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National Preparedness Month — September 2016

Throughout September, CDC and approximately 3,000 global, national, regional, and local government organizations, as well as private and public institutions, will promote the importance of being ready for emergencies (*1–3*). For Preparedness Month 2016, CDC's Office of Public Health Preparedness and Response will focus on the power of preparedness globally and locally and actions that can be taken collectively and individually (*1*).

Being prepared saves lives. Public health emergencies might take the shape of an emerging or rapidly spreading disease, a natural disaster, or an act of bioterrorism. While the nature, timing, and location of the next threat cannot be anticipated, developing programs to prevent, detect, and respond to public health emergencies can mitigate the impact of the unknown (*2*). Persons can take action now by having a family reunification plan and an emergency kit with basic supplies, medicines, and local emergency telephone numbers.

During preparedness month, CDC's *Public Health Matters* blog (*3*) will feature stories about how countries are partnering to advance health security, how emergencies prompt innovation and training, how states respond to new disease threats, and how every person plays a powerful role in protecting our communities and families. Preparedness Month will include infographics, social media, and a Twitter chat on September 27 @CDCEmergency. The month culminates with National PrepareAthon! Day on September 30. Additional information about CDC's Preparedness Month is available at http://www.cdc.gov/phpr/npm.

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School District Crisis Preparedness, Response, and Recovery Plans — United States, 2012

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The unique characteristics of children dictate the need for school-based all-hazards response plans during natural disasters, emerging infectious diseases, and terrorism (*1–3*). Schools are a critical community institution serving a vulnerable population that must be accounted for in public health preparedness plans; prepared schools are adopting policies and plans for crisis preparedness, response, and recovery (*2–4*). The importance of having such plans in place is underscored by the development

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of a new *Healthy People 2020* objective (PREP-5) to "increase the percentage of school districts that require schools to include specific topics in their crisis preparedness, response, and recovery plans" (*5*). Because decisions about such plans are usually made at the school district level, it is important to examine district-level policies and practices. Although previous reports have provided national estimates of the percentage of districts with policies and practices in place (*6*), these estimates have not been analyzed by U.S. Census region* and urbanicity.† Using data from the 2012 School Health Policies and Practices Study (SHPPS), this report examines policies and practices related to school district preparedness, response, and recovery. In general, districts in the Midwest were less likely to require schools to include specific topics in their crisis preparedness plans than districts in the Northeast and South. Urban districts tended to be more likely than nonurban districts to require specific topics in school preparedness plans. Southern districts tended to be more likely than districts in other regions to engage with partners when developing plans. No differences in district collaboration (with the exception of local fire department engagement) were observed by level of urbanicity. School-based preparedness planning needs to be coordinated with interdisciplinary community partners to achieve *Healthy People 2020* PREP-5 objectives for this vulnerable population.

SHPPS is a national survey conducted every 6 years by CDC to assess school health policies and practices at state, district, school, and classroom levels. This report uses school district–level data from the 2012 survey (*6*). A two-stage sample design was used to generate a nationally representative sample of public school districts in the United States. Seven district-level questionnaires (each assessing different aspects of school policies and practices) were administered in each sampled district; this report provides results from the healthy and safe school environment questionnaire. Respondents were asked whether their school district required schools to have a comprehensive plan to address crisis preparedness, response, and recovery that included four specific topics identified in PREP-5: family reunification procedures, procedures for responding to pandemic influenza or other infectious disease outbreaks, provisions for students and staff members with special needs, and provision of mental health services for students

* https://www.census.gov/geo/reference/gtc/gtc_census_divreg.html.
† http://www.census.gov/geo/reference/urban-rural.html.

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and staff members after a crisis. Respondents also were asked whether the district collaborated with specified categories of partners (e.g., local fire department or local mental health or social services agency) in developing crisis preparedness plans.

A single respondent identified by the district as the most knowledgeable on the topic responded to each questionnaire module. During October 2011–August 2012, respondents completed questionnaires via a secure data collection website or paper-based questionnaires. Among eligible districts, 697 (66.5%) completed the healthy and safe school environment questionnaire. Additional data regarding SHPPS methods are available online (*6*). Data were weighted to provide national estimates and analyzed using statistical software that accounted for the complex sample design. School districts were categorized by geographic location into one of the four U.S. Census regions (Midwest, Northeast, South, and West) and by level of urbanicity (urban or nonurban). Prevalence estimates and 95% confidence intervals were computed for all point estimates. Significant differences were evaluated by census region and urbanicity by t-test, with significance set at $p<0.05$.

District requirements for school plans varied by specific topic and region, ranging from 87.8% in the South for provisions for students and staff members with special needs to 57.9% in the Midwest for procedures for responding to pandemic influenza or other infectious disease outbreaks (Table 1). Overall, 79.9% of school districts required provisions for students and staff members with special needs; 67.8% required plans that addressed family reunification procedures, 69.0% required procedures for responding to pandemic influenza or other infectious disease outbreaks, and 69.3% required plans for provision of mental health services for students, faculty, and staff members after a crisis. For all four of the topics, the percentage of school districts requiring schools to address the topic was lowest in the Midwest.

By urbanicity, on average, urban districts required schools to include more of the four topics in their preparedness plans than did nonurban districts (3.1 versus 2.7 specific topics, $p<0.05$). Urban districts also were significantly ($p<0.05$) more likely than nonurban districts to require schools to include family reunification, provisions for students and staff members with special needs, and provision of mental health services in their plans (Table 1).

Analysis of responses regarding district collaboration with community partners found differences in practices for preparedness planning by census region, although only one significant difference was found by urbanicity (Table 2). Across all districts, >90% worked with 1) staff members from individual schools within the district, 2) local fire departments, and 3) local law enforcement agencies. In contrast, 16.6% of districts (range = 12.0%–20.8%) worked with a local public transportation department[§] (Table 2).

[§] Sixty two percent of districts did not have public transportation departments.

TABLE 1. Percentage of school districts that require schools to have a comprehensive plan to address crisis preparedness, response, and recovery* that includes specific topics, by U.S. Census region and urbanicity — School Health Policies and Practices Study, United States, 2012

	Census region[†] % (95% CI)				Urbanicity % (95% CI)		
Specific topic	**Midwest**	**Northeast**	**South**	**West**	**Urban**	**Nonurban**	**Total % (95% CI)**
Family reunification procedures	60.2[§] (52.8–67.3)	72.0[¶] (62.3–80.0)	71.6 (63.7–78.4)	73.6** (63.1–82.1)	78.0[††] (71.5–83.4)	61.5 (55.8–66.8)	**67.8 (63.5–71.9)**
Procedures for responding to pandemic influenza or other infectious disease outbreaks	57.9[§] (50.2–65.3)	75.2[¶] (67.7–81.5)	79.4 (72.5–84.9)	68.5 (56.3–78.6)	72.9 (66.1–78.8)	66.5 (60.6–71.8)	**69.0 (64.7–73.1)**
Provisions for students and staff members with special needs	72.2[§] (64.3–79.0)	87.6[¶] (80.9–92.1)	87.8[§§] (82.4–91.7)	73.0[¶¶] (63.9–80.5)	85.8[††] (80.6–89.7)	76.3 (70.8–81.1)	**79.9 (76.0–83.3)**
Provision of mental health services for students, faculty, and staff members after a crisis occurred***	60.1[§] (52.7–67.1)	80.4[¶] (72.6–86.4)	72.7 (65.7–78.6)	71.6 (60.7–80.4)	77.1[††] (70.6–82.5)	64.4 (59.0–69.4)	**69.3 (65.2–73.2)**

Abbreviation: CI = confidence interval.
* In the event of a natural disaster or other emergency or crisis situation.
[†] https://www.census.gov/geo/reference/gtc/gtc_census_divreg.html.
[§] Significant difference ($p<0.05$) between Midwest and South districts.
[¶] Significant difference ($p<0.05$) between Northeast and Midwest districts.
** Significant difference ($p<0.05$) between West and Midwest districts.
[††] Significant difference ($p<0.05$) between urban and nonurban districts.
[§§] Significant difference ($p<0.05$) between South and West districts.
[¶¶] Significant difference ($p<0.05$) between West and Northeast districts.
*** For example, to treat post-traumatic stress disorder.

Discussion

Children represent approximately one fourth of the U.S. population and are separated from their caregivers while attending school. They have unique physiological, psychological, and developmental attributes that make them at heightened risk during disasters (*1*–*3*). Particular challenges for school-based preparedness are planning for children with special needs (e.g., disabilities or functional or medical needs), chronic conditions, or limited English proficiency (*1*,*2*,*4*,*7*). Effective readiness can be hampered by compartmentalized planning that overlooks the unique vulnerabilities of children in and following public health disasters (*8*). Broader community participation in school-based disaster planning can ensure that relevant stakeholders have a common framework and understanding to support response and recovery following a disaster.

Although SHPPS found that more than two thirds of districts require schools to include specified topics in their crisis plans, these requirements do not necessarily exist at the state level. A 2014 National Report Card evaluated state-level standards for preparedness planning for children and found that only 29 states met the basic standards for safety of children during an event (*9*). However, the National Report Card focused primarily on disaster planning standards for children in child care facilities with only one standard specific to K-12. A state level approach to disaster preparedness planning is needed for both child care facilities and schools.

The findings in this report are subject to at least three limitations. First, the "yes or no" responses do not provide insight into the relevance of the specific topics in the preparedness plan or whether plans were exercised or evaluated to identify areas for improvement. Second, SHPPS data are collected every 6 years, and the most recent district data are from 2012. It is possible that some districts have updated their policies and practices related to preparedness since the data were collected. Finally, SHPPS data are self-reported and as such there might be opportunity for misclassification because of respondent interpretation of a particular question.

TABLE 2. Percentage of school districts that collaborated with school or community partners to develop preparedness, response, and recovery plans,* by planning partner type, U.S. Census region, and urbanicity — School Health Policies and Practices Study, United States, 2012

	Census region† % (95% CI)				Urbanicity % (95% CI)		
Partners engaged	**Midwest**	**Northeast**	**South**	**West**	**Urban**	**Nonurban**	**Total§ % (95% CI)**
Staff members from individual schools within district	93.0 (88.3–95.9)	97.4 (92.3–99.1)	96.9 (92.7–98.7)	95.7 (87.6–98.6)	97.1 (94.0–98.6)	94.3 (91.1–96.5)	**95.4 (93.2–96.9)**
Students or their families	33.5¶ (27.4–40.1)	47.0** (36.7–57.6)	50.9 (43.5–58.2)	43.8 (34.2–53.8)	42.8 (36.2–49.8)	43.0 (39.9–48.3)	**42.8 (38.7–46.9)**
Local fire department	90.9 (86.2–94.1)	95.8 (90.3–98.2)	91.7 (86.4–95.0)	89.3 (80.8–94.4)	94.7†† (90.8–97.0)	90.1 (86.6–92.7)	**91.9 (89.4–93.9)**
Local law enforcement agency	93.8 (89.4–96.5)	100**,§§ (100–100)	94.0 (89.0–96.8)	91.7¶¶ (83.1–96.1)	96.7 (93.5–98.3)	93.7 (90.4–95.9)	**94.8 (92.6–96.4)**
Local emergency medical services	80.0 (73.6–85.2)	86.0 (78.4–91.2)	87.4 (81.0–91.9)	75.6 (63.2–84.8)	82.3 (76.0–87.2)	83.2 (78.6–86.9)	**82.8 (79.2–85.9)**
Local public transportation department	12.0¶ (8.1–17.4)	20.6 (13.4–30.4)	20.8 (15.5–27.4)	13.7 (8.2–22.1)	20.7 (15.4–27.2)	14.0 (10.7–18.2)	**16.6 (13.7–20.0)**
Local health department	62.4 (55.4–69.1)	69.1 (58.9–77.8)	69.1 (61.5–75.7)	60.9 (49.5–71.3)	68.9 (61.9–75.2)	63.5 (58.1–68.7)	**65.6 (61.3–69.6)**
Local mental health or social services agency	41.0 (34.5–47.9)	51.8 (43.3–60.2)	48.5 (40.7–56.4)	46.1 (34.3–58.4)	49.9 (43.1–56.7)	43.8 (38.4–49.3)	**46.1 (41.9–50.4)**
Local hospital	39.7 (32.5–47.3)	36.7§§ (27.6–46.8)	50.3*** (42.4–58.2)	32.1 (23.3–42.3)	42.8 (35.7–50.1)	40.1 (34.8–45.7)	**41.2 (36.9–45.6)**
Local homeland security office or emergency management agency	36.9¶ (29.8–44.6)	51.6** (41.9–61.3)	58.0*** (49.6–66.0)	29.4¶¶ (20.7–39.8)	49.2 (42.2–56.2)	41.8 (36.0–47.9)	**45.1 (40.6–49.7)**
Other community members	61.4¶ (54.5–67.9)	70.8 (61.6–78.5)	76.7*** (69.0–83.0)	58.6 (47.6–68.9)	66.1 (59.5–72.2)	67.7 (62.2–72.7)	**67.4 (63.2–71.3)**

Abbreviation: CI = confidence interval.

* Among districts that had a preparedness plan or required schools to have a plan.

† https://www.census.gov/geo/reference/gtc/gtc_census_divreg.html.

§ Total refers to the total number of districts that responded to the evaluated question on the healthy and safe school environment module. Districts with missing data were not included in the denominator.

¶ Significant difference (p<0.05) between Midwest and South districts.

** Significant difference (p<0.05) between Northeast and Midwest districts.

†† Significant difference (p<0.05) between urban and nonurban districts.

§§ Significant difference (p<0.05) between Northeast and South districts.

¶¶ Significant difference (p<0.05) between West and Northeast districts.

*** Significant difference (p<0.05) between South and West districts.

Summary

What is already known about this topic?

Children represent nearly one fourth of the U.S. population, have unique vulnerabilities, and might be in a school setting, separated from families, when a disaster occurs. The U.S. Department of Education recommends that schools develop and exercise crisis preparedness plans in collaboration with community partners.

What is added by this report?

Data from the 2012 School Health Policies and Practices Study indicated that 79.9% of school districts required schools to have a comprehensive plan that includes provisions for students and staff members with special needs, whereas 67.8% to 69.3% of districts required plans that addressed family reunification procedures, procedures for responding to pandemic influenza or other infectious disease outbreaks, and provision of mental health services for students, faculty, and staff members, after a crisis. On average, urban districts required schools to include more of the four selected topics in their plans than nonurban districts. Across all districts, >90% collaborated on plans with staff members from individual schools within the district, local fire departments, and local law enforcement agencies.

What are the implications for public health practice?

The deficiencies found in some census regions show a need to strengthen school district–based disaster preparedness planning. These deficiencies need to be addressed to meet the four Healthy People 2020 preparedness objectives (PREP-5).

The U.S. Department of Education's *Practical Information on Crisis Planning: a Guide for Schools and Communities* recommends that school crisis plans be developed in partnership with other community stakeholders (*4*). In this report, percentages of districts collaborating with school staff members and law enforcement, fire department, and emergency medical services were high across all census regions and levels of urbanicity, although other partnerships need improvement. The American Academy of Pediatrics suggests that additional efforts are needed to address deficiencies in partner engagement for school disaster planning and to address the unique vulnerabilities of children (*3*). School-based and community-based preparedness planning, training, exercises, and drills to improve emergency response, recovery, and overall community resilience are needed (*7*).

National and district-specific information on school crisis preparedness planning is required to identify and address critical gaps in preparedness, response, and recovery policies and plans for children. Findings from this report can strengthen school and community preparedness through multi-organizational, transdisciplinary partnerships engaged in preparedness planning (*7*). Disaster planning is a shared responsibility (*2*). The Children and Youth Task Force, Office of Human Services Emergency Preparedness and Response, is promoting a coordinated planning approach involving governmental and nongovernmental organizations and health care providers to improve outcomes and minimize the consequences of disasters on this vulnerable population (*7*).

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Physical Inactivity Among Adults Aged 50 Years and Older — United States, 2014

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Physical activity can help delay, prevent, or manage many of the chronic diseases for which adults aged ≥50 years are at risk (*1–3*). These diseases can impact the length and quality of life, as well as the long-term ability to live independently.* All adults aged ≥50 years, with or without chronic disease, gain health benefits by avoiding inactivity (*2*,*3*). To examine the prevalence of inactivity by selected demographic characteristics and chronic disease status in mid-life and older adults, CDC analyzed data on adults aged ≥50 years from the 2014 Behavioral Risk Factor Surveillance System (BRFSS). Overall, 27.5% of adults aged ≥50 years reported no physical activity outside of work during the past month. Inactivity prevalence significantly increased with increasing age and was 25.4% among adults aged 50–64 years, 26.9% among those aged 65–74 years, and 35.3% among those aged ≥75 years. Inactivity prevalence was significantly higher among women than men, among Hispanics and non-Hispanic blacks than among non-Hispanic whites, and among adults who reported ever having one or more of seven selected chronic diseases than among those not reporting one. Inactivity prevalence significantly increased with decreasing levels of education and increasing body mass index. To help adults with and without chronic disease start or maintain an active lifestyle, communities can implement evidence-based strategies, such as creating or enhancing access to places for physical activity, designing communities and streets to encourage physical activity, and offering programs that address specific barriers to physical activity.

BRFSS is a state-based, random-digit–dialed telephone survey of the noninstitutionalized U.S. civilian population aged ≥18 years. Data were collected among 304,129 adults aged ≥50 years from the 50 states and the District of Columbia (DC). The 2014 median landline and cellphone combined response rate was 47.0%, and ranged from 25.1% to 60.1%.†

Inactivity is defined as participating in no activity beyond baseline activities of daily living (*2*,*3*). For this analysis, inactivity was operationalized as a "no" response to the question, "During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?" In addition to self-reported sex, age, race/ethnicity, and highest level of education completed, adults reported weight and height. Body mass index (BMI) was calculated (weight [kg]/height [m]^2), and adults were classified as underweight or normal weight (<25.0 kg/m^2), overweight (25.0–29.9 kg/m^2) or obese (≥30 kg/m^2) (*4*). Questions about seven chronic diseases for which recommendations for physical activity in preventing or treatment of the disease are well-established were included in analyses (*2*,*3*,*5*). Respondents were defined as ever having one of these selected chronic diseases if they responded "yes" to a question asking if a doctor, nurse, or other health care professional ever told them they had the specific condition (stroke, coronary heart disease, arthritis, cancer [excluding skin cancer], diabetes, chronic obstructive pulmonary disease, and depressive disorder). Ever having coronary heart disease was defined as a "yes" response to myocardial infarction or coronary heart disease.

Data were analyzed by selected demographic characteristics and weighted to provide overall prevalence estimates with accompanying 95% confidence intervals (CIs). Linear contrasts and pairwise t tests were used to identify significant trends and differences by subgroups. Only differences and trends that reached statistical significance ($p<0.05$) were reported. Multiple logistic regression analysis was used to estimate the adjusted prevalence ratio (aPR) after controlling for the potential confounding effects from the following characteristics: sex, age group, race/ethnicity, education level, and BMI category. By using the multiple logistic regression model, the prevalence in activity by each characteristic controlled for the effects from the remaining characteristics in which studies have shown to be associated with inactivity. Statistical software was used to account for the complex sampling design and to provide weighted estimates.

Among the 304,129 adults aged ≥50 years living in the 50 states and DC, data from 27,210 adults were excluded because of missing information, resulting in a final sample of 276,919 adults. Overall, 27.5% of U.S. adults aged ≥50 years, approximately 31 million persons, were inactive (Table). Inactivity increased with increasing age for adults aged 50–64 years (25.4%), 65–74 years (26.9%), and ≥75 years (35.3%). The prevalence of inactivity was higher for women (29.4%) than men (25.5%), and for Hispanics (32.7%) and non-Hispanic blacks (33.1%) than non-Hispanic whites (26.2%) and those of other race/ethnicity (27.1%). The prevalence decreased

* http://www.cdc.gov/aging/pdf/state-aging-health-in-america-2013.pdf.
† http://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf.

TABLE. Self-reported prevalence of inactivity among adults aged ≥50 years, by selected characteristic — Behavioral Risk Factor Surveillance System, 2014*

Characteristic	Sample	Prevalence of inactivity	
	Unweighted sample size no. (%)	% prevalence† (95% CI)	aPR§ (95% CI)
Total	**276,919 (100.0)**	**27.5 (27.2–27.9)**	—
Sex			
Male	114,367 (47.8)	25.5 (25.0–26.0)	Ref
Female	162,552 (52.2)	29.4 (29.0–29.9)	1.1 (1.1–1.2)
Age group (yrs)			
50–64	133,362 (57.8)	25.4 (25.0–25.9)	Ref
65–74	82,474 (24.4)	26.9 (26.3–27.5)	1.1 (1.0–1.1)
>75	61,083 (17.8)	35.3 (34.5–36.1)	1.3 (1.3–1.4)
Race/Ethnicity			
White, non-Hispanic	234,458 (75.4)	26.2 (25.9–26.5)	Ref
Black, non-Hispanic	19,705 (10.7)	33.1 (31.8–34.3)	1.1 (1.1–1.2)
Hispanic	10,309 (8.6)	32.7 (31.0–34.5)	1.0 (0.9–1.0)
Other¶	12,447 (5.3)	27.1 (24.9–29.5)	1.1 (1.1–1.2)
Education			
<High school graduate	21,180 (13.9)	44.1 (42.7–45.4)	Ref
High school graduate	82,519 (29.7)	34.7 (34.0–35.3)	0.8 (0.8–0.8)
Some college	74,195 (30.0)	24.6 (24.0–25.2)	0.6 (0.6–0.6)
College graduate	99,025 (26.4)	14.2 (13.8–14.7)	0.4 (0.3–0.4)
Body mass index (kg/m2)**			
Underweight/Normal weight	89,886 (30.5)	23.1 (22.5–23.7)	Ref
Overweight	104,639 (38.3)	24.4 (23.9–25.0)	1.1 (1.0–1.1)
Obese	82,394 (31.2)	35.8 (35.1–36.4)	1.5 (1.5–1.6)
Region			
Midwest	76,631 (22.5)	28.4 (27.8–29.0)	1.1 (1.1–1.2)
Northeast	50,774 (18.8)	26.6 (25.8–27.4)	1.1 (1.1–1.2)
South	84,135 (37.4)	30.1 (29.5–30.6)	1.2 (1.1–1.2)
West	65,379 (21.3)	23.1 (22.2–24.0)	Ref
Ever had the following chronic disease			
Arthritis			
Yes	127,024 (43.4)	33.1 (32.5–33.6)	1.2 (1.2–1.2)
No	149,895 (56.6)	23.3 (22.9–23.8)	Ref
Cancer§§			
Yes	36,293 (11.6)	31.6 (30.6–32.6)	1.1 (1.1–1.2)
No	240,626 (88.4)	27.0 (26.6–27.4)	Ref
Coronary heart disease¶¶			
Yes	36,362 (12.8)	37.2 (36.2–38.2)	1.3 (1.2–1.3)
No	240,557 (87.2)	26.1 (25.8–26.5)	Ref
COPD			
Yes	29,737 (10.6)	44.4 (43.3–45.5)	1.5 (1.5–1.6)
No	247,182 (89.4)	25.6 (25.2–25.9)	Ref
Depressive disorder			
Yes	52,399 (18.5)	38.0 (37.2–38.8)	1.4 (1.4–1.4)
No	224,520 (81.5)	25.2 (24.8–25.6)	Ref
Diabetes			
Yes	47,773 (18.3)	38.4 (37.5–39.3)	1.3 (1.2–1.3)
No	229,146 (81.7)	25.1 (24.7–25.5)	Ref
Stroke			
Yes	15,523 (5.4)	42.9 (41.3–44.5)	1.4 (1.3–1.5)
No	261,396 (94.6)	26.7 (26.3–27.0)	Ref

Abbreviations: aPR = prevalence ratio; CI = confidence interval; COPD = chronic obstructive pulmonary disease; Ref = referent.

* Inactivity is defined as responding "No" to the following question: "During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?"

† All pairwise comparisons are significant except for the following two pairs: non-Hispanic black versus Hispanic and non-Hispanic white versus other race; age, education, and BMI have significant linear trends.

§ aPR is adjusted for sex, age group, race/ethnicity, education, and body mass index.

¶ Other includes Multiracial, Asian, Native Hawaiian or Other Pacific Islander, or American Indian, or Alaska Native.

** Body mass index classifications are as follows: underweight/normal (<25.0 kg/m^2); overweight (25.0–29.9 kg/m^2); obese (≥30 kg/m^2).

†† Excluding skin cancer.

§§ Coronary heart disease includes myocardial infarction and coronary heart disease.

from 44.1% to 14.2% with increasing levels of education and increased from 23.1% to 35.8% with increasing BMI category. Differences in prevalence of inactivity by sex, age group, race/ethnicity, education level, and BMI category remained after simultaneously adjusting for these characteristics.

By region, the prevalence of inactivity was highest in the South (30.1%), followed by the Midwest (28.4%) and Northeast (26.6%). The West (23.1%) had the lowest prevalence. After adjusting for demographic characteristics, differences in prevalence by region remained. Among the 50 states and DC, the prevalence ranged from 17.9% in Colorado to 38.8% in Arkansas (Figure 1).

Among those who ever had one of the seven chronic diseases, the prevalence of inactivity was higher among those who ever had any of the diseases compared with those who did not (Table). The magnitude of the difference ranged from an aPR of 1.1 (CI = 1.1–1.2) for cancer to an aPR of 1.5 (CI = 1.5–1.6) for chronic obstructive lung disease. Overall, more adults reporting at least one chronic disease were inactive (31.9%) compared with those not reporting any (19.2%) (Figure 2). The demographics-adjusted prevalence of inactivity among adults with at least one chronic disease was 40% higher (aPR = 1.4; CI = 1.3–1.4) compared with adults without a chronic disease. By age group, the prevalence of inactivity for adults with at least one chronic disease compared with those with no disease was 30.9% versus 18.1% for 50–64 years, 29.6% versus 19.2% for 65–74 years, and 37.3% versus 26.8% for ≥75 years (Figure 2).

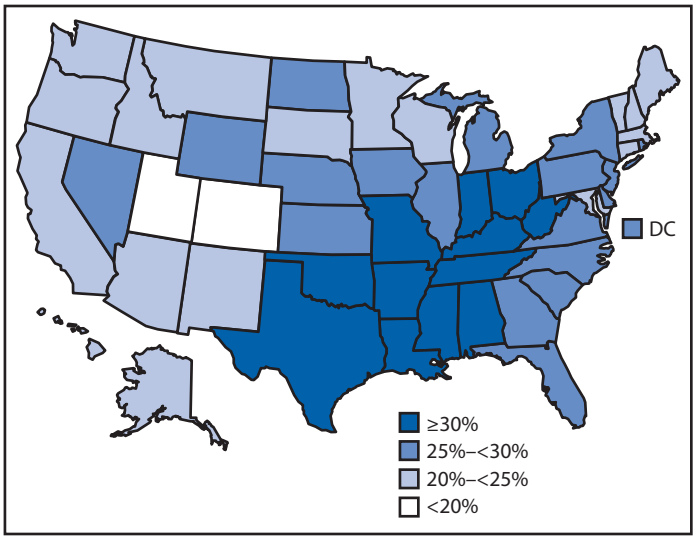
Discussion

Approximately 28% of adults aged ≥50 years (31 million persons) were inactive. Inactivity increased with increasing age and BMI, and decreased with increasing levels of education. The prevalence of inactivity was higher among women than among men, and among Hispanics and non-Hispanic blacks compared with non-Hispanic whites. The prevalence was 10%–50% higher among adults who reported having had one of seven specific chronic diseases than among those who reported not having it. The prevalence among the 50 states and DC ranged from 18% to 39%. Results of this analysis are consistent with findings from a national survey showing these differences by demographic characteristics[§] and by chronic disease status (*6*).

Older adults might be inactive for a number of reasons. Despite benefits of physical activity, it might be that some adults with chronic diseases become inactive because of the disease. However, according to *2008 Physical Activity Guidelines for Americans* (*2*,*3*), older adults and adults with chronic diseases or disabilities should try to engage in physical activity appropriate for their abilities. Among those with a chronic disease, physical activity can help lessen their condition's severity, manage the disease, or prevent or delay other chronic diseases. For example, among persons with arthritis, joint pain could be reduced through being more active; low impact activity is often recommended (*2*,*3*).

Similar to persons with disabilities, older adults might want to be active but face barriers, such as limited places to be safely active in their community or not knowing how to be active given their physical limitations (*7*). Communities can provide supports that help everyone become more active by using recommended evidence-based strategies.[¶] These community strategies were recently highlighted in *Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities*[**] and complement existing recommendations and initiatives to help Americans become more physically active, such as *Healthy People 2020*, the National Prevention Strategy: America's Plan for Better Health and Wellness, Let's Move!, the Go4Life Campaign, the National Physical Activity Plan, and the U.S. Department of Transportation's Safer People, Safer Streets Initiative.[††]

FIGURE 1. Prevalence of self-reported physical inactivity among adults aged ≥50 years — Behavioral Risk Factor Surveillance System, 2014



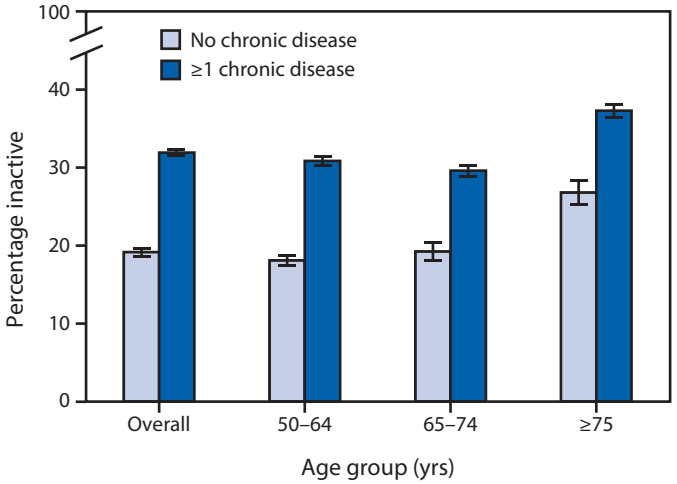
[§] https://www.healthypeople.gov/2020/topics-objectives/topic/physical-activity.

[¶] http://www.thecommunityguide.org/pa/index.html.

[**] http://www.surgeongeneral.gov/library/calls/walking-and-walkable-communities/call-to-action-walking-and-walkable-communites.pdf.

[††] Information can be found for *Healthy People 2020* (https://www.healthypeople.gov/2020/topics-objectives/topic/physical-activity), the National Prevention Strategy (http://www.surgeongeneral.gov/priorities/prevention/strategy/report.pdf), Let's Move! (http://www.letsmove.gov/), Go4Life (http://go4life.nia.nih.gov), the National Physical Activity Plan (http://physicalactivityplan.org/docs/2016NPAP_Finalforwebsite.pdf), and the Safer People, Safer Streets: Pedestrian and Bicycle Safety Initiative (http://www.dot.gov/policy-initiatives/ped-bike-safety/safer-people-safer-streets-pedestrian-and-bicycle-safety).

FIGURE 2. Prevalence of self-reported physical inactivity among adults aged ≥50 years, by chronic disease status* and age group — Behavioral Risk Factor Surveillance System, 2014



* Among adults aged ≥50 years, 65.7% (confidence interval [CI] = 65.3%–66.1%) had one or more chronic diseases and 34.3% (CI = 33.9%–34.7%) had no chronic disease. Chronic disease is defined as responding yes to at least one of the following conditions: stroke, coronary heart disease, arthritis, cancer (excluding skin cancer), chronic obstructive pulmonary disease, diabetes, and depression. Coronary heart disease includes myocardial infarction and coronary heart disease.

Summary

What is already known about this topic?

Physical activity has health benefits for persons of all ages. When adults are not able to meet guidelines because of factors such as age, chronic disease, or disabilities, they should engage in physical activity according to their abilities; adults who participate in any physical activity will gain some health benefits. Communities can provide supports that help everyone become more active by using recommended evidence-based strategies.

What is added by this report?

Overall, 27.5% of adults aged ≥50 years reported no physical activity outside of work during the past month. Inactivity prevalence significantly increased with increasing age, and was 25.4% among adults aged 50–64 years, 26.9% among adults aged 65–74 years, and 35.3% among adults aged ≥75 years. Inactivity prevalence was significantly higher among women than men, among Hispanics and non-Hispanic blacks than among non-Hispanic whites, and among persons reporting ever having had one or more of seven selected chronic diseases than among those not reporting one. Inactivity prevalence significantly increased with decreasing levels of education and increasing body mass index.

What are the implications for public health practice?

Despite the many benefits of being physically active, approximately one in four adults aged ≥50 years are inactive. Communities can be designed and enhanced to make it safer and easier for persons of all ages and abilities to be physically active.

Communities can be enhanced and designed to make it safe and easy for persons of all ages and abilities to be active. Community design can support physical activity, for example, by locating residences within short walking distance of destinations (e.g., stores) and building well-connected safe paths between destinations. Street design can support walking and enhance pedestrian safety through measures that improve safety and aesthetics, as well as addressing barriers for persons with limitations (e.g., using curb cuts). Currently, enhancing and designing communities to promote physical activity is supported in several federally funded programs.[§§] For example, through the State Public Health Actions to Prevent and Control Diabetes, Heart Disease, Obesity and Associated Risk Factors and Promote School Health program,[¶¶] CDC works with state departments of health to increase physical activity by increasing the number of communities that have pedestrian and bike-friendly master transportation plans.

Creating or enhancing access to places for physical activity, combined with information to promote and encourage use of these places, is another recommended strategy to increase physical activity. Examples of such community locations include public parks, recreational facilities, senior centers, and malls. Programs, such as an organized mall walking program,[***] can help enhance access and promote and encourage use of these locations.

Through campaigns and informational approaches, community groups and organizations can also provide access to evidence-based community programs to help adults start and continue to be physically active. Given higher levels of inactivity among persons with chronic conditions, it is important that organizations offer programs that address specific concerns these adults might have and barriers they might face. For example, the Arthritis Foundation's Walk With Ease program has been shown to reduce pain, increase balance and strength, and improve overall health through walking.[†††] Health care professionals can play a role in promoting physical activity by counseling patients, writing prescriptions for physical activity, and possibly referring them to community programs or facilities where they can be active (*8*,*9*).[§§§]

[§§] Information can be found for the State Public Health Actions to Prevent and Control Diabetes, Heart Disease, Obesity and Associated Risk Factors and Promote School Health program (http://www.cdc.gov/chronicdisease/about/state-public-health-actions.htm) and the Department of Transportation's Transportation Alternatives Program (http://www.fhwa.dot.gov/environment/transportation_alternatives/).

[¶¶] http://www.cdc.gov/chronicdisease/about/state-public-health-actions.htm.

[***] http://www.cdc.gov/physicalactivity/downloads/mallwalking-guide.pdf.

[†††] http://www.cdc.gov/arthritis/interventions/index.htm and http://www.arthritis.org/living-with-arthritis/tools-resources/walk-with-ease/about.php.

[§§§] http://www.uspreventiveservicestaskforce.org/Page/Document/UpdateSummaryFinal/healthy-diet-and-physical-activity-counseling-adults-with-high-risk-of-cvd.

The findings in this report are subject to at least five limitations. First, BRFSS data are self-reported and subject to recall and social-desirability biases. This can result in an underestimate of physical inactivity (*10*). Second, BRFSS physical activity questions do not include occupational activities, and not considering a person's work hours might result in overestimates of physical inactivity. Third, the data are from noninstitutionalized adults and are not generalizable to the institutionalized population. Fourth, complete case analysis was used to handle missing data, which could result in an over- or underestimation of physical activity. Finally, the 2014 lowest state-level survey response rate was 25.1%, which can result in response bias. However, BRFSS data are weighted to adjust for nonresponse.

Approximately 28% of adults aged ≥50 years are inactive and are missing the opportunity to improve their health through physical activity. Communities can be designed and enhanced to make it safer and easier for persons of all ages and abilities to be physically active.

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Association Between User-Generated Commuting Data and Population-Representative Active Commuting Surveillance Data — Four Cities, 2014–2015

Geoffrey P. Whitfield, PhD[1]; Emily N. Ussery, PhD[1]; Brian Riordan[2]; Arthur M Wendel, MD[3]

Creating environments that support all types of physical activity, including active transportation, is a public health priority (*1*). Public health surveillance that identifies the locations where community members walk and bicycle (i.e., engage in active transportation) can inform such efforts. Traditional population-representative active transportation surveillance incurs a considerable time lag between data collection and dissemination, and often lacks geographic specificity (*2*). Conversely, user-generated active transportation data from Global Positioning System (GPS)-based activity tracking devices and mobile applications can provide near real-time information, but might be subject to self-selection bias among users. CDC analyzed the association between GPS-based commuting data from a company that allows tracking of activity with a mobile application (Strava, Inc., San Francisco, California) and population-representative commuting data from the U.S. Census Bureau's American Community Survey (ACS) (*3*) for four U.S. cities. The level of analysis was the Census block group. The number of GPS-tracked commuters in Strava was associated with the number of ACS active commuters (Spearman's rho = 0.60), suggesting block groups were ranked similarly based on these distinct but related measurements. The correlation was higher in high population density areas. User-generated active transportation data might complement traditional surveillance systems by providing near real-time, location-specific information on where active transportation occurs.

Physical activity, including walking and bicycling for transportation, is a valuable health behavior. Public health surveillance can identify areas with high and low levels of active transportation and guide efficient investments in active transportation programs and infrastructure, as recommended in "Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities" (*1*).

Historically, active transportation surveillance using surveys or logs has used purposeful sampling to provide population-representative estimates, despite a time lag between the activity and data availability (*2*). User-generated, GPS-tracked active transportation data are available in near real-time but are subject to selection bias because the only persons who contribute data are those who can use the requisite technology and have the interest in doing so. The magnitude of this bias has not been established. If user-generated active transportation data demonstrate some validity in measuring this behavior, they could complement traditional active transportation surveillance. Cities have begun using these data sources to plan infrastructure, so evaluation relative to an established surveillance system is important (*4*). The purpose of this analysis was to determine if the number of GPS-tracked active commuters is associated with the number of workers who walk or bicycle to work at the block group level in four U.S. cities.

Strava is one of several companies that has built an activity-tracking application and repository for GPS-tracked data. It was chosen for this analysis because of its large user base, amassed by offering a free social media platform where users can compare activities with peers. Further, cities have begun using Strava for planning bicycle and pedestrian infrastructure (*4*). Strava analysts identified user-logged commute trips (versus recreational trips) using two methods. First, users could mark or label activities as commutes in the application. Second, a proprietary algorithm was used that analyzed trip origin, destination, and timing to identify trips that were likely commute-oriented. Strava analysts provided CDC with the number of unique application users who started a commute trip in each block group in the study area during May 2014–May 2015 (GPS-tracked commuters). Block groups are subdivisions of census tracts and generally contain 600–3,000 residents. No personally identifiable information was provided to CDC, and the software users agreed to Strava's use of deidentified data at the time of registration.

Comparison data were obtained from ACS. ACS samples approximately 3.5 million addresses each year, and all residents at an address complete the survey. ACS achieves 96%–98% response rates with internet, mail, telephone, and in-person data collection. Employed ACS respondents aged ≥16 years reported the single mode of transportation that accounted for the majority of miles traveled to work during the previous week. The estimated number of commuters per block group who reported bicycling or walking (ACS active commuters) was downloaded from the Census Bureau (*5*). Although GPS-tracked commuters could be counted in any block group where they begin a commute trip, ACS active commuters were only counted in their block group of residence. Five ACS cycles were merged to increase the reliability of block group estimates and maintain respondent anonymity; for this analysis, ACS cycles 2009–2013 were used. Population density, which

is strongly associated with active transportation (*2*), was also obtained from ACS. ACS samples continuously to account for seasonal variation.

Four U.S. cities (Austin, Texas; Denver, Colorado; Nashville, Tennessee; and San Francisco, California) were selected, based on a high number of tracking application users and their geographic diversity across the United States. Because the number of active commuters (both GPS-tracked and ACS) was skewed and had a high prevalence of zero values, this analysis presents medians with interquartile ranges and Spearman's rank correlation coefficients (rho) (*6*). The large number of block groups resulted in uniformly significant correlation coefficients, so interpretation of rho followed Cohen (low = 0.1–0.3; moderate >0.3–0.5; strong >0.5–0.7) (*7*). The number of commuters per block group was analyzed both as a raw count and as a percentage of the block group population. Analyses were stratified by city and by population density tertiles.

Population density within block groups varied across cities; the median ranged from 2,785 persons per square mile in Nashville to 25,567 in San Francisco (Table 1). The median number of GPS-tracked commuters and ACS active commuters per block group was similar within each city and for the sample as a whole, with a maximum difference of five commuters per block group in San Francisco.

Across all block groups in all cities, the number of GPS-tracked commuters was strongly associated with the number of ACS active commuters (rho = 0.60). The correlation differed across cities, ranging from 0.28 in Nashville to 0.58 in San Francisco (Table 1). Analyses examining commuter percentages were similar to the count estimates (Table 1). The correlations were progressively stronger with higher block group population density, reaching rho = 0.61 for both numbers and percentages of active commuters in block groups with at least 10,443 persons per square mile (Table 2).

Discussion

Across block groups in four U.S. cities, the number of GPS-tracked commuters in Strava correlated with the number of ACS active commuters at rho = 0.60, indicating that these distinct but related variables rank block groups similarly regarding the presence of active transportation. This degree of correlation suggests some degree of convergent validity between user-generated, GPS-tracked commuting data and representative data from ACS.

The association between GPS-tracked and ACS commuter variables was stronger in cities and block groups with higher population densities. This finding might be attributable to a higher prevalence of activity tracking application users in more densely populated areas: information given to CDC by the data provider indicated the most densely populated city (San Francisco) also had the most GPS-tracking application users per capita (4.1%). As use of these applications increases within an area, the data produced by these users might more closely approximate the general population's behavior, and better match representative surveys like ACS.

Despite the differences between GPS tracking and ACS in sampling and assessment, the findings from this analysis suggest that user-generated, GPS-based activity tracking can perform similarly to ACS in identifying block groups where active transportation is common. In fact, the magnitude of the overall correlation (rho = 0.60) was larger than that seen in other comparable analyses. For example, when walk and bike commuting from ACS were disaggregated into two separate variables and compared in this same sample of block groups, they

TABLE 1. Correlations between block group level GPS-tracked and ACS active commuting variables, stratified by city — Austin, Denver, Nashville, and San Francisco, 2009–2013* and 2014–2015*

	City				
Characteristic	**Austin**	**Denver**	**Nashville**	**San Francisco**	**Total**
No. block groups	527	481	473	581	**2,062**
Population per block group, median (IQR)	1,469 (1,013)	1,134 (653)	1,172 (867)	1,289 (709)	**1,271 (829)**
Population density,† median (IQR)	4,234 (4,114)	7,077 (4,940)	2,785 (2,934)	25,567 (18,024)	**6,214 (13,425)**
Median no. of active commuters					
GPS-tracked, no. (IQR)	19 (30)	16 (27)	2 (6)	54 (89)	**17 (41)**
ACS, weighted, no. (IQR)	16 (43)	18 (52)	0 (13)	59 (118)	**18 (60)**
Spearman's rho§	0.36	0.52	0.28	0.58	**0.60**
Median percentages¶ of active commuters					
GPS-tracked, % (IQR)	1.1 (2.6)	1.5 (2.7)	0.2 (0.7)	4.4 (6.7)	**1.3 (3.5)**
ACS, % (IQR)	0.8 (3.0)	1.6 (4.2)	0 (1.2)	4.7 (9.3)	**1.3 (4.7)**
Spearman's rho§	0.37	0.49	0.27	0.55	**0.59**

Abbreviations: ACS = American Community Survey; GPS = Global Positioning System; IQR = interquartile range.
* ACS from 2009–2013 and GPS-tracked from 2014–2015.
† Persons per square mile of land area.
§ All Spearman's rho have p<0.001.
¶ Within block groups; count divided by total population.

were only moderately correlated at rho = 0.38 (data not shown). Further, previous research has assessed the association between physical activity questionnaires and accelerometer-assessed bodily movement in individual persons. A 2010 review found that only one of 41 questionnaires had a correlation >0.50 with accelerometer data (*8*). The correlation between GPS-tracked and ACS data in these block groups is as strong as or stronger than the correlation between questionnaire and accelerometer-based activity assessment among individual adults.

The findings in this report are subject to at least four limitations. First, although ACS served as a comparison measure, it is not a standard for assessing total population participation in active transportation because it does not capture infrequent and non-work active transportation. Second, user-generated GPS-tracked commuting data only capture trips made by persons who download and use the applications, and this group is likely more active than the general population. Similarly, these results cannot be generalized to all GPS data collection efforts because of potential differences in the user bases across systems. High numbers of users and variation in demographic characteristics and physical activity among users would likely yield more representative systems. Third, the algorithms used in the present study to identify commute-related trips are proprietary, and their actual performance is unknown. Finally, ACS data are self-reported via questionnaire for only the past week and subject to social desirability and recall biases.

Planning and evaluation of interventions to increase active transportation need detailed information about where and when persons engage in active transportation and will therefore benefit from location- and time-specific data. User-generated GPS data from mobile applications can capture this information, but their use could be limited by concerns about the performance of user-generated data in public health surveillance. Surveillance evaluation often includes comparison of a systems' data quality to the quality of existing methods (*9*). These results suggest that user-generated active transportation data might provide valuable information to assist with achieving public health and transportation goals. Additional research into the validity of other information collected from users (e.g., route, heart rate, and speed) might further support their usefulness.

Summary

What is already known about this topic?

City health and transportation officials are increasingly interested in measuring walking and bicycling, and user-generated, Global Positioning System (GPS)-tracked methods are emerging as popular choices. Questions remain about how representative the users of these systems are of the general population.

What is added by this report?

A comparison of user-generated GPS-tracked commuting data with similar data from a representative sample of the general U.S. population suggests that these systems similarly rank census block groups according to the presence of active commuting, and that the similarity might be stronger in areas that have a higher population density.

What are the implications for public health practice?

Public health and transportation officials need information on where and when persons engage in active transportation. User-generated, GPS-tracked data sources might provide critical information regarding active transportation to local health and transportation officials as a complement to traditional active transportation surveillance systems; these data might inform investments in active transportation programs and infrastructure.

TABLE 2. Correlations between block-group level GPS-tracked and ACS active commuting variables, stratified by tertile of population density — Austin, Denver, Nashville, and San Francisco, 2009–2013* and 2014–2015*

	Population density tertile			
Characteristic	**I**	**II**	**III**	**Total**
No. persons per square mile	0–4,107	4,108–10,442	10,443–175,523	—
Median population density† (IQR)	2,211 (1,866)	6,214 (2,598)	23,254 (17,643)	**6,214 (13,425)**
Median no. of active commuters				
GPS-tracked, no. (IQR)	8 (24)	13 (25)	38 (72)	**17 (41)**
ACS, weighted, no. (IQR)	0 (21)	15 (42)	60 (119)	**18 (60)**
Spearman's rho§	0.40	0.49	0.61	**0.60**
Median percentages¶ of active commuters				
GPS-tracked, % (IQR)	0.7 (2.0)	1.0 (2.3)	2.9 (5.8)	**1.3 (3.5)**
ACS, % (IQR)	0.0 (1.6)	1.2 (3.4)	4.5 (9.3)	**1.3 (4.7)**
Spearman's rho§	0.38	0.50	0.61	**0.59**

Abbreviations: ACS = American Community Survey; GPS = Global Positioning System; IQR = interquartile range.
* ACS from 2009–2013 and GPS-tracked from 2014–2015.
† Persons per square mile of land area.
§ All Spearman's rho have p<0.001.
¶ Within block groups; count divided by total population.

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Implementation of a National Semen Testing and Counseling Program for Male Ebola Survivors — Liberia, 2015–2016

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According to World Health Organization (WHO) data, the Ebola virus disease (Ebola) outbreak that began in West Africa in 2014 has resulted in 28,603 cases and 11,301 deaths (*1*). In March 2015, epidemiologic investigation and genetic sequencing in Liberia implicated sexual transmission from a male Ebola survivor, with Ebola virus detected by reverse transcription–polymerase chain reaction (RT-PCR) 199 days after symptom onset (*2*,*3*), far exceeding the 101 days reported from an earlier Ebola outbreak (*4*). In response, WHO released interim guidelines recommending that all male survivors, in addition to receiving condoms and sexual risk reduction counseling at discharge from an Ebola treatment unit (ETU), be offered semen testing for Ebola virus RNA by RT-PCR 3 months after disease onset, and every month thereafter until two consecutive semen specimens collected at least 1 week apart test negative for Ebola virus RNA (*5*). Male Ebola survivors should also receive counseling to promote safe sexual practices until their semen twice tests negative. When these recommendations were released, testing of semen was not widely available in Liberia. Challenges in establishing and operating the first nationwide semen testing and counseling program for male Ebola survivors included securing sufficient resources for the program, managing a public health semen testing program in the context of ongoing research studies that were also collecting and screening semen, identification of adequate numbers of trained counselors and appropriate health communication messages for the program, overcoming Ebola survivor–associated stigma, identification and recruitment of male Ebola survivors, and operation of mobile teams.

In July 2015, the Men's Health Screening Program (MHSP) was launched in Liberia (*6*). MHSP is a public health program that provides 1) semen testing for Ebola virus RNA using real-time RT-PCR (rRT-PCR) to male Ebola survivors; 2) counseling on safe sexual practices; 3) condoms and instructions on condom use; and 4) referrals for health care services. The program is a collaboration between the Liberian Ministry of Health (MOH), CDC, WHO, and the Academic Consortium to Combat Ebola in Liberia and operates at Redemption Hospital in Montserrado County, Phebe Hospital in Bong County, and Tellewoyan Hospital in Lofa County. All male Ebola survivors aged ≥15 years with proof of survivorship (e.g., a discharge certificate from an ETU) are eligible to enroll. In accordance with WHO guidelines (*5*), participants graduate from the program after receiving two consecutive negative Ebola virus RNA rRT-PCR results on semen specimens collected at least 1 week apart. The primary location for service delivery is the program clinic; however, Ebola survivors who are unable to travel to the clinic are offered services at a location of their choosing by a mobile team that includes a counselor and a semen technician. Participants receiving services from the mobile team are also offered the opportunity to include their sexual partners in their counseling sessions.

At the program's inception, little was known about the duration of Ebola virus persistence in semen, and several research institutions recruited Ebola survivors into studies designed to evaluate this. These studies often operate at the same time and in the same counties as MHSP. Because these research studies and MHSP use different RT-PCR platforms to test semen, and the potential for differing interpretations of test results exists, it was necessary to inform MHSP participants before graduation that they might receive different results if they chose to enroll in another semen testing service. To minimize differences in test results, MHSP collaborated with the research institutions providing semen testing to harmonize test interpretation and counseling messages.

As of May 2015, the longest reported time after the onset of an Ebola survivor's symptoms to collection of a semen specimen that tested positive for Ebola virus RNA was 6 months (*2*). The peak of the Ebola outbreak in Liberia occurred approximately 9 months before the program began; thus, the initial expectation was that the program would need to operate for 6 months, and budgets were prepared accordingly. However, as program operations approached the 6-month mark, 24 (11%) of the 228 enrolled participants had produced at least one semen sample that tested positive for Ebola virus RNA; among these, only four had two consecutive negative specimens. In response, MOH extended program operations; however, the inability to accurately approximate the end of program operations posed program planning and budgeting challenges. Currently, the program is funded through December 2016.

Because no validated risk reduction counseling protocols or scripts had been developed especially for Ebola survivors in Liberia, risk reduction materials for MHSP were adapted from the Sierra Leone study of persistence of Ebola virus RNA in semen (*7*). To ensure that messages were culturally appropriate, feedback on all program materials was solicited from a survivor advisory board of eight male and two female Ebola survivors from several highly affected counties in Liberia. Identification of counselors was hindered by the limited availability of trained mental health counselors in Liberia; in addition, the need to rapidly implement program services precluded training new mental health counselors. MHSP trained two of Redemption Hospital's mental health counselors to provide behavioral counseling to MHSP participants, which increased Liberia's current capacity to deliver specialized behavioral counseling and helped to ensure its availability should another outbreak occur.

In the aftermath of the Ebola outbreak, many Ebola survivors faced stigma and were shunned by their families and ostracized by their communities; the biologic possibility of sexual transmission of Ebola virus further exacerbated the fear and mistrust of Ebola survivors (*8*). In an effort to minimize stigma among program participants, the program name (Men's Health Screening Program) intentionally avoided using the terms "Ebola" and "survivor." At the recommendation of the advisory board, the program is not advertised through the radio. Instead, information about the program is disseminated by word-of-mouth through Ebola survivors or by directly contacting survivors listed in the national Ebola survivor registry.* Initial efforts to recruit Ebola survivors were limited to telephoning men listed in the survivor registry, which includes contact information for 527 laboratory-confirmed male Ebola survivors in Liberia. To be included in the registry, a survivor must have been admitted to an ETU, tested positive for Ebola virus infection, later discharged from an ETU, and then added to the registry. By the time the MHSP began operations in July 2015, much of the contact information in the registry, which was collected at the time of ETU admission, was no longer valid. In addition, it is certain that the registry underestimated the actual number of Ebola survivors in Liberia, because not all survivors necessarily met the registry requirements; in fact, only half of MHSP participants who produced an Ebola virus RNA rRT-PCR–positive semen specimen were listed in the registry.

*The Ebola survivor registry was only used to identify and contact potential participants, and not as MHSP enrollment criteria. ETU discharge certificates were used as enrollment criteria; not all survivors with ETU certificates were in the survivor registry.

Summary

What is already known about this topic?

Persistence of Ebola virus in semen of survivors of Ebola virus disease (Ebola) was documented before the 2014 outbreak in West Africa; however, the duration of viral persistence continues to exceed previous estimates. To prevent sexual transmission of Ebola, semen testing services have been established in Liberia, Sierra Leone, and Guinea.

What is added by this report?

In 2015, the first nationwide semen testing and counseling program for male Ebola survivors, the Men's Health Screening Program, was established in Liberia. Challenges in establishing and operating the program included securing sufficient resources for the program, managing a public health semen testing program in the context of ongoing research studies (including collecting and screening semen), identifying adequate numbers of trained counselors and appropriate health communication messages for the program, overcoming Ebola survivor–associated stigma, identifying and recruiting male Ebola survivors, and operating mobile teams. Approximately 80% of enrollees have graduated from the program.

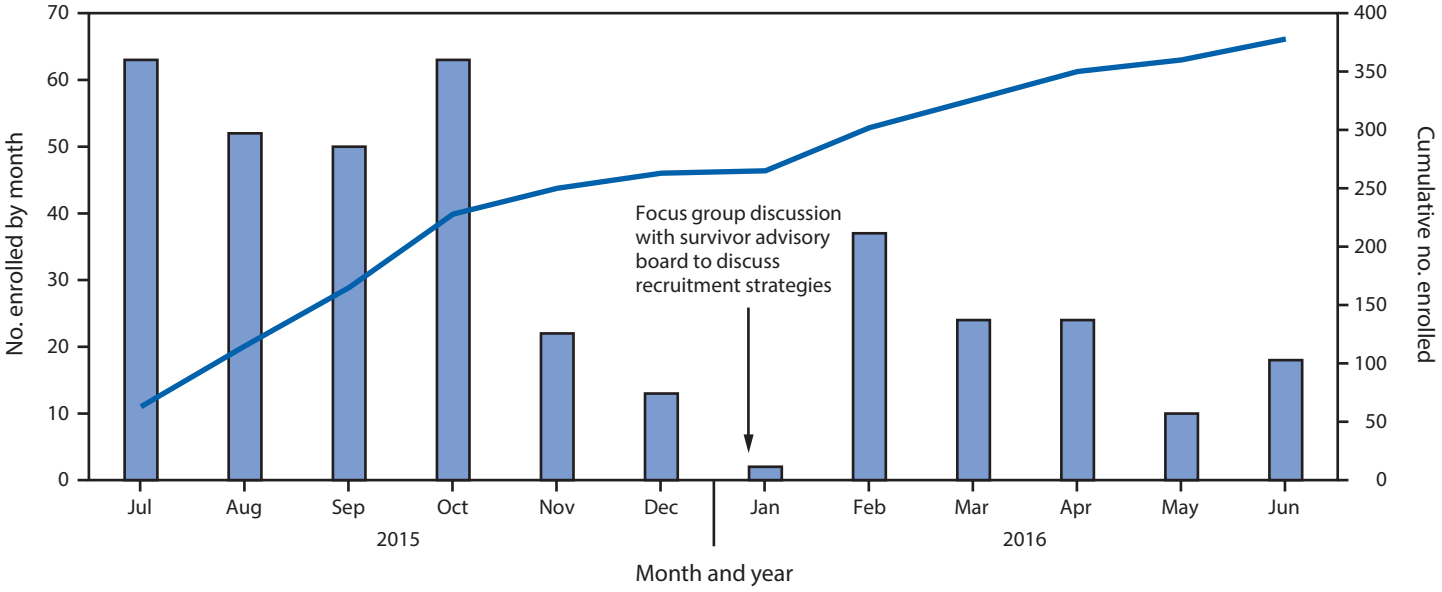
What are the implications for public health practice?

Engagement with the survivor community, communication, and flexibility were important to the success of the program. Lessons learned during the establishment of the MHSP in Liberia might inform the planning and implementation of future semen testing programs for other sexually transmissible diseases.

As a result of the limited recruitment strategy, enrollment began to decline at the Redemption Hospital Montserrado County site in November, 2015 (Figure). To address this issue, a focus group discussion with members of the survivor advisory board identified the need for closer engagement with other Ebola survivor associations to increase awareness about the program. Since that time, MHSP has been meeting regularly with representatives of the survivor associations, and representatives from these associations have been hired to facilitate identification and recruitment of male survivors into the program.

Overall, 20% of MHSP participants chose to receive services via mobile teams. Reported benefits of this service included convenience, privacy, and reduced waiting times; the mobile teams also provided a means for clinic-based clients who had challenges related to transportation to remain in the program. Five participants who received services at home chose to invite their sexual partners to participate in the behavioral counseling sessions. Joint counseling was reported to facilitate the participant's adherence to safe sex practices, and as a result, MHSP now offers joint counseling to clinic-based participants as well.

FIGURE. Number of male Ebola virus disease survivors enrolled at the Men's Health Screening Program Redemption Hospital site, by month — Montserrado County, Liberia, July 2015–June 2016



Despite these benefits, mobile service visits have not been as efficient as clinic visits. For example, on a typical day, the clinic is able to provide services to 15 participants; whereas, the mobile team is only able to provide services to four. In addition, in many cases, the participant is not present when the mobile team arrives, and the presence of friends and family members in the home at the time of the mobile team visit can compromise participant privacy. To improve efficiency, the mobile team attempts to schedule visits based on the geographic location of participants' homes to reduce travel time, and telephones participants the day before the scheduled visit to remind them of the appointment. Counselors remind participants of the importance of identifying a time and place to meet where they can talk privately.

Discussion

Since the launch of MHSP in July 2015, approximately 500 male Ebola survivors have been enrolled in the program at the Montserrado, Bong, and Lofa County sites, and approximately 80% have graduated from the program; more than 95% of graduates reported that they would refer a friend or family member to MHSP. Soliciting input from members of the survivor community regarding program planning, counseling messages, and avoidance of stigma was critical to gaining acceptance of the program and enhancing participant recruitment.

Hiring and training local staff members can enhance local capacity, creating a pool of trained personnel who can respond in the aftermath of another public health crisis. The use of a mobile team and joint counseling sessions with partners were effective in providing privacy and facilitating counseling. Lessons learned during the establishment of MHSP in Liberia might inform the planning and implementation of future semen testing programs for other sexually transmissible diseases.

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Vital Signs: Disparities in Antihypertensive Medication Nonadherence Among Medicare Part D Beneficiaries — United States, 2014

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Abstract

Introduction: Nonadherence to taking prescribed antihypertensive medication (antihypertensive) regimens has been identified as a leading cause of poor blood pressure control among persons with hypertension and an important risk factor for adverse cardiovascular disease outcomes. CDC and the Centers for Medicare and Medicaid Services analyzed geographic, racial-ethnic, and other disparities in nonadherence to antihypertensives among Medicare Part D beneficiaries in 2014.
Methods: Antihypertensive nonadherence, defined as a proportion of days a beneficiary was covered with antihypertensives of <80%, was assessed using prescription drug claims data among Medicare Advantage or Medicare fee-for-service beneficiaries aged ≥65 years with Medicare Part D coverage during 2014 (N = 18.5 million). Analyses were stratified by antihypertensive class, beneficiaries' state and county of residence, type of prescription drug plan, and treatment and demographic characteristics.
Results: Overall, 26.3% (4.9 million) of Medicare Part D beneficiaries using antihypertensives were nonadherent to their regimen. Nonadherence differed by multiple factors, including medication class (range: 16.9% for angiotensin II receptor blockers to 28.9% for diuretics); race-ethnicity (24.3% for non-Hispanic whites, 26.3% for Asian/Pacific Islanders, 33.8% for Hispanics, 35.7% for blacks, and 38.8% for American Indians/Alaska Natives); and state of residence (range 18.7% for North Dakota to 33.7% for the District of Columbia). Considerable county-level variation in nonadherence was found; the highest nonadherence tended to occur in the southern United States (U.S. Census region nonadherence = 28.9% [South], 26.7% [West], 24.1% [Northeast], and 22.8% [Midwest])
Conclusions and Implications for Public Health Practice: More than one in four Medicare Part D beneficiaries using antihypertensives were nonadherent to their regimen, and certain racial/ethnic groups, states, and geographic areas were at increased risk for nonadherence. These findings can help inform focused interventions among these groups, which might improve blood pressure control and cardiovascular disease outcomes.

Introduction

Hypertension is a leading risk factor for cardiovascular disease (*1*). Use of prescribed antihypertensive medication (antihypertensives), in conjunction with diet and lifestyle modifications to lower blood pressure among persons with hypertension substantially decreases their risk for adverse cardiovascular disease outcomes (*1*,*2*). Approximately 70% of U.S. adults aged ≥65 years have hypertension, only about half of whom have their blood pressure controlled (i.e., <140/90 mm Hg) (*3*).

Medication nonadherence, or not following a health care professional's instructions concerning taking prescribed antihypertensives (e.g., take one tablet twice daily), is a leading reason for poor blood pressure control among persons treated for hypertension, a strong risk factor for adverse cardiovascular disease outcomes, and a cause of excessive health care costs (*2*,*4*). The reasons for nonadherence to chronic disease medications, including antihypertensives, are numerous and complex. They include factors involving the patients, their health care professionals, and the policies and procedures of health systems and payers (*5*).

In 2006, the Centers for Medicare and Medicaid Services (CMS) implemented the Medicare Part D prescription drug benefit program,* a United States federal government program to subsidize the costs of prescription drugs and prescription drug insurance premiums for Medicare beneficiaries, which has increased the affordability and accessibility of prescription medications among U.S. adults aged ≥65 years and the disabled. The program has decreased out-of-pocket prescription medication spending by about $150 per year per beneficiary and

* The Medicare Part D prescription drug benefit program was established by the Medicare Modernization Act of 2003. This entitlement went into effect in 2006, and provides voluntary coverage to disabled and older adults (https://www.medicare.gov/part-d/).

increased medication use by a mean of one to three more prescriptions per year per beneficiary (*6*). In 2015, approximately 39 million beneficiaries were enrolled in Medicare Part D, 61% of whom were enrolled in stand-alone prescription drug plans (PDPs) that supplement Original Medicare[†] coverage and 39% of whom were enrolled in Medicare Advantage[§] prescription drug (MA-PD) plans (*7*). The implementation of the Medicare Part D program has been associated with up to a 13.5% improvement in antihypertensive adherence among beneficiaries (8). However, antihypertensive nonadherence continues to pose a threat to this population's health, especially among certain demographic groups (*9*).

This study used the most currently available data to describe antihypertensive nonadherence among Medicare Part D beneficiaries, and assessed nonadherence stratified by multiple factors, including antihypertensive class and beneficiaries' state and county of residence, type of prescription drug plan, and treatment and demographic characteristics, to help identify and inform targeted interventions among the groups and regions most at risk.

Methods

Administrative data and prescription drug event data for all Medicare Part D beneficiaries in 2014 were accessed via the CMS Chronic Conditions Data Warehouse.[¶] Among 30.0 million beneficiaries aged ≥65 years as of January 1, 2014, 10.5 million were excluded from analysis, including 1.1 million who were long-term institutionalized residents (e.g., resided in nursing home); 0.9 million who did not have continuous enrollment in full fee-for-service (FFS) Medicare (i.e., Part A and Part B coverage within Original Medicare) with additional PDP coverage or in a MA-PD plan during January 1–December 31, 2014 or until their death in 2014; and 8.5 million who did not have at least one antihypertensive prescription filled in 2014, leaving 19.5 million beneficiaries for analysis.

Analyses were limited to beneficiaries with two or more antihypertensive prescriptions filled (fills) within the same pharmacologic therapeutic class on different service dates within a measurement period of >90 days[**] (N = 18.5 million). Therapeutic classes were identified using the Uniform System of Classification[††] schema and included the following: angiotensin converting enzyme inhibitors and angiotensin II receptor blockers, which were assessed individually and collectively with direct renin inhibitors as renin-angiotensin system antagonists; beta blockers; calcium channel blockers; diuretics; and other antihypertensives.[§§]

Nonadherence was measured using the proportion of days covered (PDC) metric (*10*), which represents the percentage of days a beneficiary had access to the prescribed medication from the date of the first antihypertensive fill through the end of 2014 or the beneficiary's death in 2014.[¶¶] To align with current standards, beneficiaries with a PDC <80% were considered nonadherent (*10*). Among beneficiaries taking multiple antihypertensives, overall PDC was calculated as an average of the PDCs calculated for each therapeutic class.[***] Nonadherence was calculated by plan type, and in the FFS-PDP population, among beneficiaries with and without a diagnosis of hypertension (i.e., had or had not received an administrative billing code for hypertension[†††]). Factors assessed for relationship with nonadherence were age, sex, race/ethnicity, low-income subsidy status[§§§] (which includes persons eligible for both

[†] Original Medicare is administered directly through the federal government and includes the potential to enroll in both Part A and Part B. If a drug benefit is desired, the beneficiary must buy separate coverage through a Prescription Drug Plan from a private insurance company. Typically, beneficiaries pay a monthly premium covering 25.5% of the cost of the benefit and the Medicare Trust Funds subsidizes the remaining 74.5% (https://www.medicare.gov/sign-up-change-plans/decide-how-to-get-medicare/original-medicare/how-original-medicare-works.html).

[§] Medicare Advantage plans are sold by private insurance companies, but are subsidized by the Medicare Trust Funds. At a minimum, they must provide Part A and Part B coverage. Beneficiaries who also want a drug benefit, typically select a plan that provides both health and drug coverage, called a Medicare Advantage Prescription Drug Plan (https://www.medicare.gov/sign-up-change-plans/medicare-health-plans/medicare-advantage-plans/how-medicare-advantage-plans-work.html).

[¶] The CMS Chronic Condition Warehouse was accessed via the CMS Virtual Research Data Center (https://www.ccwdata.org/web/guest/home).

[**] Reflects a standard recommended by the Pharmacy Quality Alliance and used by CMS to help ensure an adequate amount of time to effectively assess adherence among beneficiaries.

[††] IMS Uniform System of Classification is a standard for pharmaceutical product classification (https://www.imshealth.com/files/web/IMSH%20Institute/USC_Classiification_Process_2011.pdf.

[§§] Other antihypertensives include selective aldosterone receptor inhibitors, peripheral vasodilators, alpha blockers, and centrally acting agents.

[¶¶] The PDC measure is endorsed by the National Quality Forum and is the preferred method of measuring medication adherence by the Pharmacy Quality Alliance. A PDC was calculated for each class for which a beneficiary met the inclusion criteria. If multiple prescriptions for the same target medication (i.e., same generic ingredient) were dispensed on different days such that the prescriptions overlapped, the start date for the new prescription accounted for the remaining medication from the previous fill. Days' supply that extended beyond the end of the measurement period was not included in the PDC calculation. All analyses were performed using SAS Version 9.4 (SAS Institute Inc, Cary, North Carolina). See Supplemental Document 1 (https://stacks.cdc.gov/view/cdc/40808) for the SAS coding used to perform the analyses in this study.

[***] Beneficiaries' overall PDC is the average of their PDCs for renin-angiotensin system antagonists, beta blockers, calcium channel blockers, diuretics, and other antihypertensives. If the average PDC is <80%, they are considered nonadherent for the combined use of all antihypertensives.

[†††] The definition CMS used to determine if a FFS-PDP beneficiary ever received an administrative billing code for hypertension while enrolled with FFS coverage can be found at https://www.ccwdata.org/web/guest/condition-categories. Hypertension status could not be determined among MA-PD beneficiaries.

[§§§] Beneficiaries who receive a low-income subsidy include those who are automatically deemed eligible, as well as those who apply and are determined eligible (https://www.cms.gov/Medicare/Eligibility-and-Enrollment/LowIncSubMedicarePresCov/index.html?redirect=/LowIncSubMedicarePresCov/03_MedicareLINET.asp).

Medicare and Medicaid), end-stage renal disease (ESRD) classification, initial entitlement eligibility designation (i.e., age ≥65 years or disability and/or ESRD), and whether any of the antihypertensives filled were for fixed-dose combinations (i.e., >1 antihypertensive within each pill). The maximum number of antihypertensive classes on hand at any one time was used as a proxy for blood pressure treatment intensity; the number of unique prescription medications used to treat any condition as a proxy for health status; the number of non-antihypertensive prescription medications filled as a proxy for overall medication burden; and the number of antihypertensive prescribers as a proxy for continuity of care for blood pressure management.¶¶¶

Descriptive analyses included calculating the mean annual total and out-of-pocket spending on antihypertensives per beneficiary and the percentage of overall beneficiary prescription medication spending attributed to antihypertensives. For antihypertensives, mean days' supply per fill (i.e., the mean number of days a prescription fill would last based on the amount of medication supplied), percentage of fills with generic rather than brand-name medications, and the percentage of fills with fixed-dose combinations were calculated. Nonadherence was stratified by beneficiaries' U.S. Census Region and state or territory of residence and mapped by county of residence using a spatial empirical Bayesian smoothing technique to enhance estimate stability. The data used in these analyses represent 100% of the beneficiaries who met the inclusion criteria; therefore, no statistical testing was needed to assess for differences among subgroups for the previously described variables.

Results

Among the 18.5 million Medicare Part D beneficiaries who were prescribed antihypertensives, 4.9 million (26.3%) were nonadherent (Table 1). Nonadherence varied by race (24.3% [whites], 26.3% [Asian/Pacific Islanders], 33.8% [Hispanics], 35.7% [blacks], 38.8% [American Indians/Alaska Natives]); low-income subsidy status (32.1% [low-income subsidy], 25.4% [no subsidy]); and reason for initial entitlement, which was highest (42.4%) among beneficiaries with disability and ESRD.

Nonadherence was slightly higher among older age groups and when a second class of antihypertensive was added (27.2%) compared with a single class (23.2%), and was slightly lower among beneficiaries with any fixed-dose combination medication use (Table 1). Nonadherence increased with decreases in health status and as the number of antihypertensive prescribers increased. There was little relationship between the overall medication burden proxy or plan type (FFS-PDP versus MA-PD) and nonadherence. Nonadherence differed by medication class, ranging from 16.9% (angiotensin II receptor

Key Points

- Cardiovascular disease (heart disease and stroke) is the leading cause of death in the United States.
- Hypertension, or high blood pressure, is a primary risk factor for heart disease and stroke, and approximately 70% of adults aged ≥65 years have the condition. Only about half of persons with high blood pressure have it under control (i.e., blood pressure <140/90 mm Hg).
- Nonadherence, or not following a health care professional's instructions concerning taking their prescribed blood pressure medicine, is a well-known reason for uncontrolled high blood pressure and an important risk factor for adverse cardiovascular disease outcomes and increased health care costs.
- In this study, 26.3% (4.9 million) Medicare Part D beneficiaries aged ≥65 years using blood pressure medicine were considered nonadherent.
- Different groups and geographic regions had a high proportion of beneficiaries classified as nonadherent. For example, 24.3% of whites, 26.3% of Asian/Pacific Islanders, 33.8% of Hispanics, 35.7% of blacks, and 38.8% of American Indians or Alaska Natives were classified as being nonadherent. In addition, socioeconomic status classifications showed differences, with 32.1% of persons with a low-income subsidy being classified as nonadherent, compared with 25.4% of persons with no subsidy. The highest nonadherence prevalence tended to occur in the southern United States.
- Factors and opportunities were identified that could be addressed by prescribers, health systems, and payers to improve adherence, including, especially among older adults, simplifying their blood pressure medication regimen.
- Additional information is available at http://www.cdc.gov/vitalsigns.

¶¶¶ The maximum number of antihypertensive classes on hand at any one time in 2014 variable was grouped in three categories (one antihypertensive class, two antihypertensive classes, and three or more antihypertensive classes). The health status proxy describes the number of unique prescriptions filled, by generic medication name, and was grouped into quartiles with the fourth quartile representing beneficiaries with potentially the worst health status (i.e., taking the most unique types of medication). The overall medication burden proxy describes the number of non-antihypertensive prescription medications filled for in 2014, and was grouped into quartiles with the fourth quartile representing beneficiaries with the greatest medication burden (i.e., most number of fills per year). The continuity of care for blood pressure management proxy describes the number of unique antihypertensive prescribers in 2014, and was grouped into three categories (one antihypertensive prescriber, two antihypertensive prescribers, and three or more antihypertensive prescribers). The larger the number of unique prescribers the potentially less the continuity of care.

TABLE 1. National antihypertensive medication nonadherence among Medicare Part D beneficiaries aged ≥65 years, by demographic and treatment characteristics — United States, 2014

		AHM fills			Annual AHM spending			
Category	No. beneficiaries	Total (millions)	Percent fixed-dose combinations	Mean days' supply per fill	Total spending per beneficiary ($)	Out-of-pocket spending per beneficiary ($)	Percent of out-of-pocket spending attributed to AHM	Percent nonadherent*
Total	**18,500,811**	**215.9**	**8.9**	**53.9**	**318†**	**92†**	**18.4**	**26.3**
Sex								
Female	11,019,771	131.4	9.4	52.4	333	91	18.9	26.7
Male	7,481,040	84.4	8.2	56.2	297	93	17.6	25.8
Age								
65–74	10,083,964	111.5	10.5	55.3	305	88	17.7	25.4
75–84	6,187,631	74.9	7.9	53.7	335	95	17.8	27.0
≥85	2,229,216	29.4	5.4	49.0	333	100	20.2	29.0
Race/Ethnicity								
White, non-Hispanic	14,302,318	160.1	8.4	56.0	309	100	17.8	24.3
Black	1,715,144	24.9	10.7	47.0	382	79	24.1	35.7
Asian/Pacific Islander	571,551	6.3	9.9	54.6	392	57	22.0	26.3
American Indian/ Alaska Native	50,261	0.7	3.7	41.0	267	60	15.5	38.8
Hispanic	1,635,662	21.5	10.6	45.9	307	48	19.9	33.8
Other	143,919	1.6	9.5	56.1	353	83	20.1	26.5
Unknown	81,956	0.9	10.9	56.5	318	93	18.5	22.6
Initial Medicare entitlement reason								
Age ≥65	16,575,264	189.3	9.2	54.7	318	95	18.8	25.7
Disability	1,900,602	26.2	7.1	48.0	320	66	14.0	32.0
ESRD	12,934	0.2	1.2	47.0	427	90	12.2	40.7
Disability and ESRD	12,011	0.2	1.0	44.8	440	84	12.8	42.4
ESRD								
No	18,369,467	213.8	9.0	54.0	318	92	18.4	26.1
Yes	131,344	2.1	0.9	43.4	392	80	12.6	55.9
Income status								
Standard	15,875,135	175.0	9.2	56.6	307	104	18.3	25.4
LIS or Medicaid dual eligible	2,625,676	40.8	7.8	42.3	386	19	19.4	32.1
Fixed-dose combination use§								
No	14,951,894	175.6	0.0	53.9	282	86	17.0	27.0
Yes	3,548,917	40.2	47.9	53.8	469	118	24.7	23.4
Maximum treatment intensity¶								
1 AHM	5,170,222	29.1	0.1	55.7	141	47	11.1	23.3
2 AHMs	6,610,125	66.3	11.4	55.0	264	81	16.9	27.2
3 AHMs	4,667,463	73.1	10.5	53.6	427	121	21.9	27.9
≥4 AHMs	2,053,001	47.4	8.6	51.6	693	173	27.4	27.8
Health status proxy quartile**								
Quartile 1	5,498,142	45.6	13.9	59.3	234	79	32.4	21.8
Quartile 2	4,465,520	48.5	9.7	56.8	299	94	21.4	23.8
Quartile 3	4,345,870	55.3	7.8	53.9	344	100	16.7	27.0
Quartile 4	4,191,279	66.6	5.9	48.2	422	99	12.2	34.4
Medication burden proxy quartile††								
Quartile 1	4,926,566	38.8	12.5	68.4	253	83	40.2	26.4
Quartile 2	4,528,839	46.4	10.3	59.6	299	91	23.6	25.0
Quartile 3	4,812,272	60.5	8.6	52.4	337	97	16.8	26.2
Quartile 4	4,233,134	70.0	6.3	43.4	393	99	11.2	27.8
Continuity of care for blood pressure management proxy§§								
1 prescriber	11,082,496	109.8	11.1	57.1	285	85	18.4	22.7
2 prescribers	4,961,460	63.3	7.8	52.6	340	98	18.3	29.4
≥3 prescribers	2,456,855	42.8	4.8	47.5	423	113	18.4	36.8
Prescription drug plan type								
FFS-PDP	10,265,439	122.4	8.7	53.1	350	103	18.2	26.3
MA-PD	8,235,372	93.4	9.2	55.0	278	79	18.6	26.4

See table footnotes on next page.

TABLE 1. (*Continued*) National antihypertensive medication nonadherence among Medicare Part D beneficiaries aged ≥65 years, by demographic and treatment characteristics — United States, 2014

Abbreviations: AHM = antihypertensive medication; ESRD = end-stage renal disease; FFS-PDP = Medicare fee-for-service prescription drug plan; LIS = low-income subsidy; MA-PD = Medicare Advantage prescription drug plan.

* Nonadherence is defined as patients not following their health care professional's instructions concerning taking their prescribed medication. Using the proportion of days covered methodology, beneficiaries were considered nonadherent if they had access to AHM for <80% of the days from the date of their first AHM fill through the end of 2014 or until their death in 2014.

† Amounts to $5.9 billion in total spending on AHM fills, including almost $2.1 billion in beneficiary out-of-pocket spending.

§ Filled for a fixed-dose AHM combination medication (i.e., has >1 AHM per pill) at any point during 2014.

¶ Maximum number of AHM classes on hand at any one time as a proxy for blood pressure treatment intensity.

** Based on the number of unique prescriptions filled, by generic medication name, in 2014 as a proxy for overall health status.

†† Based on the number of non-AHM prescription medications filled for in 2014 as a proxy for overall medication burden.

§§ Number of unique AHM prescribers in 2014 as a proxy for continuity of care for blood pressure management (i.e., the greater the number of unique prescribers the potentially less the continuity).

blockers) to 28.9% (diuretics); 20.4% of beneficiaries who were prescribed renin-angiotensin system antagonists, the medication category used in the CMS Part C and D Star Ratings Program,**** were nonadherent (Table 2).

At the state level, beneficiaries in North Dakota (18.7%), Wisconsin (18.8%), and Minnesota (18.9%) had the lowest nonadherence, and beneficiaries in Washington, D.C. (33.7%), Mississippi (32.8%), and Louisiana (31.5%) had the highest (Table 3; Supplemental Figure 1 [https://stacks.cdc.gov/view/cdc/40807]). Nonadherence was higher in the U.S. territories of Puerto Rico (39.6%) and the Virgin Islands (46.9%) than within the states (range: 18.7%–33.7%). At the county level, considerable variation in nonadherence was found (range: 15.9% to 56.2%). The greatest nonadherence tended to occur in the southern United States (nonadherence, by U.S. Census region, of 28.9% for the South, 26.7% for the West, 24.1% for the Northeast, and 22.8% for the Midwest) (Figure).

In 2014, the 215.9 million antihypertensive fills accounted for almost $5.9 billion in total spending, of which $2.1 billion (35.6%) was borne by beneficiaries (Table 1). On average, per-person out-of-pocket spending for antihypertensives was about $92 per year, reflecting 18.4% of beneficiaries' overall annual prescription medication spending. Total annual spending on antihypertensives differed by beneficiary characteristics (Table 1), medication class (Table 2), and beneficiary state of residence (Table 3). The highest mean annual total spending occurred among beneficiaries using a maximum of four or more antihypertensive classes at one time ($693 per year), using angiotensin II receptor blockers ($476 spending per year on that class alone), and living in New Jersey ($472 per year). Overall, 95.5% of antihypertensive fills were for generic formulations. Fixed-dose combination fills accounted for 8.9% of antihypertensive fills (Table 1), with thiazide diuretics, a specific type of diuretic, being the antihypertensive most often prescribed in combination (46.5% of fills) (Table 2). Mean days' supply per fill was 53.9 days and varied by beneficiary characteristics (Table 1), including state of residence (Table 3).

**** The Medicare Part C and D Star Ratings Program includes a medication adherence measure for renin-angiotensin system antagonists medication based on the Pharmacy Quality Alliance measure specifications (https://www.cms.gov/Medicare/Prescription-Drug-Coverage/PrescriptionDrugCovGenIn/PerformanceData.html). See Supplemental Table 1 (https://stacks.cdc.gov/view/cdc/40806) for renin-angiotensin system antagonist nonadherence results by U.S. state and territory.

Conclusions and Comments

More than one fourth of Medicare Part D beneficiaries aged ≥65 years were nonadherent to their antihypertensive regimen. Uncontrolled blood pressure is a main risk factor for the first and third leading causes of death (heart disease and stroke, respectively) among adults aged ≥65 years (*1*).†††† Although multiple factors contribute to the high proportion of uncontrolled blood pressure among persons in this age group (*11*), persons who are adherent to their antihypertensives are 45% more likely to achieve blood pressure control and have up to a 38% decreased risk for having a cardiovascular event compared with persons who are nonadherent (*2*,*4*).

Several groups had higher antihypertensive nonadherence, including blacks and American Indians/Alaska Natives, who are also at higher risk for poor blood pressure control and cardiovascular morbidity and mortality compared with other racial and ethnic groups (*1*). Moreover, beneficiaries living in the southern United States had the highest nonadherence. These differences in nonadherence could play a role in persistent disparities in blood pressure control and cardiovascular disease outcomes in these groups and regions (*1*,*12*). Although still suboptimal, if the average nonadherence rate of 18.9% among Medicare Part D beneficiary populations in the three states with the lowest nonadherence rates (North Dakota, Wisconsin, and Minnesota) were to be achieved in all states, the national nonadherence rate would decrease by about one third, and 1.4 million more beneficiaries would be taking their antihypertensives as directed.

†††† The leading cause of death among U.S. adults aged ≥65 years in 2014 was obtained from CDC WONDER Online Database (http://wonder.cdc.gov/ucd-icd10.html). Data are from the Multiple Cause of Death Files, 1999–2014, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program.

TABLE 2. National antihypertensive medication nonadherence among Medicare Part D beneficiaries aged ≥65 years, by medication class and plan type, United States, 2014

	Beneficiaries		AHM fills				Annual AHM spending		
AHM class/ Plan type	No.	Percent with diagnosis of hypertension*	Total (millions)	Percent generic	Percent fixed-dose combinations	Mean days' supply per fill	Total spending per beneficiary ($)	Out-of-pocket spending per beneficiary ($)	Percent nonadherent†
ACEI	**7,410,281**	—	**42.0**	**99.8**	**18.1**	**57.1**	**82**	**30**	**18.5**
FFS-PDP	3,932,634	98.2	22.7	99.8	18.7	56.3	84	34	18.2
MA-PD	3,477,647	—	19.4	99.9	19.4	58.0	80	26	18.9
ARB	**4,890,687**	—	**29.7**	**78.4**	**32.4**	**53.6**	**476**	**98**	**16.9**
FFS-PDP	2,790,168	99.0	17.0	74.3	32.7	53.7	543	114	16.7
MA-PD	2,100,519	—	12.7	84.0	31.9	53.5	389	78	17.2
RASA§	**12,819,640**	—	**73.5**	**90.7**	**24.2**	**55.4**	**236**	**57**	**20.4**
FFS-PDP	7,010,872	98.5	40.7	88.6	24.2	54.9	271	66	20.2
MA-PD	5,808,768	—	32.8	93.4	24.2	55.9	194	45	20.6
BB	**9,645,375**	—	**54.3**	**95.1**	**2.5**	**54.1**	**139**	**48**	**23.4**
FFS-PDP	5,458,653	97.6	31.3	94.1	2.4	53.2	152	54	23.1
MA-PD	4,186,722	—	22.9	96.4	2.6	55.4	122	41	23.8
CCB	**7,144,600**	—	**40.5**	**97.0**	**8.0**	**53.0**	**176**	**49**	**22.9**
FFS-PDP	3,992,363	98.9	23.0	96.5	8.3	52.4	183	53	22.5
MA-PD	3,152,237	—	17.6	97.6	7.7	53.7	167	45	23.4
Diuretic	**9,969,492**	—	**56.6**	**97.4**	**28.8**	**53.7**	**111**	**35**	**28.9**
FFS-PDP	5,603,616	98.1	32.6	97.0	27.5	52.8	119	38	28.9
MA-PD	4,365,876	—	24.1	98.0	30.6	54.9	101	31	28.9
TD¶	**6,874,909**	—	**35.1**	**96.0**	**46.5**	**57.4**	**135**	**39**	**27.2**
FFS-PDP	3,762,961	98.3	19.4	95.2	46.1	56.8	149	44	27.1
MA-PD	3,111,948	—	15.6	97.0	47.0	58.2	118	34	27.3
Other AHM**	**1,847,807**	—	**10.4**	**99.8**	**<0.1**	**50.5**	**170**	**42**	**35.9**
FFS-PDP	985,786	97.7	5.7	99.7	0.1	48.8	184	44	36.5
MA-PD	862,021	—	4.7	99.9	<0.1	52.7	153	40	35.1

Abbreviations: ACEI = angiotensin converting enzyme inhibitor; AHM = antihypertensive medication; ARB = angiotensin II receptor blocker; BB = beta blocker; CCB = calcium channel blocker; FFS-PDP = Medicare fee-for-service prescription drug plan; MA-PD = Medicare Advantage prescription drug plan; RASA = renin-angiotensin system antagonist; TD = thiazide diuretic.

* Diagnosed hypertension status was only available for beneficiaries with FFS-PDP coverage.

† Nonadherence is defined as patients not following their health care professional's instructions concerning taking their prescribed medication. Using the proportion of days covered methodology, beneficiaries were considered nonadherent if they had access to AHM for <80% of the days from the date of their first AHM fill through the end of 2014 or until their death in 2014.

§ RASAs include ACEIs, ARBs, and direct renin inhibitors.

¶ Thiazide diuretics, which also include thiazide-like diuretics (e.g. chlorthalidone), are a type of diuretic and are commonly used as a first-line medication to treat hypertension.

** Other AHMs include selective aldosterone receptor inhibitors, peripheral vasodilators, alpha blockers, and centrally acting agents.

Factors and opportunities have been identified that prescribers, health systems, and payers can address to improve medication adherence. For older adults, who are often taking multiple chronic disease medications (*13*), including 72% of beneficiaries in this study taking two or more antihypertensives, an important factor in improving adherence is simplification of the antihypertensive regimen. Some strategies include decreasing pill count through the use of fixed-dose combination medications (*14*,*15*), which were underused among most beneficiary groups in this study; limiting the number of pharmacy visits needed by increasing the days' supply per fill (e.g., prescribing 90-day versus 30-day allotments), which had wide variability among beneficiary groups, and synchronizing fills for all medication (*14*); and using reminder devices and technology aids that encourage patients to follow their recommended medication schedule (*16*). These strategies can be implemented by health care teams that are using standardized hypertension treatment approaches to manage patients' blood pressure (*15*). These teams might include physicians and physician assistants, nurses and nurse practitioners, pharmacists, and community health workers, and their collective work can help ensure patients' medication regimens and adherence are regularly assessed and their blood pressure controlled. Coordinated care might help overcome the finding of increased nonadherence when patients have more prescribers managing their antihypertensive regimens.

Additional interventions to improve adherence include engaging patients in medication regimen decision making using motivational counseling techniques and educating patients about the risks associated with uncontrolled blood pressure (*17*); encouraging the use of home blood pressure monitoring (*18*); maximizing use of generic medication (*19*); leveraging health information technologies that allow for e-prescribing, additional patient engagement, and clinical-decision support

Table 3. Antihypertensive medication nonadherence among Medicare Part D beneficiaries aged ≥65 years, by state and territory, United States, 2014

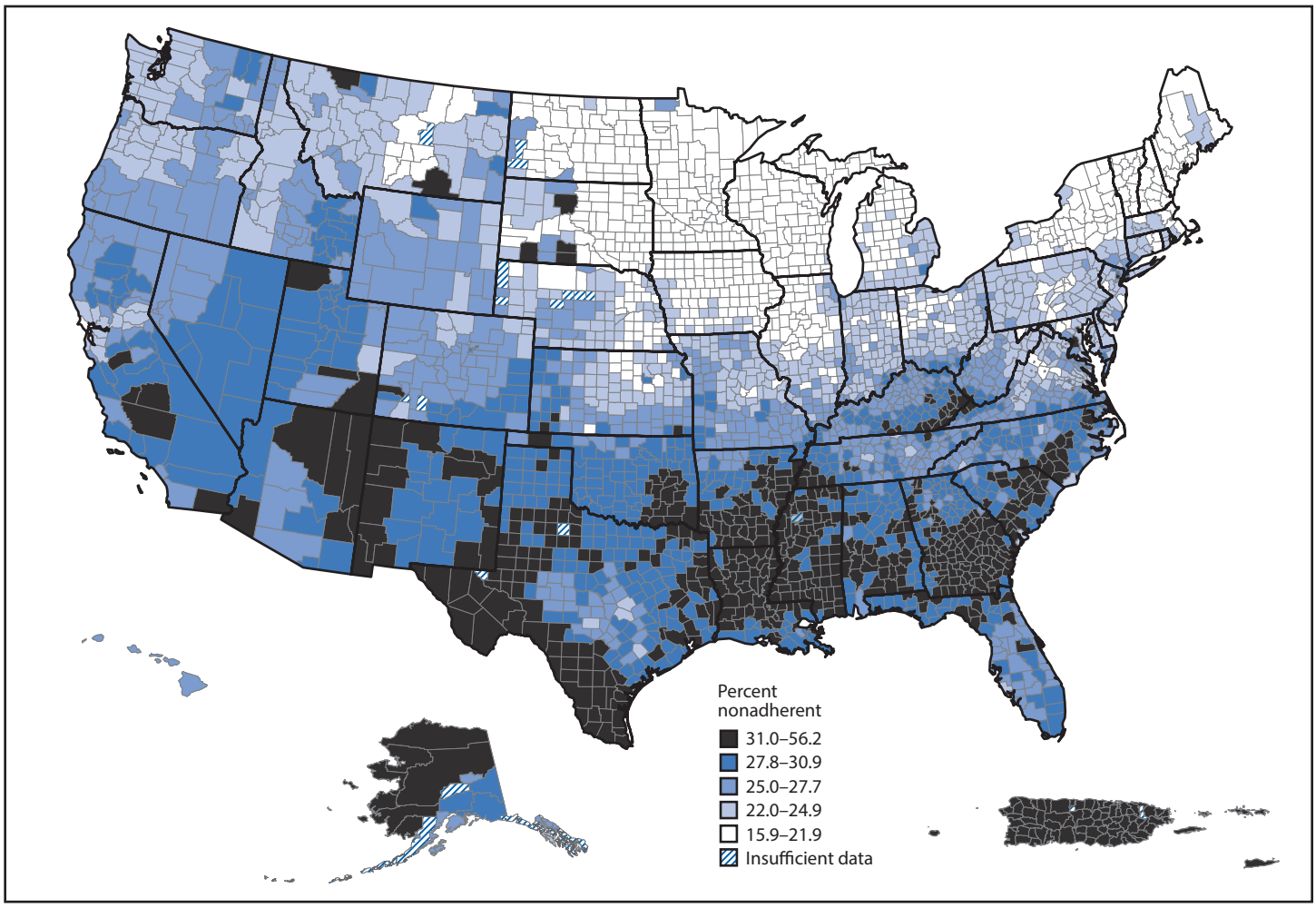
		AHM fills				Annual AHM spending			
State/Territory	No. beneficiaries	Total (millions)	Mean maximum treatment intensity*	Percent fixed-dose combinations	Mean days' supply per fill	Total spending per beneficiary ($)	Out-of-pocket spending per beneficiary ($)	Percent of out-of-pocket spending attributed to AHM	Percent nonadherent†
Alabama	314,946	4.02	2.33	11.5	49.6	303	89	16.9	29.9
Alaska	12,929	0.19	2.17	5.7	41.0	370	97	19.6	29.0
Arizona	358,006	3.63	2.11	6.0	59.6	278	95	18.1	28.2
Arkansas	180,717	2.57	2.27	10.4	43.7	294	91	17.9	30.4
California	1,941,483	20.56	2.16	7.2	58.6	307	81	19.5	27.1
Colorado	223,556	2.20	2.04	7.7	59.3	242	94	17.9	26.3
Connecticut	218,472	2.31	2.15	8.3	59.2	392	104	21.7	23.1
Delaware	62,885	0.55	2.20	10.4	71.0	399	109	19.5	23.0
DC	18,920	0.25	2.35	8.6	48.5	395	83	23.9	33.7
Florida	1,424,739	16.33	2.23	8.7	55.0	304	78	17.1	27.7
Georgia	487,641	6.44	2.30	11.0	46.8	334	106	18.2	31.0
Hawaii	84,596	0.87	2.03	10.5	55.5	362	82	21.7	25.5
Idaho	81,219	0.87	2.12	8.0	57.0	263	91	17.3	25.2
Illinois	622,034	7.31	2.25	8.1	55.6	320	102	18.3	23.8
Indiana	404,132	4.56	2.27	9.9	57.5	318	112	18.2	23.9
Iowa	216,867	2.75	2.19	7.4	51.6	253	97	17.2	19.7
Kansas	167,235	2.06	2.18	8.7	50.9	284	101	16.4	25.0
Kentucky	290,743	3.95	2.30	8.7	47.9	328	102	18.1	27.7
Louisiana	272,341	3.89	2.38	10.8	45.1	381	101	18.6	31.5
Maine	93,689	0.92	2.11	4.2	64.9	266	66	18.1	20.7
Maryland	257,600	2.55	2.26	9.5	64.7	362	107	20.1	25.4
Massachusetts	369,603	4.49	2.14	3.8	53.7	297	85	19.4	21.9
Michigan	688,611	6.70	2.22	8.5	65.9	260	89	17.7	23.3
Minnesota	326,243	3.33	2.16	6.0	64.2	224	89	17.6	18.9
Mississippi	181,510	2.66	2.36	12.6	42.8	339	94	18.2	32.8
Missouri	389,448	5.02	2.22	7.4	49.8	296	92	17.3	25.3
Montana	55,376	0.63	2.10	6.8	54.1	242	87	16.5	23.3
Nebraska	66,971	0.71	2.10	5.2	60.4	285	99	18.6	20.5
Nevada	532,767	5.49	2.22	11.2	60.5	472	117	21.5	25.3
New Hampshire	103,182	1.06	2.08	7.0	56.9	261	77	17.9	29.8
New Jersey	1,243,971	15.11	2.23	9.6	52.3	404	83	20.2	25.3
New Mexico	615,702	8.05	2.24	10.4	47.4	307	93	17.4	28.1
New York	42,929	0.54	2.24	7.3	53.5	272	109	17.5	18.7
North Carolina	108,367	1.49	2.20	8.7	46.4	302	111	17.9	22.6
North Dakota	135,396	1.38	2.15	8.6	59.1	250	73	15.6	28.2
Ohio	807,252	9.16	2.24	8.9	56.8	297	99	18.5	23.9
Oklahoma	212,004	2.50	2.27	9.6	53.0	327	102	17.4	29.6
Oregon	246,556	2.69	2.10	5.3	57.0	242	88	17.5	23.9
Pennsylvania	934,545	11.72	2.17	8.5	49.7	352	102	19.1	24.0
Puerto Rico	290,517	4.72	2.27	13.5	35.3	256	48	21.6	39.6
Rhode Island	72,279	1.04	2.18	6.7	44.6	298	84	18.4	22.9
South Carolina	307,134	3.80	2.27	13.1	49.0	350	100	17.7	29.6
South Dakota	51,359	0.65	2.18	7.0	51.2	268	100	16.7	21.0
Tennessee	427,203	5.38	2.29	9.2	51.0	302	91	17.1	28.0
Texas	1,184,240	13.31	2.26	11.3	54.3	354	94	17.8	30.8
USVI	6,041	0.09	2.28	17.7	36.1	280	138	29.3	46.9
Utah	94,690	0.89	2.08	11.2	60.5	246	96	15.6	28.7
Vermont	38,691	0.40	2.07	4.9	62.4	272	83	19.6	19.1
Virginia	387,911	4.57	2.24	9.6	53.9	313	100	17.8	25.7
Washington	326,047	3.48	2.11	4.7	58.8	237	88	17.4	24.1
West Virginia	137,169	1.78	2.28	8.9	50.3	332	95	18.6	25.8
Wisconsin	348,628	3.85	2.19	6.9	59.9	274	98	18.4	18.8
Wyoming	26,660	0.30	2.12	7.9	54.4	283	107	17.6	25.5

Abbreviation: AHM = antihypertensive medication; DC = District of Columbia; USVI = U.S. Virgin Islands.

* Mean of the maximum number of AHM classes on hand at any one time per beneficiary; proxy for blood pressure treatment intensity.

† Nonadherence is defined as patients not following their health care professional's instructions concerning taking their prescribed medication. Using the proportion of days covered methodology, beneficiaries were considered nonadherent if they had access to AHM for <80% of the days from the date of their first AHM fill through the end of 2014 or their death in 2014.

FIGURE. Antihypertensive medication nonadherence* among Medicare Part D beneficiaries aged ≥65 years, by county — United States, Puerto Rico, and U.S. Virgin Islands, 2014†



* Nonadherence is defined as patients not following their health care professional's instructions concerning taking their prescribed medication. Using the proportion of days covered methodology, beneficiaries were considered nonadherent if they had access to antihypertensive medication for <80% of the days from the date of filling their first antihypertensive medication prescription through the end of 2014 or until their death in 2014.

† Additional maps of nonadherence by beneficiaries' race/ethnicity and for renin-angiotensin system antagonists and diuretics are available on the Interactive Atlas for Heart Disease and Stroke at https://www.cdc.gov/dhdsp/maps/atlas/.

that informs prescribing decisions (*15*,*16*); and implementing payment reforms that decrease spending, such as limiting deductibles and copayments (*20*). Although annual out-of-pocket antihypertensive spending for most beneficiaries was low (around $100 per year), it represented almost one fifth of their total prescription medication spending and might be a barrier to adherence among certain groups.

CMS has taken steps to decrease cost-sharing in the Medicare Part D coverage gap (i.e., 'donut hole', where beneficiaries who meet a specific spending threshold are responsible for a higher percentage of prescription medication spending) (*21*), which could reduce nonadherence. In addition, CMS has included medication adherence measures as part of the Part C and D Star Ratings Program to encourage health plans that participate in Medicare Part D to support improved adherence for specific medications, including antihypertensives. Plans achieve this through using interventions such as medication therapy management programs to review beneficiaries' medication regimens and follow up with those who are nonadherent.

The findings in this report are subject to at least six limitations. First, PDC assesses only the availability of medication and not the actual taking of medication. However, use of measures, like PDC, which rely on administrative data to assess nonadherence have typically correlated well with self-reported nonadherence, plasma medication levels, physiologic markers, and cardiovascular disease outcomes (*2*,*22*), and might better assess nonadherence among older adults than self-reported or other objective measures (*22*). Second, because the PDC calculation excludes patients with only one antihypertensive fill and does not include persons who are prescribed medication

but never initiate treatment, it probably underestimates nonadherence. Approximately 300,000 beneficiaries in this study had only one filled prescription within a class; in general, up to one fourth of prescriptions for newly prescribed antihypertensives are never filled (*23*). Third, nonadherence might be overestimated among beneficiaries who switched antihypertensive classes based on their clinician's recommendation (e.g., because of side effects) or sometimes directly purchased low-priced generic antihypertensives without involvement of their prescription drug plan, but were considered nonadherent. Fourth, periods when beneficiaries were hospitalized were not censored because hospitalization data were not available for beneficiaries with MA-PD plans; however, the effect of this on nonadherence rates is small based on earlier research and guidance (*10*). Fifth, proxy measures used here might not accurately reflect their intended purpose. For example, a higher number of antihypertensive prescribers per patient might indicate better team-based care rather than splintered care, and methodologies accounting for these increasingly popular models of care should be considered in future analyses. Finally, subpopulation comparisons were not adjusted for other factors and should be addressed in future studies.

More than one fourth of Medicare Part D beneficiaries assessed were nonadherent to their antihypertensive therapy. This was the first study to identify considerable geographic variation in antihypertensive nonadherence at the county level. Although recognized as challenging, improving adherence to antihypertensives is an effective way to improve blood pressure control and reduce cardiovascular events in this population, which is already at high risk for having cardiovascular disease. This study identified multiple groups at increased risk for nonadherence and potentially modifiable risk factors. Strategies to improve adherence range from individual patient engagement and intervention to systematic health system changes, and coordinated approaches are important to improving adherence and the cardiovascular health of this population.

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Investigation of First Identified *mcr-1* Gene in an Isolate from a U.S. Patient — Pennsylvania, 2016

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In 2015, scientists reported the emergence of the plasmid-encoded *mcr-1* gene conferring bacterial resistance to the antibiotic colistin (*1*), signaling potential emergence of a pandrug-resistant bacterium. In May 2016, *mcr-1*-positive *Escherichia coli* was first isolated from a specimen from a U.S. patient (*2*) when a Pennsylvania woman was evaluated for a urinary tract infection. The urine culture and subsequent testing identified the gene in an extended-spectrum beta-lactamase (ESBL)–producing *E. coli* with reduced susceptibility to colistin. The patient had no international travel for approximately 1 year, no livestock exposure, and a limited role in meal preparation with store-bought groceries; however, she had multiple and repeated admissions to four medical facilities during 2016.

In collaboration with CDC, the Pennsylvania Department of Health conducted an investigation to guide contact tracing and perirectal swab screening for bacteria with the *mcr-1* gene in the patient's household and in two facilities where she had frequent, extensive, and prolonged (≥7 days) interactions with health care personnel. Within these three high-risk locations, transmission risk was stratified into higher-risk and lower-risk categories based on the nature and duration of contact. Twenty persons at higher risk included the patient's medical facility roommate, household contacts, home health personnel, friends who assisted with activities of daily living such as cleaning, bathing, rotating, ambulating and toileting, and a patient who developed an *E. coli* infection after receiving direct care from a caregiver who also assisted the index patient. Persons at lower risk included 98 health care personnel from the two high-risk facilities who directly assisted with activities of daily living while generally adhering to contact precautions. All 20 higher-risk contacts completed screening; among the 98 lower-risk contacts, 78 agreed to testing.

To determine whether transmission was occurring between patients, the state health department offered to conduct point prevalence studies at the two high-risk facilities. One facility declined; the other offered testing to 18 patients residing in the same unit where the index patient had received care. Seven patients completed screening.

No bacteria with the *mcr-1* gene were detected among the 105 persons screened. In addition, no colistin-resistant organisms were detected among 51 ESBL-producing isolates prospectively collected over a 30-day period from the four facilities to which the index patient was admitted in 2016. These findings suggest that the risk for transmission from a colonized patient to otherwise healthy persons, including persons with substantial exposure to the patient, might be relatively low.

The index patient was screened monthly to monitor colonization status. Perirectal swabs collected on May 31 and June 26 were positive for bacteria with the *mcr-1* gene, but a swab collected on August 1 was negative. The patient received no antibiotics during this period, and there are no current recommendations to decolonize patients with Gram-negative bacteria in their gastrointestinal tracts.

It is not known how the patient became colonized, especially in the absence of an epidemiologic link to known persons or places with identified *mcr-1*. Nonetheless, as more surveillance systems with broader testing are established, it is anticipated that *mcr-1* will be identified with increasing frequency. In July, *mcr-1* in *E. coli* was identified from a patient specimen collected in New York in 2015 (*3*), and *mcr-2,* another colistin-resistance gene, was discovered in porcine and bovine *E. coli* isolates (*4*). The emergence of these novel resistance mechanisms highlights the urgency of a more global and comprehensive approach to antimicrobial stewardship and preventing transmission of antibiotic-resistant pathogens between persons and institutions. Health care personnel should immediately report colistin-resistant bacteria to their local health department. Health departments are encouraged to rapidly investigate reports of colistin-resistant bacteria to prevent transmission to other patients and thereby decrease the risk for transmitting plasmid-encoded genes to bacteria that might already contain other resistance genes. The Pennsylvania Department of Health's investigation suggests that focused screening of contacts at highest transmission risk can be recommended.

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Investigation of *Escherichia coli* Harboring the *mcr-1* Resistance Gene — Connecticut, 2016

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The *mcr-1* gene confers resistance to the polymyxins, including the antibiotic colistin, a medication of last resort for multidrug-resistant infections. The *mcr-1* gene was first reported in 2015 in food, animal, and patient isolates from China (*1*) and is notable for being the first plasmid-mediated colistin resistance mechanism to be identified. Plasmids can be transferred between bacteria, potentially spreading the resistance gene to other bacterial species. Since its discovery, the *mcr-1* gene has been reported from Africa, Asia, Europe, South America, and North America (*2*,*3*), including the United States, where it has been identified in *Escherichia coli* isolated from three patients and from two intestinal samples from pigs (*2*,*4*–*6*). In July 2016, the Pathogen Detection System at the National Center for Biotechnology Information (Bethesda, Maryland) identified *mcr-1* in the whole genome sequence of an *E. coli* isolate from a Connecticut patient (*7*); this is the fourth isolate from a U.S. patient to contain the *mcr-1* gene.

The isolate was non-Shiga toxin–producing *E. coli* O157 from stool collected on June 16, 2016 from a pediatric patient with diarrhea. The patient traveled to the Caribbean for approximately 2 weeks to visit friends and relatives and developed fever and bloody diarrhea on June 12, 2 days before returning to the United States. The patient took paromomycin, an aminoglycoside antibiotic, from symptom onset until a pediatric outpatient visit on June 16, at which time a stool specimen was collected. The patient was not hospitalized and, in addition to the primary care visit, had one brief emergency department visit during the illness.

E. coli O157 harboring *mcr-1* was isolated from three stool cultures from the patient: the June 16 culture and follow-up cultures on June 18 and 23. Reference susceptibility testing by broth microdilution showed that the isolates had a colistin (also known as polymyxin E) minimum inhibitory concentration (MIC) of 2 μg/ml, and polymyxin B MIC of 4 μg/ml. The isolates also carried a plasmid $bla_{\text{cmy-2}}$ gene, which encodes AmpC, an enzyme that confers resistance to third generation cephalosporins; the isolates were susceptible to carbapenems. Stool cultures on June 24 and July 1 were negative for *E. coli* O157.

The patient's parent and health care provider were interviewed to assess patient risk factors and close contacts who might be at risk for acquiring bacteria carrying *mcr-1*. The patient was typically healthy with no prior surgeries or hospitalizations. The patient's usual diet included fruit, dairy products, and meat (pork, chicken, and beef). While traveling, the patient ate chicken and goat meat from a live animal market that the patient did not visit. The patient stayed in a home with a pet cat and dog in the Caribbean but did not have any animal contact in the United States.

Persons with close contact with the patient, particularly those involved in bathing or diapering, were considered to be at risk for *mcr-1* acquisition. On July 19–20, perirectal swabs were obtained from all six identified household contacts; a perirectal swab and swab of a soiled diaper from the patient were collected approximately 24 hours apart. Bacteria with the *mcr-1* gene were not detected by real-time polymerase chain reaction in any specimen, indicating that the patient and family members were not colonized with bacteria carrying *mcr-1*. Sixteen environmental samples collected from surfaces in the kitchen and diaper changing area of the patient's home were negative for the presence of *mcr-1*. The patient did not have close contact with other persons after returning to the United States. Health care personnel had no direct contact with the patient's body fluids and were not screened.

In this investigation of potentially travel-associated *mcr-1* acquisition, no transmission beyond the index patient or persistent environmental contamination were identified, and the patient was transiently colonized. At this time, CDC recommends that Enterobacteriaceae isolates with a colistin or polymyxin B MIC ≥4 μg/ml be tested for the presence of *mcr-1*; testing is available through CDC (*5*).* Prompt reporting of *mcr-1*–carrying isolates to public health officials allows for a rapid response to identify transmission and limit further spread.

*http://www.cdc.gov/laboratory/specimen-submission/detail.html?CDCTestCode=CDC-10223.

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Preliminary Findings from an Investigation of Zika Virus Infection in a Patient with No Known Risk Factors — Utah, 2016

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On July 12, 2016, the Utah Department of Health (UDOH) was notified by a clinician caring for an adult (patient A) who was evaluated for fever, rash, and conjunctivitis that began on July 1. Patient A had not traveled to an area with ongoing Zika virus transmission; had not had sexual contact with a person who recently traveled; and had not received a blood transfusion, organ transplant, or mosquito bites (*1*). Patient A provided care over several days to an elderly male family contact (the index patient) who contracted Zika virus abroad. The index patient developed septic shock with multiple organ failure and died in the hospital on June 25, 2016. The index patient's blood specimen obtained 2 days before his death had a level of viremia approximately 100,000 times higher than the average level reported in persons infected with Zika virus (*2*). Zika virus infection was diagnosed in patient A by real-time reverse transcription–polymerase chain reaction (rRT-PCR) testing on a urine specimen collected 7 days after symptom onset. In addition, a serum specimen collected 11 days after symptom onset, after patient A's symptoms had resolved, was positive for antibodies to Zika virus by Zika immunoglobulin M (IgM) capture enzyme-linked immunosorbent assay (MAC-ELISA) and had neutralizing antibodies detected by plaque-reduction neutralization testing (PRNT). Working with Salt Lake and Davis County Health Departments, UDOH requested assistance from CDC with an investigation to determine patient A's exposures and determine a probable source of infection.

The investigation consisted of four components: 1) an epidemiologic evaluation of family contacts of the index patient, 2) a serosurvey of health care workers who provided direct care to the index patient before his death, 3) a community serosurvey around the locations where the index patient had resided, and 4) active vector surveillance near the residences of the index patient and patient A. For the purpose of this investigation, a family contact was defined as a person who resided in the same household as the index patient or had direct contact with his body fluids (i.e., tears, conjunctival discharge, saliva, vomitus, urine, or stool) during the period when he was most likely viremic, including a few days before his illness onset and until his death.

Nineteen family contacts, including patient A, were identified and interviewed, and provided blood or urine specimens for testing. Thirteen family contacts reported hugging and kissing the index patient's face. Five family contacts reported being present while the index patient's stool, urine, or vomitus was being cleaned. Patient A reported hugging and kissing the index patient, in a similar fashion to other family contacts, and assisted hospital personnel in holding the index patient while his stool was being cleaned, but did not have direct contact with stool. Other than patient A, all family contacts were negative for Zika virus infection by rRT-PCR or MAC-ELISA on specimens obtained roughly 2–3 weeks after last exposure.

Health care workers who provided care to the index patient and residents living within a 200-meter radius of the two homes where the index patient resided before becoming hospitalized were interviewed to assess risk factors for Zika virus infection and were offered Zika virus testing. As of August 22, 86 health care worker contacts have been identified and interviewed to assess types of patient interactions and to quantify level of exposure to the index patient's body fluids. A total of 238 households were approached, and all available and consenting household members were interviewed using a standardized questionnaire about risk factors for mosquito-borne transmission. All health care workers and community members who provided blood specimens are being tested for Zika virus IgM antibodies using a MAC-ELISA. Urine specimens were also collected from any persons who reported Zika virus-like symptoms in the 14 days before their interview. Testing is incomplete, but as of August 22 it has not revealed any persons with Zika virus infections.

Local mosquito abatement districts worked in collaboration with vector entomologists from CDC to conduct larval and adult mosquito surveillance near the index patient's and patient A's residences. Door-to-door surveys around neighborhood homes were conducted and a variety of mosquito traps (e.g., Biogents Sentinel, gravid, light traps baited with carbon dioxide, and ovitraps) were deployed. Larval specimens obtained in the field were reared to the adult stage for identification. Adult mosquitoes are in the process of being identified and tested for Zika virus RNA by rRT-PCR, but no *Aedes aegypti* or *Aedes albopictus* mosquitoes have been identified as part of this investigation.

It remains unclear how patient A was infected; however patient A was known to have had close contact (i.e. kissing and touching) with the index patient while the index patient's viral load was found to be very high. Although it is not certain that these types of close contact were the source of transmission, family contacts should be aware that blood and body fluids of severely ill patients might be infectious. Given recognition of high levels of viremia during illness, it is essential that health care workers continue to apply standard precautions while caring for all patients, including those who might have Zika virus disease (*3*).

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Zika Virus Disease Cases — 50 States and the District of Columbia, January 1–July 31, 2016

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Zika virus is a mosquito-borne flavivirus primarily transmitted to humans by *Aedes aegypti* mosquitoes (*1*). Zika virus infections have also been documented through intrauterine transmission resulting in congenital infection; intrapartum transmission from a viremic mother to her newborn; sexual transmission; blood transfusion; and laboratory exposure (*1–5*). Most Zika virus infections are asymptomatic (*1*,*6*). Clinical illness, when it occurs, is generally mild and characterized by acute onset of fever, maculopapular rash, arthralgia, or nonpurulent conjunctivitis. However, Zika virus infection during pregnancy can cause adverse outcomes such as fetal loss, and microcephaly and other serious brain anomalies (*1–3*). Guillain-Barré syndrome, a rare autoimmune condition affecting the peripheral nervous system, also has been associated with Zika virus infection (*1*). Following the identification of local transmission of Zika virus in Brazil in May 2015, the virus has continued to spread throughout the Region of the Americas, and travel-associated cases have increased (*7*). In 2016, Zika virus disease and congenital infections became nationally notifiable conditions in the United States (*8*). As of September 3, 2016, a total of 2,382 confirmed and probable cases of Zika virus disease with symptom onset during January 1–July 31, 2016, had been reported from 48 of 50 U.S. states and the District of Columbia. Most cases (2,354; 99%) were travel-associated, with either direct travel or an epidemiologic link to a traveler to a Zika virus-affected area. Twenty-eight (1%) cases were reported as locally acquired, including 26 associated with mosquito-borne transmission, one acquired in a laboratory, and one with an unknown mode of transmission. Zika virus disease should be considered in patients with compatible clinical signs or symptoms who traveled to or reside in areas with ongoing Zika virus transmission or who had unprotected sex with someone who traveled to those areas. Health care providers should continue to educate patients, especially pregnant women, about the importance of avoiding infection with Zika virus, and all pregnant women should be assessed for possible Zika virus exposure at each prenatal visit (*2*).

On February 26, 2016, the Council of State and Territorial Epidemiologists (CSTE) approved interim case definitions for Zika virus disease and congenital Zika virus infection, adding them to the list of nationally notifiable conditions (*8*). This report includes confirmed and probable cases of Zika virus disease with illness onset during January 1–July 31, 2016 reported from U.S. states and the District of Columbia to ArboNET, the national arboviral surveillance system managed by CDC and state health departments. Cases were classified as confirmed or probable according to the clinical, epidemiologic, and laboratory testing criteria in the CSTE interim case definition (*8*). Infants with congenital infections were excluded; more information on congenital infections is available online (http://www.cdc.gov/zika/geo/pregnancy-outcomes.html).

As of September 3, 2016, a total of 2,382 confirmed and probable cases of Zika virus disease with illness onset during January 1–July 31, 2016 had been reported to ArboNET. Reports were received from 48 of 50 states and the District of Columbia (Figure 1). Half of all cases were reported from four states: New York (558 cases; 23%), Florida (483; 20%), California (147; 6%), and Texas (117; 5%). Overall, 1,495 (63%) reported cases were in females (Table). The median age of Zika virus disease patients was 39 years (range = 1 month–86 years) with 80% aged 20–59 years.

Since January 1, 2016, a median of 49 cases (range = 22–207) have been reported from U.S. states per week. The number of cases reported increased in May and continued to increase through July (Figure 2). Among all reported cases, 2,354 (99%) were associated with travel, including 2,331 (98%) with reported travel to an affected area and 23 (1%) with sexual contact with a traveler to an affected area. The most frequent travel destinations were countries and territories in the Caribbean (n = 1,545; 65%) followed by Central America (434; 18%), South America (224; 9%), North America (111; 5%), and Southeast Asia and the Pacific Islands (11; <1%) (Table); 10 persons with Zika virus disease traveled to more than one region.

Among the 28 cases reported as locally acquired, 26 were associated with local mosquito-borne transmission. All 26 local cases of mosquito-borne disease were reported from Florida; patients ranged in age from 19 to 54 years, and 18 (69%) were male. One case that was not mosquito-borne occurred in a researcher who had a needle stick exposure while working in a laboratory. The second case that was not mosquito-borne occurred in a patient for whom the mode of transmission is not yet known but who had close personal contact with a family contact with travel-associated Zika virus disease; the family

FIGURE 1. Number of confirmed and probable Zika virus disease cases reported from U.S. states and the District of Columbia — January 1–July 31, 2016

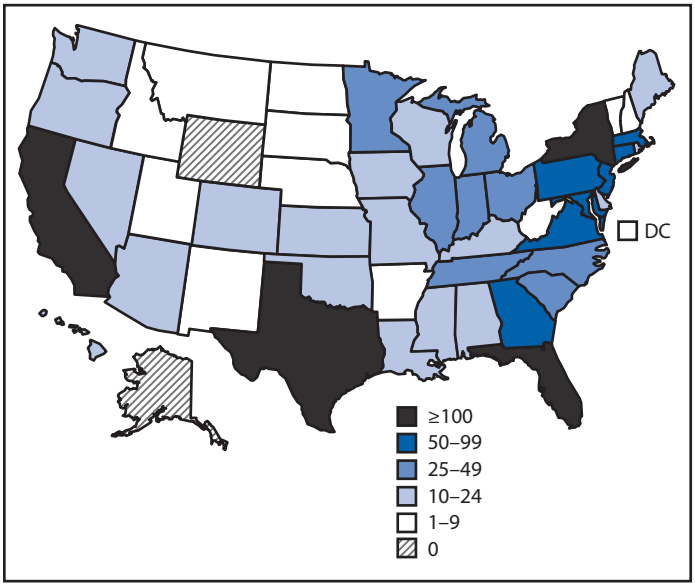


TABLE. Characteristics of 2,382 confirmed and probable cases of Zika virus disease reported from 48 U.S. states and the District of Columbia — January 1–July 31, 2016

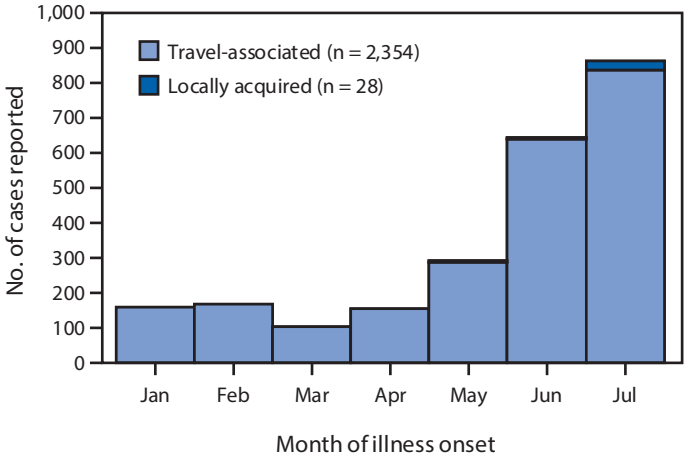
Characteristic	No. (%)
Sex	
Female	1,495 (63)
Male	886 (37)
Unknown	1 (<1)
Age group (yrs)	
0–19	208 (9)
20–39	1,012 (42)
40–59	889 (37)
≥60	273 (11)
Region visited during travel*	
Caribbean	1,545 (65)
Central America	434 (18)
South America	224 (9)
North America	111 (5)
Southeast Asia and Pacific Islands	11 (<1)
No direct travel†	51 (2)
Unknown	16 (<1)
Clinical outcome	
Hospitalized	65 (3)
Died	1 (<1)

* Sum exceeds 100% because of exposures in multiple regions during travel.
† Includes sexually transmitted cases and locally acquired cases.

contact had a level of viremia approximately 100,000 times higher than average and subsequently died (*9*).

Sixty-five (3%) patients with Zika virus disease were hospitalized, and one patient died (*9*). The 65 hospitalized patients were reported from 16 states and had a median age of 44 years (range = 1 month–86 years); 44 (68%) were female. Detailed information about hospitalization was available for 27 (42%) hospitalized patients. The median duration of hospitalization

FIGURE 2. Number of confirmed and probable Zika virus disease cases reported from U.S. states and the District of Columbia, by month of illness onset and source of infection — January 1–July 31, 2016



was 3 days (range = 1–7 days). Documented reasons for hospitalization included viral illness (11 patients), neurologic manifestation (six), need for further clinical evaluation (six), possible respiratory infection (two), exacerbation of underlying medical condition (one), and septic shock (one). The six patients with neurologic manifestations included five patients with Guillain-Barré syndrome and one with paresthesia. All hospitalized patients were discharged, with the exception of the patient with septic shock, who developed multiple organ failure and died in the hospital (*9*).

Discussion

The number of travel-associated Zika virus disease cases reported from U.S. states has increased markedly; 2,354 cases were reported during the first 7 months of 2016, compared with only 11 cases during 2010–2014 and 24 in 2015 (*7*,*10*). In July 2016, the first local mosquito-borne transmission of Zika virus in the continental United States was reported in Florida.

The demographic characteristics of Zika virus disease cases reported by U.S. states are similar to those reported from other countries. The age distribution of cases is similar to that reported for U.S. travelers infected with other *Aedes aegypti*–borne viral diseases (chikungunya and dengue). Sixty-three percent of cases reported from U.S. states in 2016 have been in females, similar to the proportion of symptomatic cases in females (61%) reported in Yap, Micronesia (*6*). The higher proportion of women with symptomatic disease might be because of care-seeking behavior, differential exposure to mosquitoes or sexual transmission, or increased testing of pregnant women.

The findings in this report are subject to at least three limitations. First, the number of cases are likely underestimated because most symptomatic Zika virus infections are mild,

and infected persons might not seek health care or be tested. Second, because ArboNET does not require information about clinical signs and symptoms or laboratory findings, it is possible that cases could be misclassified. Finally, the number of cases in this report should be considered preliminary, particularly as cases might be reclassified based on revisions to the case definition for Zika virus disease that were approved by CSTE in June 2016.*

Recent outbreaks of Zika virus disease have identified new modes of transmission and clinical manifestations, including adverse pregnancy and birth outcomes (*1*). CDC has issued guidance to reduce the risk for Zika virus infections and to aid in the diagnosis† and management of cases, particularly among pregnant women, sexual contacts of travelers, and among infants (*2–4*). The Food and Drug Administration recommends temporary deferral of blood donations from persons who recently traveled to areas with Zika virus transmission, as well as testing of all blood donations collected in the United States and its territories to reduce the risk for transfusion-associated transmission of Zika virus (*5*). Providers should continue to consider Zika virus disease in patients with compatible clinical signs or symptoms and who traveled to or reside in areas with ongoing transmission or had sex without a condom with someone who traveled to or resides in those areas; these areas currently include specific areas of Florida.§ All pregnant women should be assessed for possible Zika virus exposure at each prenatal care visit. Zika virus testing should be offered to asymptomatic pregnant women who traveled to or live in an area with active Zika virus transmission, or who had sex without using condoms to prevent infection with a partner who has traveled to or resides in an area with active Zika virus transmission (*2*).

Providers are encouraged to contact their state or local health departments to report suspected cases and to obtain guidance on laboratory testing and assistance with interpretation of test results. To mitigate the risk for spread of Zika virus, health care providers should continue to educate patients about the risks of Zika virus infection and steps they can take to prevent infection. Additional information is available at http://www.cdc.gov/zika/index.html.

* http://c.ymcdn.com/sites/www.cste.org/resource/resmgr/2016PS/16_ID_01_edited7.29.pdf.

† http://www.cdc.gov/zika/laboratories/lab-guidance.html.

§ http://www.floridahealth.gov/diseases-and-conditions/zika-virus/index.html.

Summary

What is already known about this topic?

Zika virus disease is an arboviral disease usually causing mild illness; however, congenital infection is associated with birth defects. Although most cases in U.S. residents are travel-associated, local transmission has been reported.

What is added by this report?

As of September 3, 2016, a total of 2,382 confirmed or probable cases of Zika virus disease with symptom onset during January 1–July 31, 2016 were reported to ArboNET, the national arboviral surveillance system managed by CDC and state health departments. Most (99%) cases were travel-associated. Locally acquired cases include 26 mosquito-borne disease cases, one laboratory-acquired infection, and one patient with unknown transmission mode. Sixty-five (3%) patients were hospitalized, and one died.

What are the implications for public health practice?

Health care providers should continue to educate patients, especially pregnant women, about the importance of avoiding infection with Zika virus, and all pregnant women should be assessed for possible Zika virus exposure at each prenatal visit. Zika virus disease should be considered in patients with compatible clinical signs or symptoms who traveled to or reside in areas with ongoing Zika virus transmission or who had unprotected sex with someone who traveled to those areas.

Acknowledgments

State and local health departments reporting to ArboNET and the Zika Virus Response Epidemiology and Laboratory Team.

[1]Epidemic Intelligence Service, CDC; [2]Arboviral Diseases Branch, Division of Vector-Borne Diseases, National Center for Emerging and Zoonotic Infectious Diseases, CDC.

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Announcement

National Child Passenger Safety Week — September 18–24, 2016

This year, National Child Passenger Safety Week is September 18–24. In the United States, motor vehicle–related injuries are a leading cause of death among children (*1*). In 2014, a total of 602 passenger vehicle occupants aged 0–12 years died as a result of a crash (*2*), and more than 121,350 were injured (*1*). Of the children who died in 2014, 34% were known to be unrestrained (*2*). To keep child passengers as safe as possible, drivers should use age- and size-appropriate restraints for all child passengers until adult seat belts fit properly (a lap belt should lay across upper thighs, not abdomen, and a shoulder belt should lay across shoulder and chest, not neck or face) and follow the American Academy of Pediatrics child passenger safety recommendations (*3*). In addition, children aged <13 years should be properly restrained in the back seat.

As part of National Child Passenger Safety Week, September 24 has been designated as National Seat Check Saturday. On this day, drivers with children who ride in car seats or booster seats are encouraged to visit a child safety seat inspection station to have a certified technician inspect their car seat for proper installation and proper use free of charge. Additional information and an inspection station locator are available from CDC at http://www.cdc.gov/motorvehiclesafety/child_passenger_safety and the National Highway Traffic Safety Administration at http://www.nhtsa.gov/Safety/CPS. Promotional materials in English and Spanish are available at http://www.trafficsafetymarketing.gov/cps.

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Errata

Vol. 65, No. 26

In the report, "Notes from The Field: Ebola Virus Disease Cluster — Northern Sierra Leone, January 2016," the following two persons should have been included as members of The Interagency Investigation Team: "**Kerry Souza, ScD, CDC; Raoul E. Guetiya W, MS, Department of Public Health, University of Makeni, Makeni, Sierra Leone.**"

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In the report, "Notes from the Field: Cluster of Lymphogranuloma Venereum Cases Among Men Who Have Sex with Men — Michigan, August 2015–April 2016," on page 920, the first sentence of the third paragraph should have read, "During August 12, 2015–April 30, 2016, MDHHS received 38 reports of LGV all among MSM who were HIV-**infected**."

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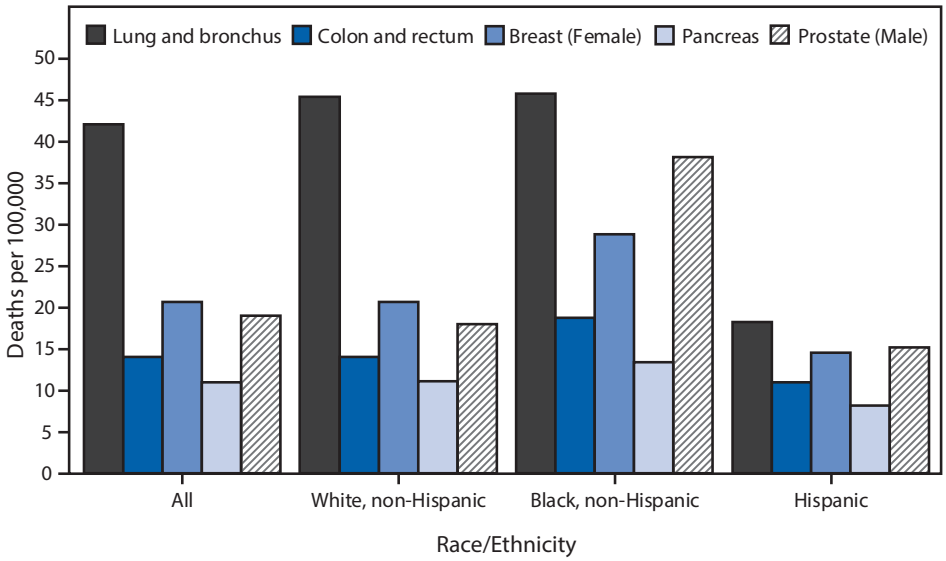
In the report, "Increases in Fentanyl-Related Overdose Deaths — Florida and Ohio, 2013–2015," on page 845, in "FIGURE. Number of fentanyl-related law enforcement submissions* and overdose deaths, and rate of fentanyl prescriptions — Florida and Ohio, January 2013–June 2015," in the Florida line chart, the second and third labels in the legend should be reversed. The second label should read "**Fentanyl-related overdose deaths**," and the third label should read "**Fentanyl-related law enforcement submissions**."

On page 846, in "TABLE 1. Demographic characteristics and toxicology findings for fentanyl-related overdose decedents — Florida, 2010–2012, 2013–2014, and January–June, 2015," there were four errors. In the first row, "Total," under 2010–2012, the mean annual rate should read **0.8;** under 2013–2014, the mean annual rate should read **1.8**; and under % change from 2010–2012 to 2013–2014, the value should read **121.9***. In the "Cocaine or Heroin" row, the % change from 2010–2012 to 2013–2014 should read **138.8*.**

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Age-Adjusted Death Rates* for Top Five Causes of Cancer Death,† by Race/Hispanic Ethnicity — United States, 2014



* Deaths per 100,000 standard population. Breast cancer death rate is per 100,000 females; prostate cancer is per 100,000 males. These breast and prostate cancer death rates differ from those published by National Center for Health Statistics, which are based on the population of both sexes. The top five cancer causes overall were also the top five for the non-Hispanic white and black populations, but prostate cancer was not among the top five for the Hispanic population.

† As the underlying causes of death, lung and bronchus cancer was coded as C34, colorectal cancer as C18–C20, breast cancer as C50, pancreatic cancer as C25, and prostate cancer as C61 based on the *International Classification of Diseases, 10th revision*.

In 2014, the top five causes of cancer deaths for the total population were lung, colorectal, female breast, pancreatic, and prostate cancer. The non-Hispanic black population had the highest age-adjusted death rates for each of these five cancers, followed by non-Hispanic white and Hispanic groups. The age-adjusted death rate for lung cancer, the leading cause of cancer death in all groups, was 42.1 per 100,000 standard population for the total population, 45.4 for non-Hispanic white, 45.7 for non-Hispanic black, and 18.3 for Hispanic populations.

Source: National Vital Statistics System. Underlying cause of death data, 2014. http://wonder.cdc.gov/ucd-icd10.html.

Reported by: Jiaquan Xu, MD, jax4@cdc.gov, 301-458-4086; Arialdi M. Minino, MPH.

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