(1.3–1.9)	2.6	(2.2–3.0)	3.0	(2.6–3.5)	15.4	114.3¶
Other	2.0	(1.4–2.9)	2.2	(1.5–3.2)	1.9	(1.3–2.7)	1.7	(1.3–2.2)	-10.5	-15.0
Place of residence										
CBSA with ≥1 million persons	1.8§§	(1.4–2.2)	2.0§	(1.5–2.6)	2.4	(2.0–2.9)	3.0	(2.4–3.6)	25.0	66.7¶
Other area	1.4§	(1.1–1.8)	1.5§	(1.2–1.9)	2.3	(1.8–2.9)	2.1	(1.7–2.5)	-8.7	50.0¶
Annual household income										
<$20,000	3.4§	(2.5–4.6)	3.3§§	(2.4–4.6)	4.4	(3.4–5.7)	5.5	(4.5–6.8)	25.0	61.8¶
$20,000–$49,999	1.3§§	(1.0–1.7)	1.9	(1.5–2.5)	2.7	(2.0–3.6)	2.3	(1.8–3.0)	-17.4	76.9¶
≥$50,000	1.0§	(0.7–1.4)	1.0	(0.6–1.6)	1.4	(1.2–1.7)	1.6	(1.3–1.9)	14.3	60.0¶
Health insurance coverage										
None	4.2§	(3.0–5.9)	4.8	(3.6–6.4)	6.3	(4.9–8.0)	6.7	(5.4–8.2)	6.3	59.5¶
Medicaid	4.3	(3.0–6.0)	4.7	(3.1–7.0)	4.3	(3.3–5.6)	4.7	(3.7–5.9)	8.9	9.3
Private or other	0.8§§	(0.7–1.0)	0.8§§	(0.6–1.0)	1.3	(1.0–1.6)	1.3	(1.1–1.6)	0.0	62.5¶
Substance use										
Past-month binge drinking	3.7§§	(3.0–4.5)	4.1§	(3.3–5.1)	5.2	(4.3–6.3)	5.8	(4.4–6.4)	11.5	56.8¶
Past-year marijuana use	11.6§§	(9.5–14.1)	13.2	(10.6–16.4)	14.4	(12.6–16.6)	16.9	(14.4–19.8)	17.4	45.7¶
Past-year cocaine use	48.9§§§	(40.2–59.3)	57.6§§§	(45.9–72.2)	68.3§	(55.4–83.9)	91.5	(78.2–106.8)	34.0	87.1¶
Past-year opioid pain reliever nonmedical use	17.8§§§	(14.3–22.0)	25.1§§§	(19.9–31.7)	34.0§	(28.9–39.8)	42.4	(36.6–49.1)	24.7	138.2¶
Past-year other psychotherapeutic nonmedical use**	23.1§§§	(18.6–28.7)	28.5§§§	(23.1–35.1)	41.6	(33.8–51.0)	45.6	(38.9–53.4)	9.6	97.4¶

Abbreviations: CBSA = Core Based Statistical Area; CI = confidence interval.
* Rate is per 1,000 population of each analytic group.
† Past-year heroin use is defined as any use of heroin in the 12 months preceding the National Survey on Drug Use and Health survey interview.
§ Rate is statistically significantly different from 2011–2013 rate; §p<0.05; §§p<0.01; §§§p<0.001.
¶ p-value for trend <0.05.
** Other psychotherapeutics includes tranquilizers, sedatives, and stimulants.

compared with 2002–2004 and 2005–2007. Among age groups, persons aged 18–25 years experienced the largest increase (108.6%) between 2002–2004 and 2011–2013.

The rate of past-year heroin use among non-Hispanic whites increased 114.3% from 1.4 per 1,000 in 2002–2004 to 3.0 per 1,000 in 2011–2013. Past-year heroin use increased across the three annual household income levels (<$20,000; $20,000–$49,000; ≥$50,000) between 2002–2004 and 2011–2013. Individuals with no health insurance as well as those with private or other insurance experienced statistically significant increases in heroin use rates between 2002–2004 and 2011–2013.

During 2002–2013, past-year heroin use increased among persons reporting past-year use of other substances. The highest rate was consistently found among users of cocaine; during 2011–2013, this rate was 91.5 per 1,000. During the study period, the largest percentage increase, 138.2%, occurred among nonmedical users of opioid pain relievers. In this group, the past-year heroin use rate increased from 17.8 per 1,000 to 42.4 per 1,000, but was still considerably lower than the rate among cocaine users.

Overall, 96% of past-year heroin users reported use of at least one other drug during the past year, and 61% reported using at least three different drugs. In addition, a significant percentage of heroin users met diagnostic criteria for past-year abuse of, or dependence on, other substances (Figure 1). The percentage of heroin users with past-year marijuana, cocaine, or alcohol abuse or dependence remained stable during most

of the study periods. However, the percentage of heroin users with opioid pain reliever abuse or dependence more than doubled from 20.7% in 2002–2004 to 45.2% in 2011–2013. By 2011–2013, opioid pain reliever abuse or dependence was more common among heroin users than alcohol, marijuana, or cocaine abuse or dependence.

The rate of heroin-related drug overdose deaths was stable at approximately 0.7 per 100,000 during 2002–2006, and began to increase gradually through 2009, when the rate was 1.1 per 100,000. Beginning in 2011, the overdose death rate increased sharply, from 1.4 per 100,000 to 2.7 per 100,000 in 2013, a rate that represents a more than 286% increase since 2002 (Figure 2). There was a strong positive correlation ($r = 0.9$; $p<0.001$) between the rates of past-year heroin abuse or dependence and heroin-related drug overdose deaths over time.

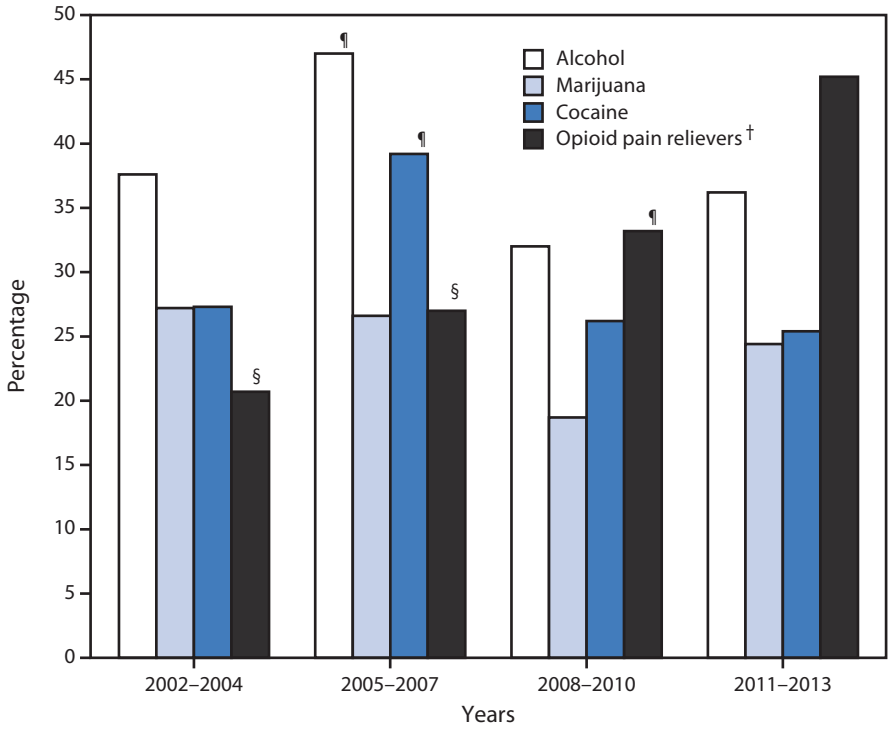
The multivariable logistic regression model, adjusted for demographic and specific substance abuse or dependence variables (Table 2), indicates that the following characteristics were associated with higher odds of past-year heroin abuse or dependence: male sex; aged 18–25 years; non-Hispanic white race/ethnicity; residence in a large urban area (Core Based Statistical Area with >1 million persons); <$20,000 annual household income; having no health insurance or having Medicaid; and having past-year abuse or dependence on alcohol, marijuana, cocaine, or opioid pain relievers. Among those with other substance abuse or dependence, the largest adjusted odds ratio (aOR) for heroin abuse or dependence was found among persons with opioid pain reliever abuse or dependence (aOR = 40.0; 95% CI = 24.6–65.3), followed by persons with cocaine abuse or dependence (aOR = 14.7; 95% CI = 7.4–29.2), marijuana abuse or dependence (aOR = 2.6; 95% CI = 1.5–4.6), and alcohol abuse or dependence (aOR = 1.8; 95% CI = 1.2–2.9).

Conclusions and Comment

There was a significant increase in the rate of past-year heroin use in the United States between 2002–2004 and 2011–2013. Rates remained highest among males, persons aged 18–25 years, persons with annual household incomes <$20,000, persons living in urban areas, and persons with no health insurance or with Medicaid. However, rates increased significantly across almost all study groups. The greatest increases in heroin use occurred in demographic groups that historically have had lower rates of heroin use: doubling among women and more than doubling among non-Hispanic whites. Of particular note is the near doubling in the rate of people with heroin abuse or dependence during the study period, with a 35.7% increase since 2008–2010 alone. This increase parallels the sharp increase in heroin-related overdose deaths reported since 2010.

This study also indicates that the problem of heroin abuse or dependence is not occurring in isolation. Past-year alcohol, marijuana, cocaine, and opioid pain reliever abuse or dependence were each significant risk factors for heroin abuse or dependence. Research has identified poly-substance use as a risk factor for overdose death; most overdose deaths involve multiple drugs (*10*,*11*). In 2013, 59% of the 8,257 heroin-related overdose deaths in the United States involved at least one other drug (*9*). Data presented here indicate the relationship between heroin and opioid pain relievers, as well as the relationship between heroin and cocaine, was particularly strong. In fact, abuse or dependence on opioid pain relievers was the strongest risk factor for heroin abuse or dependence. Taken together, these results underscore the significance of heroin use in the

FIGURE 1. Annual average percentage of past-year heroin users* with past-year selected substance abuse or dependence, by time interval — United States, 2002–2013



* Past-year heroin use defined as any use of heroin in the 12 months preceding the National Survey on Drug Use and Health survey interview.
† p-value for trend <0.05.
§ Rate is statistically significantly different from 2011–2013 rate; p<0.001.
¶ Rate is statistically significantly different from 2011–2013 rate; p<0.05.

context of broader poly-substance use, a finding that should be considered when prevention policies are being developed and implemented.

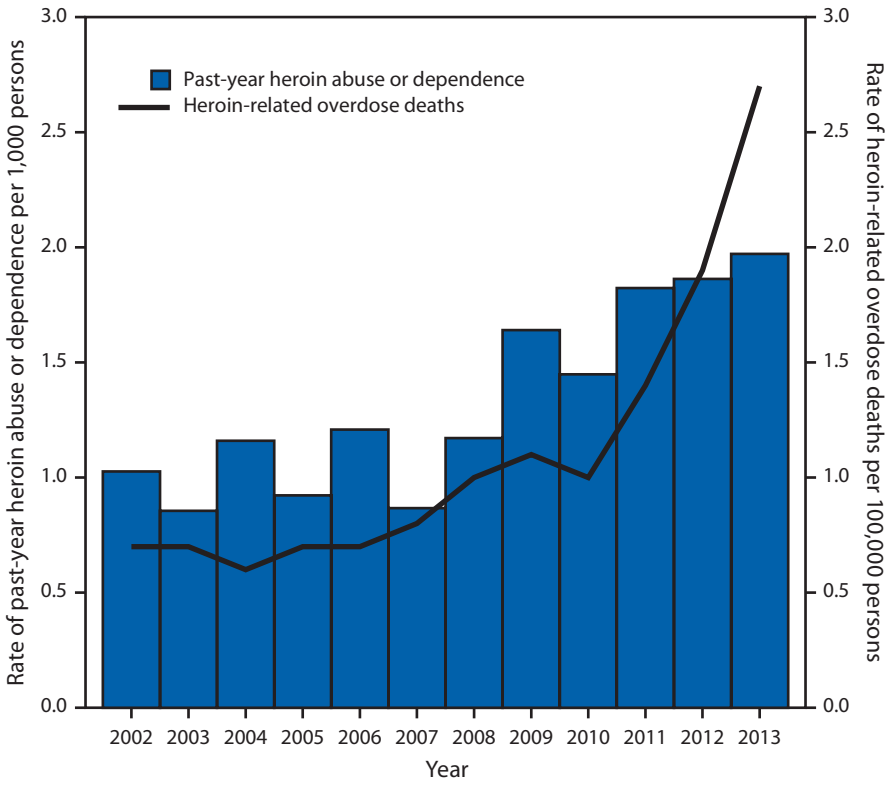
The increased availability and lower price of heroin in the United States has been identified as a potential contributor to rising rates of heroin use (*12*). According to data from the Drug Enforcement Administration's National Seizure System, the amounts of heroin seized each year at the southwest border of the United States were approximately ≤500 kg during 2000–2008. This amount quadrupled to 2,196 kg in 2013 (*12*). Since 2010, increased availability of heroin has been accompanied by a decline in price and an increase in purity, which may contribute to its increased use in the United States (*13*). This increase in the amount of heroin seized, increased availability and purity, and decreased cost are temporally associated with the increases in heroin use, abuse and dependence, and mortality found in this study. Increasing availability points to the importance of public health and law enforcement partnering to comprehensively address this public health crisis.

This study is subject to several limitations. First, NSDUH data are self-reported, and their value depends on the truthfulness and accuracy of individual respondents; under- or over-reporting might occur. Second, because the survey is cross-sectional and different individuals were sampled each year, it is not possible to infer causality from the observed associations. Third, because NSDUH only captures noninstitutionalized civilians, it excludes active duty military personnel, homeless and incarcerated populations, and persons in residential substance abuse treatment programs. Therefore, the drug use estimates in this study might not be generalizable to the total U.S. population, particularly for estimates of uncommonly used drugs like heroin. Finally, the heroin mortality rate is underestimated in the Multiple Cause of Death Files, because the specific drug or drugs involved in the overdose is not specified in approximately 25% of death certificates where the cause of death is drug overdose (*14*).

These findings indicate significant increases in heroin use across a growing number of demographic groups, including women, the privately insured, and persons with higher incomes. In fact, the gaps in heroin use rates between groups such as men and women, persons with low and higher incomes, and Medicaid and private insurance beneficiaries have narrowed during the past decade. These findings are consistent with recent research documenting significant demographic shifts among people entering heroin addiction treatment over the last 40 to 50 years (*4*). In addition, persons using heroin are abusing multiple other substances, especially cocaine and opioid pain relievers.

A comprehensive response that targets the wider range of demographic groups using heroin and addresses the key risk factors for heroin abuse and dependence is needed. Specifically, a focus on reducing opioid pain reliever abuse is needed given the strong association between opioid pain relievers and heroin abuse and dependence seen in this study, and prior research indicating that the rate of heroin initiation among people with a history of nonmedical use of opioid pain relievers was approximately 19 times greater than those with no history of nonmedical use (*3*). Interventions such as prescription drug monitoring programs to reduce inappropriate prescribing of opioids and enable the early identification of persons demonstrating problematic use must be strengthened. The increases in the number of people with heroin abuse or dependence and those dying from heroin-related overdose, as well as the recent increases in hepatitis C virus (HCV) and human immunodeficiency virus (HIV) associated with injection drug use (*15*,*16*), underscore the critical importance

FIGURE 2. Rates of past-year heroin abuse or dependence* and heroin-related overdose deaths — United States, 2002–2013



* Past-year heroin abuse or dependence is based on diagnostic criteria contained in the *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition*.

Key Points

- Heroin use in the United States increased 63% from 2002 through 2013. This increase occurred among a broad range of demographics, including men and women, most age groups, and all income levels.
- As heroin use, abuse, and dependence have increased, so have heroin-related overdose deaths. From 2002 through 2013, the rate of heroin-related overdose deaths nearly quadrupled.
- Persons often use heroin with other substances, including marijuana, cocaine, alcohol, and opioid pain relievers. This practice is especially dangerous.
- Groups with an increased risk for heroin abuse or dependence include men, persons aged 18–25 years, non-Hispanic whites, persons with annual household income less than $20,000, Medicaid recipients, and the uninsured.
- States play a key role in addressing heroin use, abuse, dependence, and overdose. States can implement strategies to reduce the abuse of opioid pain relievers, the strongest risk factor for heroin abuse or dependence. They can also improve access and insurance coverage for medication-assisted treatment for opioid use disorders and expand access and training for naloxone administration to reverse overdoses.
- Additional information is available at http://www.cdc.gov/vitalsigns.

of improving access to, and insurance coverage for, evidence-based substance abuse treatment. In particular, medication-assisted treatment for opioid use disorders has been shown to reduce opioid use and mortality, and to reduce risk behaviors that transmit HCV and HIV (*17*). The increases in abuse or dependence and overdose deaths also highlight the urgent need to expand overdose recognition and response training and broaden access to naloxone to treat opioid pain reliever and heroin overdoses.

[1]Office of Public Health Strategy and Analysis, Office of the Commissioner, Food and Drug Administration; [2]Division of Violence Prevention, National Center for Injury Prevention and Control, CDC; [3]Division of Unintentional Injury Prevention, National Center for Injury Prevention and Control, CDC.

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TABLE 2. Multivariable logistic regression analysis of demographic and substance use characteristics associated with past-year heroin abuse or dependence* — United States, 2011–2013

	Past-year heroin abuse or dependence	
Characteristic	**aOR**	**(95% CI)**
Sex		
Male	2.1†††	(1.4–3.0)
Female	1.0	
Age (yrs)		
12–17	0.3††	(0.1–0.6)
18–25	1.0	
26	0.6††	(0.4–0.9)
Race/Ethnicity		
Non-Hispanic white	3.1†††	(1.8–5.1)
Other	1.0	
Geography		
Residing in CBSA with ≥1 million persons	2.4†††	(1.5–3.6)
Residing in other area	1.0	
Household income (annual)		
<20,000	1.0	
$20,000-$49,999	0.5††	(0.3–0.7)
≥$50,000 or more	0.6†	(0.3–0.9)
Insurance coverage		
None	3.1†††	(2.2–4.3)
Medicaid	3.2†††	(1.9–5.4)
Private or other	1.0	
Past-year substance abuse or dependence§		
Alcohol	1.8††	(1.2–2.9)
Marijuana	2.6††	(1.5–4.6)
Cocaine	14.7†††	(7.4–29.2)
Opioid pain relievers	40.0†††	(24.6–65.3)
Other psychotherapeutics¶	1.6	(0.8–3.2)

Abbreviations: aOR = adjusted odds ratio; CBSA = Core Based Statistical Area; CI = confidence interval.

* Past-year heroin abuse or dependence is based on diagnostic criteria contained in the *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition*.

† Statistically significant finding; †p<0.05; ††p<0.01; †††p<0.001.

§ Referent group is no past-year abuse or dependence.

¶ Other psychotherapeutics includes tranquilizers, sedatives, and stimulants.

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Announcement

Recommendation Regarding Cardiovascular Disease Prevention and Control — Community Preventive Services Task Force

The Community Preventive Services Task Force recently posted new information on its website, Cardiovascular Disease Prevention and Control: Interventions Engaging Community Health Workers. The information is available at http://www.thecommunityguide.org/cvd/CHW.html.

Established in 1996 by the U.S. Department of Health and Human Services, the task force is an independent, nonfederal, uncompensated panel of public health and prevention experts whose members are appointed by the Director of CDC. The task force provides information for a wide range of decision makers on programs, services, and policies aimed at improving population health. Although CDC provides administrative, research, and technical support for the task force, the recommendations developed are those of the task force and do not undergo review or approval by CDC.

Errata

Vol. 64, No. 19

In the report, "State-Specific Prevalence of Current Cigarette Smoking and Smokeless Tobacco Use Among Adults Aged ≥18 Years — United States, 2011–2013," errors occurred. On page 533, in Table 1, the relative percent change (RPC) for cigarette smoking for Alabama (AL) should be **-11.5** and the RPC for smokeless tobacco for Washington (WA) should **not be marked as significant**. In addition, on page 534, in Figure 2, there was **no significant change** in smokeless tobacco in the District of Columbia.

Vol. 64, No. 24

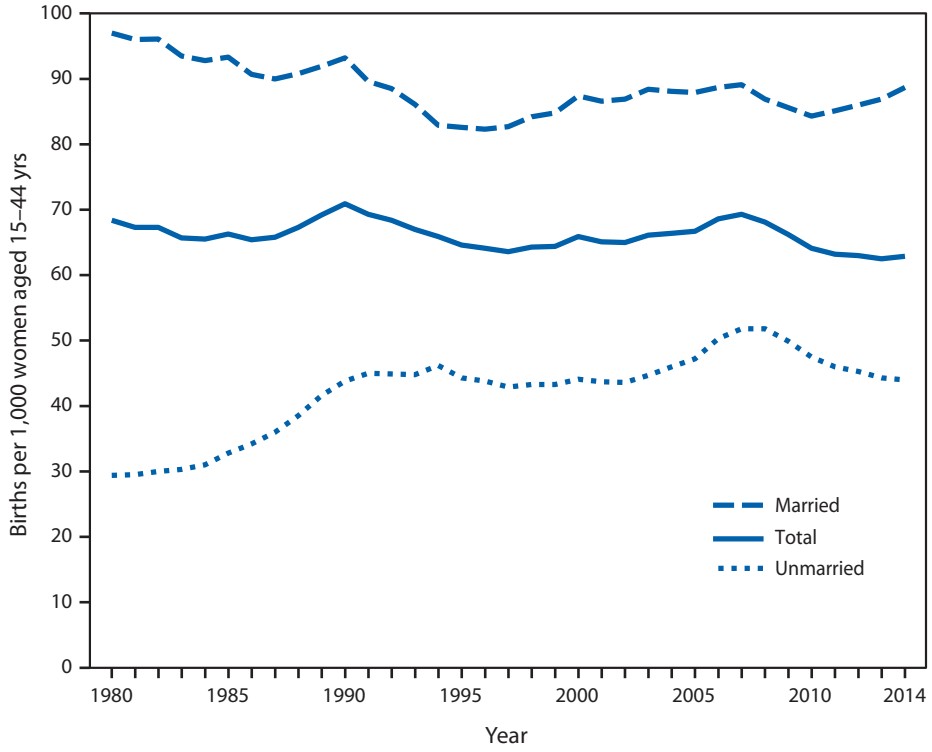
In the report, "State Tobacco Control Program Spending — United States, 2011," an error occurred. The first sentence under the "What is added by this report?" summary, should read as follows:

In fiscal year 2011, for tobacco prevention and control activities, all 50 states and the District of Columbia combined spent $658 million ($2.11 per capita) in the following categories: 41.4% on state and community interventions ($272 million [$0.87 per capita]); 18.8% on health communication interventions ($124 million [$0.40 per capita]); 20.4% on cessation interventions ($134 million [$0.43 per capita]); 9.3% on surveillance and evaluation ($61 million [$0.20 per capita]); and 10.1% on **administration and management** ($67 million [$0.21 per capita]).

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Annual Birth Rates,* by Marital Status — National Vital Statistics System, United States, 1980–2014†



* Births per 1,000 women aged 15–44 years in each category.
† Data for 2014 are preliminary.

The birth rate for married women (97.0 per 1,000) was more than three times that for unmarried women (29.4) in 1980. From1980 to the mid-1990s, the birth rate among married women generally declined, whereas the rate for unmarried women generally increased. Both rates stabilized in the mid-1990s and then increased until 2007–2008. The birth rate among unmarried women declined from 51.8 in 2007 and 2008 to 44.0 in 2014. The birth rate for married women dropped 5% during 2007–2010 but increased to 88.7 in 2014.

Source: Hamilton B, Martin J, Osterman M, Curtin S. Births: preliminary data for 2014. Natl Vital Stat Rep 2015;64(6). Available at http://www.cdc.gov/nchs/data/nvsr/nvsr64/nvsr64_06.pdf.

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ISSN: 0149-2195