Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Weekly / Vol. 67 / No. 35
September 7, 2018

National Preparedness Month — September 2018

Each September, CDC, along with 3,000 global, national, regional, and local governments, as well as private and public health institutions, supports emergency preparedness efforts and encourages U.S. residents to take action before, during, and after an emergency. Every community in the United States needs to be ready to respond to an infectious disease outbreak, a chemical or radiologic release, or a natural disaster (*1*). Public health systems need the capacity to scale up and respond to emergencies (*2*).

This year marks the 100th anniversary of the 1918 influenza pandemic, which resulted in an estimated 50 to 100 million deaths (*3*). Planning and preparedness for all types of public health emergencies are vital to keeping communities safe.

This year, CDC is highlighting four areas: 1) personal preparedness, 2) pandemic planning, 3) policy and partnerships, and 4) public health response. Personal preparedness helps communities to be more resilient in the event of an emergency. Through pandemic planning, CDC works to protect the nation from seasonal and pandemic influenza, and through partnerships, CDC plays a pivotal role in state and local readiness. CDC's Emergency Operations Center and the Division of State and Local Readiness bring together experts and state-of-the-art technology to detect and respond to public health emergencies, such as the recent Zika virus outbreak featured in this issue of *MMWR* (*4*). Additional resources are available at https://www.cdc.gov/phpr/index.htm.

References

1. CDC. In an emergency you can't respond effectively if you are not ready. Atlanta, GA: US Department of Health and Human Services, CDC; 2018. https://www.cdc.gov/phpr/whatwedo/emergency.htm
2. Redd SC, Frieden TR. CDC's evolving approach to emergency response. Health Secur 2017;15:41–52. https://doi.org/10.1089/hs.2017.0006
3. Belser JA, Tumpey TM. The 1918 flu, 100 years later. Science 2018;359:255. https://doi.org/10.1126/science.aas9565
4. Murthy BP, Vagi S, Desamu-Thorpe R, Avchen R. Assessment of state, local, and territorial Zika planning and preparedness activities—United States, June 2016–July 2017. MMWR Morb Mortal Wkly Rep 2018;67:969–73.

Assessment of State, Local, and Territorial Zika Planning and Preparedness Activities — United States, June 2016–July 2017

Bhavini Patel Murthy, MD[1,2]; Sara Vagi, PhD[2]; Rodel Desamu-Thorpe, MD[2]; Rachel Avchen, PhD[2]

The emergency response to Zika virus disease required coordinated efforts and heightened collaboration among federal, state, local, and territorial public health jurisdictions. CDC activated its Emergency Operations Center on January 21, 2016, with seven task forces to support the national response. The State Coordination Task Force, which functions as a liaison between jurisdictions and federal operations during a response, coordinated the development of CDC Guidelines for Development of State and Local Risk-based Zika Action Plans, which included a Zika Preparedness Checklist (*1*). The checklist summarized recommendations covering topics from the seven task forces. In July 2016, CDC's Office of Public Health Preparedness and Response (OPHPR) awarded $25 million in supplemental funding to 53 jurisdictions (41 states, eight

INSIDE

Continuing Education examination available at https://www.cdc.gov/mmwr/cme/conted_info.html#weekly.

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

territories, and four metropolitan areas) to support Zika preparedness and response activities. In December 2016, CDC awarded an additional $25 million to 21 of the 53 jurisdictions at the greatest risk for seeing Zika in their communities based on the presence of the mosquito responsible for spreading Zika, history of local transmission, or a high volume of travelers from Zika-affected areas. The additional $25 million was part of the $350 million in Zika supplemental funding provided to CDC by Congress in 2016* (*2,3*). Funded jurisdictions reported progress through the checklist at five quarterly points throughout the response. Data were analyzed to assess planning and response activities. Among the 53 jurisdictions, the percentage that reported having a Zika virus readiness, response, and recovery plan increased from 26% in June 2016 to 64% in July 2017. Overall, Zika planning and response activities increased among jurisdictions from June 2016 to July 2017. The recent Zika virus outbreak underscores the importance of strengthening state, local, and territorial health department capacity for rapid response to emerging threats.

Jurisdictions selected to receive supplemental funding for Zika preparedness and response were chosen based on the estimated geographic range of the two mosquito vectors known to carry and likely transmit Zika virus (i.e., *Aedes albopictus* and *Aedes aegypti*) in the United States in 2016 (*3*). Funded jurisdictions included 41 states,† eight territories (American Samoa, Federated States of Micronesia, Guam, Marshall Islands, Northern Mariana Islands, Palau, Puerto Rico, and U.S. Virgin Islands) and four local jurisdictions (Chicago, Los Angeles County, New York City, and the District of Columbia).§ In April 2016, the Zika Preparedness Guidance document, based on the CDC guidelines (*1*), was distributed from the State Coordination Task Force to state, local, and territorial health departments preparing to respond to potential Zika virus transmission; funded jurisdictions were required to complete the checklist. Health department staff members were expected to address elements in the CDC guidelines, and they

* The other funds were distributed for Zika efforts via other means. For example, CDC awarded nearly $97 million to 58 state, territorial, city, and local public health departments through the Epidemiology and Laboratory Capacity for Infectious Diseases Cooperative Agreement; $8 million to 38 state, territorial, and local jurisdictions for Zika birth defects surveillance activities; $40 million to four universities to establish vectorborne disease regional centers of excellence; and $14 million to the Puerto Rico Science, Technology, and Research Trust to oversee the first vector control unit in Puerto Rico. https://www.cdc.gov/phpr/readiness/funding-zika.htm; https://www.cdc.gov/media/releases/2016/p1222-zika-funding.html.

† Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Utah, Vermont, Virginia, West Virginia, and Wisconsin.

§ Other jurisdictions, including nine states, not receiving funding were not asked to provide any information on the checklist or progress on Zika-related activities. Although these other jurisdictions did not have mosquitoes capable of transmitting Zika virus and therefore were not selected to receive the supplemental funding, cases of Zika acquired during travel could be identified in any location.

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

Suggested citation: [Author names; first three, then et al., if more than six.] [Report title]. MMWR Morb Mortal Wkly Rep 2018;67:[inclusive page numbers].

were required to submit quarterly progress on the checklist based on whether they 1) had fully completed the actions listed; 2) had begun the actions, but had not fully implemented or completed the actions; 3) had not started the actions; or 4) did not answer because the guidance element was not applicable to their jurisdiction. Data were collected at baseline in June 2016 and at the end of each quarter in October 2016, January 2017, April 2017, and July 2017.

The checklist divided the Zika response into four phases to reflect the burden and intensity of risk for Zika virus transmission. The pre-incident stage included phase 0 (preparedness) and phase 1 (mosquito season, but no local transmission). Phase 2 was defined by confirmed local transmission, and phase 3 by confirmed local multiperson transmission. Respondents completed up to 112 questions depending on the presence of capable vectors and the extent of local transmission. Questions were aggregated within the following seven activity domains: 1) operations and planning, 2) communications and community education, 3) vector control, 4) surveillance, 5) laboratory testing, 6) outreach to pregnant women, and 7) blood safety. For each reporting period, the number and percentage of jurisdictions reporting activity on ≥85% of the guidance elements (selected as the minimum indicator of Zika preparedness) was determined.

Jurisdictions with multiple confirmed cases of local mosquitoborne transmission of Zika virus increased from three in June 2016 to seven in July 2017 (Table 1). By October 2016, all jurisdictions were reporting cases (mostly travel-related, except in the territories, where endemic transmission was occurring) during their respective mosquito seasons and provided responses to all guidance elements through phase 1. Ten jurisdictions provided responses for elements in phases 2 and 3.

During phases 0 and 1, the percentage of 53 jurisdictions reporting activity on ≥85% of the guidance elements ranged from 77% (operations and planning) to 98% (communications and community education and outreach to pregnant women) (Table 2). During phases 2 and 3, the percentage of 10 jurisdictions reporting activity on ≥85% of the guidance elements ranged from 71% (vector control and outreach to pregnant women) to 100% (operations and planning, surveillance, laboratory testing, and blood safety).

Jurisdictions reporting development of Zika virus readiness, response, and recovery plans increased from 14 (26%) in June 2016 to 34 (64%) in July 2017 (Table 3). There was an increase in the number of jurisdictions reporting updated training and educational materials for pregnant women (outreach to pregnant women domain; from 24 [45%] to 46 [87%]), publicizing travel guidance (communications and community education domain; from 31 [58%] to 51 [96%]), and developing state action plan for vector control (vector control domain; from 17 [32%] to 30 [57%]).

Among the seven jurisdictions experiencing local transmission in July 2017 (American Samoa, Florida, Federated States of Micronesia, Puerto Rico, Marshall Islands, Texas, and the U.S. Virgin Islands), five monitored effectiveness of vector control treatments through trapping and re-treating if mosquito numbers began to increase again (vector control), and five had laboratory testing staff members and surge reagents in place (laboratory testing). Similarly, six of the seven jurisdictions developed community outreach plans to prevent sexual transmission (communications and community education), expanded vector control efforts within areas of local transmission (vector control), expanded surveillance and monitoring of pregnant women (surveillance), developed procedures to follow up with Zika positive blood donors (blood safety), and identified geographic areas for aggressive response efforts (operations and planning).

TABLE 1. Response phase of jurisdictions — 53 U.S. cities, states, and territories, June 2016–July 2017

Stage	Phase level	Transmission risk category	No. (%) of jurisdictions*				
			Jun 2016	Oct 2016	Jan 2017	Apr 2017	Jul 2017
Pre-incident	Phase 0: Preparedness	Vector present or possible in the state	53 (100)	53 (100)	53 (100)	53 (100)	53 (100)
	Phase 1: Mosquito season	*Aedes aegypti* or *Aedes albopictus* mosquito biting activity or introduced travel-related cases, or cases transmitted sexually or through other body fluids	43 (81)	53 (100)	53 (100)	53 (100)	53 (100)
Suspected/ Confirmed incident	Phase 2: Confirmed local transmission	Single, locally acquired case, or cases clustered in a single household and occurring <2 weeks apart	3 (6)	7 (13)	10 (19)	10 (19)	10 (19)
Incident/ Response	Phase 3: Confirmed local multiperson transmission	Illness onsets ≥2 weeks apart, but within an approximately 1 mile (1.5 km) diameter	3 (6) (AS, PR, USVI)	5 (9) (AS, FL, FSM, PR, USVI)	7 (13) (AS, FL, FSM, MI, PR, TX, USVI)	7 (13) (AS, FL, FSM, MI, PR, TX, USVI)	7 (13) (AS, FL, FSM, MI, PR, TX, USVI)

Abbreviations: AS = American Samoa; FL = Florida; FSM = Federated States of Micronesia; MI = Marshall Islands; PR = Puerto Rico; TX = Texas; USVI = U.S. Virgin Islands.
* 41 U.S. states, eight territories (American Samoa, Federated States of Micronesia, Guam, Marshall Islands, Northern Mariana Islands, Palau, Puerto Rico, and U.S. Virgin Islands) and four local health jurisdictions (Chicago, Los Angeles County, New York City, and the District of Columbia).

TABLE 2. Zika planning and preparedness activities across the seven activity domains — 53 U.S. cities, states, and territories, July 2017

Activity domains	No. of guidance elements	No. (%) of jurisdictions responding "Yes" or "In progress" to ≥85% of domain elements
Zika response phase levels 0 and 1 (53 jurisdictions)		
Operations and planning	9	41 (77)
Communications and community education	14	52 (98)
Vector control	5*	47 (89)
Surveillance	17	44 (83)
Laboratory testing	10	49 (92)
Outreach to pregnant women	1†	52 (98)
Blood safety	4	40 (92)§
Zika response phase level 2 (10 jurisdictions) and phase level 3 (7 jurisdictions)		
Operations and planning	8	7 (100)
Communications and community education	9	6 (86)
Vector control	6	5 (71)
Surveillance	7	7 (100)
Laboratory testing	2	7 (100)
Outreach to pregnant women	11	5 (71)
Blood safety	7	7 (100)¶

* One element was deleted from the analysis because of ambiguity in interpretation.
† One element about providing window-screening kits was deleted from the analysis because it was not relevant to most jurisdictions.
§ Nine jurisdictions were subtracted from the denominator (seven territories do not have blood centers, and two localities depend on their state health department to work with blood centers).
¶ Adjusted for guidance elements that were not applicable to jurisdiction.

Discussion

Since May 2015, CDC has responded to reports of adverse pregnancy and birth outcomes associated with Zika virus infection during pregnancy. Collaboration with jurisdictions about case reports, surveillance, and registry data facilitated surveillance and increased knowledge about the impact of Zika virus infection on pregnant women and their fetuses and infants. According to CDC U.S. Zika Pregnancy Registry data since 2016, among women in the United States who had laboratory evidence of possible Zika virus infection during pregnancy, 6%–11% of fetuses or infants had evidence of Zika-associated birth defects (*4*); among women in the U.S. territories who had laboratory evidence of possible Zika virus infection during pregnancy, 4%–8% of fetuses or infants had birth defects potentially related to Zika virus (*5*).

The quarterly Zika preparedness assessments facilitated active monitoring of progress toward Zika preparedness and response activities in 53 jurisdictions and provided situational awareness among internal and external partners, including the Zika response leadership, professional health care associations, nonprofit organizations, academic and research institutions, and the private sector. The checklist documented that health departments prepared for and implemented strategies to reduce the transmission of Zika virus. From June 2016 to July 2017,

TABLE 3. Selected Zika planning and preparedness activities — 53 cities, states, and territories, United States, June 2016–July 2017

Selected elements within the Zika Preparedness Checklist domains	No. (%) of jurisdictions reporting fully completing the action within the activity domain by reporting quarter				
	Jun 2016	Oct 2016	Jan 2017	Apr 2017	Jul 2017
1. Operations and planning					
Conduct a Zika virus preparedness and response planning workshop	25 (47)	35 (66)	36 (68)	37 (70)	40 (75)
Develop a Zika virus readiness, response, and recovery plan	14 (26)	21 (40)	27 (51)	30 (57)	34 (64)
2. Communications and community education					
Develop public health communications messages	21 (40)	36 (68)	39 (74)	40 (75)	41 (77)
Publicize travel guidance	31 (58)	45 (85)	49 (92)	49 (92)	51 (96)
3. Vector control					
Develop a state action plan for vector control	17 (32)	26 (49)	29 (55)	30 (57)	30 (57)
Identify existing state, local, and national mosquito control resources	17 (32)	27 (51)	28 (53)	29 (55)	31 (58)
4. Surveillance					
Determine procedures to identify potential or confirmed Zika virus infection	32 (60)	39 (74)	41 (77)	43 (81)	45 (85)
Establish baseline prevalence of microcephaly	25 (47)	31 (58)	35 (66)	36 (68)	35 (66)
5. Laboratory testing					
Coordinate sample referral and testing with epidemiologist	48 (91)	53 (100)	53 (100)	53 (100)	53 (100)
Make available most current Zika virus testing algorithm	44 (83)	46 (87)	50 (94)	49 (92)	51 (96)
6. Outreach to pregnant women					
Updated training and educational materials with information for pregnant women	24 (45)	39 (74)	45 (85)	46 (87)	46 (87)
7. Blood safety					
Work with blood centers to ensure implementation of Food and Drug Administration blood safety recommendations	25 (47)	28 (53)	38 (72)	38 (72)	40 (75)

Summary

What is already known about this topic?

Zika virus infection can cause adverse pregnancy-related birth defects and brain abnormalities. Local transmission of Zika virus was documented in the United States and its territories after the spread of Zika virus in the World Health Organization's Region of the Americas.

What is added by this report?

Among 53 jurisdictions, Zika planning and response activities increased from June 2016 to July 2017, with the largest increases in percentage of jurisdictions reporting fully completed actions for the operations and planning, communications and community education, outreach to pregnant women, and blood safety domains.

What are the implications for public health practice?

Zika planning, preparedness, and response activities from June 2016 to July 2017 demonstrated the importance of collaboration between CDC and U.S. state, local, and territorial public health departments in preparation for and response to an emerging event.

the percentage of jurisdictions reporting full completion of actions across all domains in the Zika Preparedness Guidance increased overall. The largest reported increases were in the following domains: operations and planning, communications and community education, outreach to pregnant women, and blood safety. The Zika supplemental funding, along with the funding provided through the Public Health Emergency Preparedness cooperative agreement, supports public health preparedness infrastructure to respond to large-scale emerging public health threats (*6*).

The findings in this report are subject to at least two limitations. First, the data were collected through quarterly assessments. Second, the data represent self-reported progress on broad Zika Preparedness Guidance elements rather than objectively reviewed specific performance measures. A more detailed assessment ascertained by independent evaluators could potentially facilitate better planning and response actions in future outbreaks.

The quarterly assessment findings provide objective evidence of progress toward meeting Zika planning and preparedness goals among the 53 jurisdictions receiving supplemental funding. As a result, the preparedness plans and strategies to reduce transmission and adverse effects of Zika in these jurisdictions improved compared with those in June 2016. CDC collaboration with state, local, and territorial health departments strengthened the response to this emerging threat and demonstrated the ability of public health departments to prepare and respond to an emerging public health event.

Acknowledgments

The 53 jurisdictions funded to support the Zika response; CDC's State Coordination Task Force; the Data Collation and Integration for Public Health Event Response Team; Public Health Emergency Preparedness specialists.

Corresponding author: Bhavini Patel Murthy, bmurthy@cdc.gov, 404-718-5501.

[1]Epidemic Intelligence Service, CDC; [2]Division of State and Local Readiness, Office of Public Health Preparedness and Response, CDC.

All authors have completed and submitted the ICMJE form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

References

1. CDC. ZAP summit archive, planning template: CDC guidelines for development of state and local risk-based Zika action plans. Atlanta, GA: US Department of Health and Human Services, CDC; 2016. https://www.cdc.gov/zika/zap/actionplan-template.html
2. CDC. PHPR funding for Zika preparedness and response activities. Atlanta GA: US Department of Health and Human Services, CDC; 2016. https://www.cdc.gov/phpr/readiness/funding-zika.htm
3. CDC. Estimated range of *Aedes albopictus* and *Aedes aegypti* in the United States, 2016. Atlanta, GA: US Department of Health and Human Services, CDC; 2017. https://www.cdc.gov/zika/vector/range.html
4. Honein MA, Dawson AL, Petersen EE, et al.; US Zika Pregnancy Registry Collaboration. Birth defects among fetuses and infants of US women with evidence of possible Zika virus infection during pregnancy. JAMA 2017;317:59–68. https://doi.org/10.1001/jama.2016.19006
5. Shapiro-Mendoza CK, Rice ME, Galang RR, et al.; Zika Pregnancy and Infant Registries Working Group. Pregnancy outcomes after maternal Zika virus infection during pregnancy—U.S. territories, January 1, 2016–April 25, 2017. MMWR Morb Mortal Wkly Rep 2017;66:615–21. https://doi.org/10.15585/mmwr.mm6623e1
6. CDC. Funding and guidance for state and local health departments. Atlanta, GA: US Department of Health and Human Services, CDC; 2016. https://www.cdc.gov/phpr/coopagreement.htm

Vital Signs: State-Level Variation in Nonfatal and Fatal Cardiovascular Events Targeted for Prevention by Million Hearts 2022

Matthew D. Ritchey, DPT[1]; Hilary K. Wall, MPH[1]; Pamela L. Owens, PhD[2]; Janet S. Wright, MD[1]

Abstract

Introduction: Despite its preventability, cardiovascular disease remains a leading cause of morbidity, mortality, and health care costs in the United States. This study describes the burden, in 2016, of nonfatal and fatal cardiovascular events targeted for prevention by Million Hearts 2022, a national initiative working to prevent one million cardiovascular events during 2017–2021.

Methods: Emergency department (ED) visits and hospitalizations were identified using Healthcare Cost and Utilization Project databases, and deaths were identified using National Vital Statistics System data. Age-standardized Million Hearts–preventable event rates and hospitalization costs among adults aged ≥18 years in 2016 are described nationally and across states, as data permit. Expected 2017–2021 event totals and hospitalization costs were estimated assuming 2016 values remain unchanged.

Results: Nationally, in 2016, 2.2 million hospitalizations (850.9 per 100,000 population) resulting in $32.7 billion in costs, and 415,480 deaths (157.4 per 100,000) occurred. Hospitalization and mortality rates were highest among men (989.6 and 172.3 per 100,000, respectively) and non-Hispanic blacks (211.6 per 100,000, mortality only) and increased with age. However, 805,000 hospitalizations and 75,245 deaths occurred among adults aged 18–64 years. State-level variation occurred in rates of ED visits (from 56.4 [Connecticut] to 274.8 per 100,000 [Kentucky]), hospitalizations (484.0 [Wyoming] to 1670.3 per 100,000 [DC]), and mortality (111.2 [Vermont] to 267.3 per 100,000 [Mississippi]). Approximately 16.3 million events and $173.7 billion in hospitalization costs could occur during 2017–2021 without preventive intervention.

Conclusions and Implications for Public Health Practice: Million Hearts–preventable events place a considerable health and economic burden on the United States. With coordinated efforts, many of these events could be prevented in every state to achieve the initiative's goal.

Introduction

Heart disease and stroke are largely preventable (*1*–*3*). However, despite decades-long improvement in outcomes, they remain leading causes of morbidity, mortality, and health care costs in the United States (*2*). Moreover, considerable disparities persist and recent evidence suggests that heart disease and stroke event rates are increasing among certain demographic groups, including adults aged 35–64 years (*2*,*4*). In response, CDC and the Centers for Medicare & Medicaid Services launched Million Hearts 2022, a national initiative working to prevent one million heart attacks, strokes, and other acute cardiovascular events during 2017–2021 (*1*,*5*).

Million Hearts 2022, in collaboration with multiple federal, state, and nongovernmental partners, supports the implementation of a selected set of evidence-based public health and clinical strategies aimed at keeping adults healthy and optimizing care to prevent cardiovascular events. This includes using strategies that improve the "ABCS" (aspirin when appropriate, blood pressure control, cholesterol management, and smoking cessation) of cardiovascular care; reducing sodium consumption, tobacco use, and physical inactivity; improving care among persons who have had cardiovascular events*; and addressing known disparities in cardiovascular outcomes† (*6*). Despite their efficacy, implementation of these strategies throughout the country has been inconsistent, which might contribute to the disparities and geographic variation observed in cardiovascular disease (CVD) outcomes (*2*,*4*).

* Includes use of cardiac rehabilitation among persons who have had a qualifying cardiac event or procedure and improving awareness of the potential negative health sequelae of and avoiding exposure to poor air quality among persons who have had a previous cardiovascular event.

† Includes improving hypertension control among blacks/African Americans and improving prevention and management of CVD risk factors among adults aged 35–64 years and persons with mental and/or substance use disorders who use tobacco.

This study describes the distribution, by demographic characteristics and state, of nonfatal (emergency department [ED] visits and hospitalizations) and fatal cardiovascular events that occurred during 2016 and are being targeted for prevention by Million Hearts 2022. Furthermore, it provides a baseline for states by estimating the number of events and hospitalization costs expected to occur if 2016 rates remain unchanged during 2017–2021. These findings can be used by Million Hearts 2022 partners to understand the recent and potential future event burden if no further intervention occurs, and to focus their use of prevention strategies and assess the potential effect on cardiovascular event totals.

Methods

This study leverages a previously published methodology to identify mutually exclusive nonfatal and fatal cardiovascular events (Million Hearts–preventable events) among adults aged ≥18 years attributed to acute myocardial infarctions, strokes, precursor cardiovascular conditions, and other cardiovascular conditions, by applying specified *International Classification of Diseases, Tenth Revision* (ICD-10) codes within administrative data (Supplementary Table 1, https://stacks.cdc.gov/view/cdc/58170) (*7*).[§] Where data availability permit, event rates are described at the state and national levels for 2016 (most current available data). At the state level, the Agency for Healthcare Research and Quality's (AHRQ)[¶] Healthcare Cost and Utilization Project (HCUP) State Emergency Department Database (SEDD) was used to describe 2016 treat-and-release ED event rates for 34 states and the District of Columbia (DC)[**] and the HCUP State Inpatient Database (SID) was used to describe 2016 acute, nonfatal hospitalization event rates for 46 states and DC.[††] Data to generate weighted national estimates for 2016 ED events were unavailable at the time of publication; these data[§§] will be used for national Million Hearts surveillance as they become available. Weighted national estimates and standard errors were determined for 2016 hospitalization events by using HCUP's National Inpatient Sample (NIS),[¶¶] a database developed from data collected via the State Inpatient Database. The National Center for Health Statistics' National Vital Statistics System[***] Mortality Data were used to describe 2016 mortality rates for the nation and all 50 states and DC.

Event rates were stratified by gender and age group (18–44, 45–64, 65–74, and ≥75 years), race and Hispanic origin (mortality only[†††]), event type (acute myocardial infarction, stroke, precursor condition, and other condition), and state.[§§§] Overall mutually exclusive event rates equal the sum of the treat-and-release ED visits, acute, nonfatal hospitalizations, and deaths and are available for 35 jurisdictions with complete data. Rates were standardized by age to the 2010 U.S. Census. Costs associated with hospitalizations were determined by applying HCUP cost-to-charge ratios[¶¶¶] to the hospital billing charges provided in the SID (state estimates) and NIS (national estimates) and are presented in 2016 US$; these costs exclude professional (physician) fees. The mean cost per hospitalization was calculated and standardized by age and

[§] Million Hearts–preventable ED visits and hospitalizations were defined as events where patients had one of the specified ICD-10-CM codes listed as their first-listed/principal diagnosis (national implementation of ICD-10-CM codes occurred in October 2015); Million Hearts–related deaths were events with a specified ICD-10 code listed as the underlying cause of death (national implementation of ICD-10 mortality codes occurred in 1999). Precursor cardiovascular conditions include stable angina pectoris, transient ischemic attack, and other acute and subacute ischemic heart diseases. Other cardiovascular conditions include heart failure, abdominal aortic aneurysm, atheroembolism (hospitalizations only), atherosclerosis and peripheral artery disease (deaths only), hypertension without heart failure, and cardiac arrest that had another Million Hearts–preventable event type coded as a secondary diagnosis or contributing cause of death.

[¶] AHRQ is a Million Hearts 2022 partner and supported the release of this report. Information about AHRQ's support of Million Hearts 2022 through their EvidenceNow initiative can be found at https://www.ahrq.gov/sites/default/files/wysiwyg/evidencenow/about/evidence-now-fact-sheet.pdf.

[**] The SEDD (https://www.hcup-us.ahrq.gov/seddoverview.jsp) is an encounter-based, all-payer (including the uninsured) administrative database capturing claims for 78% of all ED visits that do not result in hospitalization at U.S. community, non-rehabilitation, acute care hospitals. In 2016, it included data from all states except Alabama, Alaska, Colorado, Delaware, Idaho, Louisiana, Michigan, Mississippi, New Hampshire, New Mexico, Oklahoma, Oregon, Pennsylvania, Virginia, Washington, and West Virginia; data for Mississippi and Oregon are regularly collected, but 2016 data were not available at the time of this report. Treat-and-release ED event rates represents ED visits that did not result in a hospitalization, and exclude visits where the patient died in the ED, was transferred to another hospital, or was admitted to the same hospital.

[††] The SID (https://www.hcup-us.ahrq.gov/sidoverview.jsp) is an encounter-based, all-payer (including the uninsured) administrative database capturing claims for 97% of all hospitalizations at U.S. community, nonrehabilitation, acute care hospitals. In 2016, it included data from all states except Alabama, Delaware, Idaho, and New Hampshire. To identify acute, nonfatal hospitalizations, hospitalizations that were reported as elective or where the patient died in the hospital or was transferred to another hospital were excluded.

[§§] For national Million Hearts surveillance weighted national ED visit rates are determined using HCUP's Nationwide Emergency Department Sample (NEDS) (https://www.hcup-us.ahrq.gov/nedsoverview.jsp), which contains data from 30.5 million ED visits from about 1,000 hospitals sampled to approximate a 20% stratified sample of U.S. hospital-based emergency departments. Weighted, there are approximately 143 million ED visits annually.

[¶¶] The NIS (https://www.hcup-us.ahrq.gov/nisoverview.jsp) approximates a 20% stratified sample of discharges from over 4,500 U.S. community hospitals. Weighted, there are approximately 36 million discharges annually.

[***] https://www.cdc.gov/nchs/nvss/index.htm.

[†††] Race/ethnicity is consistently reported in the SEDD and SID for only 32 states and was therefore not included in the presentation of ED and hospitalization event rates.

[§§§] ED and hospitalization events were assigned to the state the patient was treated in. Death events were assigned to the residence the individual lived in.

[¶¶¶] Charge information was available for ED and hospitalization events; however, charge amounts represent only what was billed for services and do not reflect how much the services actually cost the hospital to provide or the amount received in payment. Use of HCUP Cost-to-Charge Ratio Files (CCR) (HCUP. 2016. Agency for Healthcare Research and Quality, Rockville, MD. https://www.hcup-us.ahrq.gov/db/state/costtocharge.jsp) allowed for the conversion from charges to costs, but CCRs are only available for hospitalization charges and not for ED charges.

national event type distribution.**** Age-standardized per capita hospitalization costs, representing the overall cost per adult aged ≥18 years living in the jurisdiction, are presented at the national and state levels.

State-level estimates for the number of Million Hearts–preventable events and hospitalization costs (in 2016 US$) expected to occur during 2017–2021 were calculated in two ways. For states with complete 2016 data (ED, hospitalization, and mortality estimates), the overall age-specific mutually exclusive rates for 2016 were applied to the projected state population estimates†††† during 2017–2021 and summed to determine the expected event totals; the 2016 mean state- and age-specific cost per hospitalization was applied to the expected hospitalization event total to estimate expected costs. For states with incomplete 2016 data, it was assumed that the proportional relationship across their ED, hospitalization and mortality rates were the same as the average calculated among states with complete data. If a state was missing 2016 hospitalization data, the national age-specific average cost per hospitalization event was applied to their expected age-specific hospitalization event totals and summed. Expected overall U.S. event totals and hospitalization costs during 2017–2021 equal the sum of the state-level estimates.§§§§

Results

Nationally, in 2016, over 2.2 million Million Hearts–preventable hospitalizations and 415,480 deaths occurred (Table 1). The hospitalizations resulted in an estimated $32.7 billion in costs. For both event types, the burden was higher among men than among women (age-standardized hospitalization rates of 989.6 and 725.1 per 100,000 population, respectively, and mortality rates of 172.3 and 143.0 per 100,000, respectively) and increased with age. However, an estimated 805,000 hospitalizations and 75,245 deaths occurred among adults aged 18–64 years. Among all racial/ethnic groups, the highest mortality rates were in non-Hispanic blacks (211.6 per 100,000). Acute myocardial infarctions and strokes accounted for approximately half (47%) of hospitalizations (rates of 204.5 and 199.1 per 100,000, respectively) and approximately two thirds (61%) of deaths (42.2 and 53.7 per 100,000, respectively). "Other" cardiovascular events, which include those related to heart failure, contributed to 46% of hospitalizations and 38% of deaths (rates = 394.6 and 59.8 per 100,000, respectively).

Age-standardized event rates per 100,000 population varied considerably across states with available data, including for treat-and-release ED visits (34 states and DC; range = 56.4 [Connecticut] to 274.8 [Kentucky]), acute hospitalizations (46 states and DC; range = 484.0 [Wyoming] to 1670.3 [DC]), and deaths (50 states and DC; range = 111.2 [Vermont] to 267.3 [Mississippi]) (Table 2) (Supplementary Figure 1, https://stacks.cdc.gov/view/cdc/58168). Among the 35 jurisdictions with complete overall data, the three with the lowest overall mutually exclusive event rates were Utah (805.7), Wyoming (828.9), and Vermont (840.6) and those with the highest rates were DC (2,048.2), Tennessee (1,551.6), and Kentucky (1,510.3) (Figure).

In 2016, the age-standardized per-capita hospitalization cost was $125 in the United States, and ranged across states with available data from $76, in New Mexico and Wyoming, to $294, in DC (Table 2). The age- and event type-standardized mean cost per hospitalization was $16,274 nationally and ranged from $11,307 in Arkansas to $24,017 in Alaska. If the 2016 overall mutually exclusive event rates were to remain constant during 2017–2021, an estimated 16.3 million events are expected to occur, including 2.2 million ED visits, 11.8 million hospitalizations, and 2.2 million deaths (Table 3) (Supplementary Table 2, https://stacks.cdc.gov/view/cdc/58171); if mean hospitalization costs per event remained constant, an estimated $173.7 billion in costs would be expected to occur. Preventing one million events during 2017–2021 would result in approximately a 6.1% reduction in expected event totals and associated costs.

Conclusion and Comment

The subset of cardiovascular events¶¶¶¶ targeted for prevention by Million Hearts 2022 places a considerable burden on the health and economic well-being of Americans (*2*,*7*). Despite these events being highly preventable (*3*), they accounted for approximately 2 million hospitalizations and 400,000 deaths in 2016. Furthermore, without a more concerted effort to improve CVD risk factors, an estimated 16.3 million nonfatal and fatal cardiovascular events and $173.7 billion in hospitalization costs are expected to occur during 2017–2021.

**** Standardized to the 2010 decennial U.S. Census population and to the national distribution of events (percentage of events that were acute myocardial infarctions, strokes, precursor events, or other events) observed during 2016.

†††† State-level population projections were based on the linear extrapolation of 2016 July 1st Census estimates and 2020 population projections provided by the University of Virginia's Weldon Cooper Center for Public Service (Available at https://demographics.coopercenter.org/national-population-projections and accessed on May 1, 2018).

§§§§ The method used here to describe the number of events and total hospitalization cost expected at the national level differs from the method being used to officially track these estimates at the national level; that method uses estimates generated from using the NEDS, NIS, and NVSS (https://www.ahajournals.org/doi/10.1161/JAHA.117.006021).

¶¶¶¶ Overall, CVD accounts for approximately 800,000 deaths and an estimated $300 billion in direct medical expenses and lost productivity annually (2). The subset of events targeted for prevention by Million Hearts 2022 activities was identified based on multiple factors described by Ritchey et al (https://www.ahajournals.org/doi/10.1161/JAHA.117.006021) with the most important factor being the preventability of the event by current or planned Million Hearts 2022 efforts.

TABLE 1. National Million Hearts–preventable hospitalization and mortality rates (per 100,000 population) and hospitalization costs among adults aged ≥18 years, by age group, gender, race-ethnicity* and event type, 2016

Event	No., thousands (SE†)	Cost§ (SE†), in US$ billions	Crude rate (SE†)	Age-standardized rate¶ (SE†)
Acute hospitalizations				
Total	**2,238.3 (24.6)**	**32.7 (0.29)**	**897.2 (9.9)**	**850.9 (5.8)**
Men (total)	**1,180.1 (13.6)**	**18.6 (0.18)**	**971.5 (11.2)**	**989.6 (7.1)**
Age group (yrs), men				
18–44	73.0 (1.2)	1.3 (0.03)	124.6 (2.0)	—
45–64	426.0 (5.6)	7.4 (0.09)	1,036.4 (13.6)	—
65–74	286.1 (3.7)	4.8 (0.05)	2,136.5 (27.3)	—
≥75	395.0 (4.9)	5.1 (0.04)	4,700.9 (58.2)	—
Women (total)	**1,057.2 (11.4)**	**14.1 (0.12)**	**825.8 (8.9)**	**725.1 (5.1)**
Age group (yrs), women				
18–44	46.9 (0.9)	0.8 (0.02)	81.6 (1.5)	—
45–64	258.7 (3.5)	4.1 (0.05)	599.6 (8.0)	—
65–74	231.1 (2.8)	3.3 (0.03)	1516.6 (18.4)	—
≥75	520.5 (6.0)	5.9 (0.04)	4,262.2 (48.9)	—
Event type				
AMI	536.3 (8.7)	11.6 (0.09)	215.0 (3.5)	204.5 (2.0)
Stroke	524.3 (7.5)	8.4 (0.12)	210.2 (3.0)	199.1 (1.8)
Precursor**	138.4 (2.1)	1.1 (0.01)	55.5 (0.8)	52.7 (0.5)
Other††	1,039.3 (11.0)	11.6 (0.14)	416.6 (4.4)	394.6 (2.9)
Deaths				
Total	**415.5**	**NA**	**166.5**	**157.4**
Men (total)	**199.4**	**NA**	**164.1**	**172.3**
Age group (yrs), men				
18–44	5.2	NA	8.9	—
45–64	44.2	NA	107.6	—
65–74	42.0	NA	313.5	—
≥75	107.9	NA	1,284.4	—
Women (total)	**216.1**	**NA**	**168.8**	**143.0**
Age group (yrs), women				
18–44	2.7	NA	4.7	—
45–64	23.1	NA	53.5	—
65–74	28.3	NA	185.4	—
≥75	162.1	NA	1,327.2	—
Race/Ethnicity*				
White, non-Hispanic	320.2	NA	197.9	160.2
Black, non-Hispanic	52.2	NA	170.6	211.6
Hispanic§§	25.4	NA	66.4	114.9
Other, non-Hispanic	12.6	NA	75.2	97.1
Asian/PI	10.6	NA	71.5	92.3
AI/AN	2.0	NA	103.6	132.9
Event type				
AMI	111.7	NA	44.8	42.2
Stroke	141.8	NA	56.9	53.7
Precursor**	4.4	NA	1.7	1.7
Other††	157.5	NA	63.1	59.8

Sources: Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project (HCUP) National Inpatient Sample (NIS); National Center for Health Statistics' National Vital Statistics System Mortality Data.

Abbreviations: AI/AN = American Indian/Alaskan Native; AMI = acute myocardial infarction; Asian/PI = Asian/Pacific Islander; NA = not applicable; SE = standard error.

* Race/ethnicity information was consistently available nationally for only mortality data. During 1999–2011, the sensitivity for identifying the correct race and ethnicity on death certificates was 99.2% (non-Hispanic whites), 98.1% (non-Hispanic blacks), 91.3% (Hispanics), 93.5% (Asian/PI), and 73.3% (AI/AN) (Arias E, Heron M, Hakes JK. The validity of race and Hispanic-origin reporting on death certificates in the United States: An update. National Center for Health Statistics. Vital Health Stat 2 2016;172:1–21. https://www.cdc.gov/nchs/data/series/sr_02/sr02_172.pdf).

† Standard errors are provided only for acute hospitalization estimates as they are determined using a sample of hospitalizations (NIS) obtained from the HCUP State Inpatient Databases. No sampling error is produced when using mortality data from the National Vital Statistic System.

§ Described by applying HCUP cost-to-charge ratios to the charges the hospitals billed for the entire hospital stay; these costs exclude professional (physician) fees (https://www.hcup-us.ahrq.gov/db/state/costtocharge.jsp). The age- and event type-standardized mean cost per event in the United States was $16,274 per hospitalization and the age-standardized per-capita cost was $125 per U.S. adult.

¶ Standardized by age to the 2010 U.S. Census population.

** Includes stable angina pectoris, transient ischemic attack, and other acute and subacute ischemic heart disease.

†† Includes heart failure, abdominal aortic aneurysm, atheroembolism (hospitalizations only), atherosclerosis and peripheral artery disease (deaths only), hypertension without heart failure, and cardiac arrest that had another Million Hearts–preventable event type coded as a secondary diagnosis or contributing cause of death.

§§ Persons with unspecified ethnicity were considered to be non-Hispanic (approximately 0.3% of deaths).

TABLE 2. Age-standardized Million Hearts–preventable emergency department, hospitalization, mortality rates (per 100,000 population), hospitalization costs, and overall event totals among adults aged ≥18 years, by state* — United States, 2016

State	Treat-and-release ED visit rate†	Acute hospitalizations				Mortality rate†	Overall event total (thousands)††
		Rate†	Cost, in US$ (2016) billions	Mean cost (US$) per event§,¶	Per-capita costs (US$)§,**		
Alabama	—§§	—§§	—§§	—§§	—§§	206.1	—§§
Alaska	—§§	593.0	0.07	24,017	149	116.9	—§§
Arizona	132.8	666.7	0.56	14,935	97	114.4	53.9
Arkansas	192.5	914.2	0.24	11,307	95	260.0	34.2
California	154.7	698.3	4.21	23,092	143	146.4	294.9
Colorado	—§§	555.1	0.38	18,479	91	123.9	—***
Connecticut	56.4	773.5	0.42	19,256	133	120.5	30.1
Delaware	—§§	—§§	—§§	—§§	—§§	131.7	—§§
District of Columbia¶¶	202.0	1,670.3	0.13	20,600	294	175.9	9.2
Florida	113.4	916.0	2.30	13,907	116	134.3	235.1
Georgia	233.5	928.6	0.89	14,171	117	188.9	101.0
Hawaii	149.8	755.7	0.17	18,573	141	126.3	12.7
Idaho	—§§	—§§	—§§	—§§	—§§	156.3	—§§
Illinois	140.0	861.7	1.30	17,130	127	173.0	120.3
Indiana	200.8	960.1	0.68	14,122	128	177.3	71.3
Iowa	199.2	670.7	0.24	15,442	90	138.0	27.8
Kansas	184.5	754.3	0.22	13,507	96	168.1	26.1
Kentucky	274.8	1,025.2	0.56	16,591	153	210.3	55.2
Louisiana	—§§	1,097.0	0.47	12,622	130	213.4	—§§
Maine	237.6	784.3	0.17	19,136	134	136.0	15.3
Maryland	165.7	787.2	0.47	13,762	97	153.7	53.1
Massachusetts	64.9***	839.1	0.78	20,720	135	129.1	60.4
Michigan	—§§	1,013.1	1.11	14,937	131	176.3	—§§
Minnesota	127.4	659.7	0.52	20,228	114	113.1	40.9
Mississippi	—§§	1,040.0	0.29	12,216	122	267.3	—§§
Missouri	179.9	999.5	0.71	14,813	138	202.1	71.3
Montana	165.9	546.9	0.08	13,744	81	136.6	8.0
Nebraska	142.9	645.0	0.16	17,866	104	141.7	14.4
Nevada	169.3	804.1	0.27	14,105	115	134.0	25.4
New Hampshire	—§§	—§§	—§§	—§§	—§§	126.9	—§§
New Jersey	129.8	839.5	0.99	17,308	131	138.7	83.6
New Mexico	—§§	528.9	0.13	15,568	76	133.1	—§§
New York	91.1	803.9	2.28	19,676	138	134.8	169.9
North Carolina	195.9	947.6	1.00	14,132	121	159.7	107.8
North Dakota	162.8	912.4	0.09	18,224	157	134.8	7.3
Ohio	190.8	996.8	1.33	14,866	134	176.4	136.6
Oklahoma	—§§	884.8	0.35	13,539	112	197.4	—§§
Oregon	—§§	675.4	0.39	18,989	110	138.6	—§§

See table footnotes on next page.

Considerable disparities in event rates were evident. Nationally, non-Hispanic blacks continue to experience the highest CVD mortality rates (32% higher than those in non-Hispanic whites). This disparity is due, in part, to the high prevalence of uncontrolled blood pressure among blacks (*6*), placing them at higher risk than other racial/ethnic groups for acute myocardial infarction, stroke, and other CVD conditions, including heart failure (*2*,*8*). Additionally, despite the considerable increase in risk for a cardiovascular event with increasing age, in 2016, over 800,000 combined hospitalizations and deaths occurred among adults aged <65 years (approximately one in three events). Other studies have shown that decades-long improvement in heart disease and stroke mortality have stalled (*9*,*10*) and that younger populations, especially those aged 35–64 years, are experiencing worse outcomes across the country (*4*,*9*). In 2016, Million Hearts-preventable event rates among persons aged 35–64 years varied considerably by demographic characteristics and U.S. state (Supplementary Table 3, https://stacks.cdc.gov/view/cdc/58172); among the overall 16.3 million events expected to occur during 2017–2021 if no additional action is

TABLE 2. (*Continued*) Age-standardized Million Hearts–preventable emergency department, hospitalization, mortality rates (per 100,000 population), hospitalization costs, and overall event totals among adults aged ≥18 years, by state*— United States, 2016

State	Treat-and-release ED visit rate†	Acute hospitalizations				Mortality rate†	Overall event total (thousands)††
		Rate†	Cost, in US$ (2016) billions	Mean cost (US$) per event§,¶	Per-capita costs (US$)§,**		
Pennsylvania	—§§	987.3	1.55	15,986	133	162.5	—§§
Rhode Island	148.6	932.8	0.12	15,480	129	131.2	11.5
South Carolina	235.8	921.8	0.49	14,125	118	169.1	55.4
South Dakota	167.3	715.5	0.08	15,594	104	174.9	7.8
Tennessee	236.6	1,121.0	0.71	12,342	130	194.0	85.0
Texas	201.7	893.7	2.48	15,654	129	168.9	239.1
Utah	116.6	537.8	0.17	19,859	90	151.3	14.4
Vermont	157.9	571.5	0.05	17,876	90	111.2	4.9
Virginia	—§§	866.4	0.77	15,727	115	154.6	—§§
Washington	—§§	713.0	0.72	20,661	125	127.4	—§§
West Virginia	—§§	1,030.9	0.25	13,416	145	172.8	—§§
Wisconsin	145.7	730.7	0.55	17,107	111	148.6	51.2
Wyoming	194.9	484.0	0.04	15,977	76	150.0	3.8

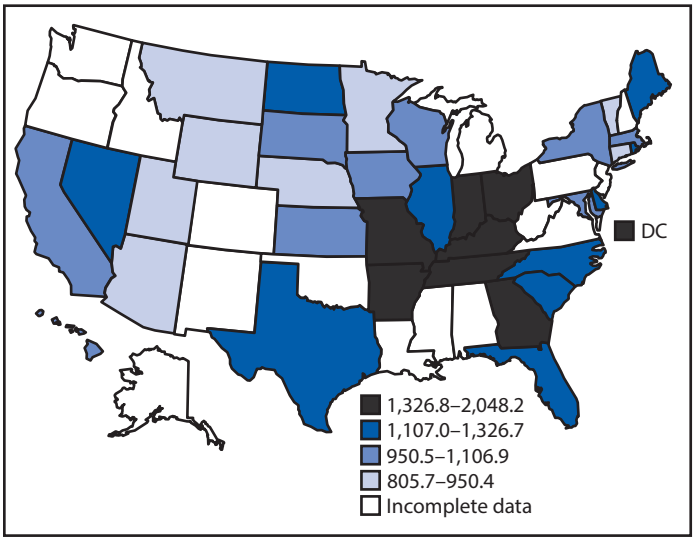
Sources: Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project (HCUP), State Emergency Department Databases and State Inpatient Databases; National Center for Health Statistics' National Vital Statistics System Mortality Data.
Abbreviation: ED = emergency department.
* Calculated only for states where data were made available.
† Standardized by age to the 2010 U.S. Census population.
§ Described by applying HCUP cost-to-charge ratios to the charges the hospitals billed for the entire hospital stay in each state; these costs exclude professional (physician) fees.
¶ Standardized by age to the 2010 U.S. Census population and by event type to the national distribution of events (acute myocardial infarctions, strokes, precursor events, and other cardiovascular events) observed during 2016.
** Represents the overall cost per adult aged ≥18 years living in the jurisdiction, standardized by age to the 2010 U.S. Census population.
†† Represents the sum of number of treat-and-release ED visits, acute, nonfatal hospitalizations, and deaths that occurred in that jurisdiction.
§§ Data were not collected or were not available for analysis (treat-and-release ED data for Mississippi and Oregon are regularly collected, but 2016 data were not available at time of this report).
¶¶ The ED and hospitalization event and cost values are likely overestimates for this location because these events are attributed to where the event was treated and not the residence of the patient.
*** Transfers to other acute care hospitals are not identified in discharge disposition codes, so they could not be excluded from the analysis and the rate may be slightly inflated.

taken, 5.0 million (30.9%) are expected to occur among this age group (Supplementary Figure 2, https://stacks.cdc.gov/view/cdc/58169). Therefore, implementation of strategies that focus on the prevention, early diagnosis, and effective management of CVD risk factors among younger adults is needed to prevent events in both the short- and long-term.

This is one of the first studies to demonstrate striking state-level variation in nonfatal cardiovascular event rates and hospitalization costs using data collected among adults of all ages and across all payer types, including the uninsured. Whereas the burden of state-level mortality was higher in the southeastern United States, which aligns with the findings from previous studies (*2*), rates for ED visits and hospitalizations were higher in both this region and elsewhere, including many Midwestern states. The overall state variation in nonfatal event rates and associated hospitalization costs is likely driven by both geographic differences in disease prevalence and severity, and differences in care delivery and public health quality (*2,11*). Additional focus on improving the environments in which persons live, work, and play (e.g., built environment modifications to promote increased physical activity) (*12*), leveraging community resources to aid in CVD risk factor management (e.g., referral to nutritional and fitness counseling groups) (*13*), providing effective outpatient care (e.g., use of team-based care for hypertension and cholesterol management) (*14*), and improving the care received after a cardiovascular event (e.g., systematic referral to cardiac rehabilitation services for those with eligible diagnoses) (*15*) might reduce the need for and the expense of many of these acute care services.

This study uses the best available data to describe the burden of Million Hearts–preventable events at the national and state levels. However, the findings in this report are subject to at least six limitations. First, not all jurisdictions provided ED and/or hospitalization data; efforts to impute missing values might produce inaccurate estimates. Second, nonfatal events are attributed to treatment location and not patient residence, therefore jurisdictions in close proximity to large population centers in neighboring states (e.g., DC) could have overestimated or underestimated rates. Third, whereas the methodology used attempts to identify mutually exclusive events, there is potential for over- or undercounting events. Fourth, cardiovascular

FIGURE. Age-standardized overall Million Hearts–preventable event* rates among adults aged ≥18 years, by U.S. state,† 2016



Sources: Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project State Emergency Department Databases and State Inpatient Databases; National Center for Health Statistics' National Vital Statistics System Mortality Data.

* Includes mutually exclusive nonfatal treat-and-release emergency department visits, nonfatal acute hospitalizations and deaths attributed to acute myocardial infarctions, strokes, precursor cardiovascular conditions (e.g., stable angina pectoris), and other cardiovascular conditions (e.g., heart failure).

† Complete data are available for 34 states and the District of Columbia (DC). Supplementary Figure 1 shows age-standardized rates of treat-and-release emergency department visits for 34 states and DC, hospitalizations for 46 states and DC, and mortality for 50 states and DC (https://stacks.cdc.gov/view/cdc/58168).

events that do not result in ED or hospital use or death are not counted. Fifth, because administrative data are being used, differences in use of health care (e.g., changes in how events are medically managed) or coding practices (e.g., changes in how nonfatal events are billed) might affect the event rates and costs presented in this study rather than changes in disease burden. However, this study attempts to address differences in practice patterns by excluding elective hospitalizations and including certain ED events (e.g., heart failure-related visits). Finally, the hospitalization cost estimates are likely conservative, as they do not include professional (physician) fees, and costs were not available for treat-and-release ED visits.

Each state would need to realize an approximate 6% decrease in its expected event totals during 2017–2021 to collectively prevent one million events at the national level. This is feasible if clinical and public health partners in every state mobilize and strengthen their focus on implementing the prevention strategies outlined by Million Hearts 2022 (https://millionhearts.hhs.gov/files/MH-Framework.pdf) to achieve 80% or greater performance on the ABCS and at least a 20% reduction in physical inactivity, tobacco use prevalence, and sodium consumption (*16*).

Summary

What is already known about this topic?

The health and economic burden of cardiovascular disease is considerable. Million Hearts 2022 supports use of evidence-based clinical and community strategies to prevent one million cardiovascular events during 2017–2021.

What is added by this report?

Nationally, in 2016, 2.2 million hospitalizations, costing $32.7 billion, and 415,480 deaths occurred that are being targeted for prevention by Million Hearts 2022, with disparities across demographic characteristics and states. Approximately 16.3 million events could occur during 2017–2021 without preventive intervention.

What are the implications for public health practice?

Achieving the Million Hearts 2022 goal likely requires states to focus on using prevention strategies that best meet the cardiovascular health needs of the persons they serve.

Acknowledgments

State data organizations that contributed data to the Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project: Alaska Department of Health and Social Services, Alaska State Hospital and Nursing Home Association, Arizona Department of Health Services, Arkansas Department of Health, California Office of Statewide Health Planning and Development, Colorado Hospital Association, Connecticut Hospital Association, District of Columbia Hospital Association, Florida Agency for Health Care Administration, Georgia Hospital Association, Hawaii Health Information Corporation, Illinois Department of Public Health, Indiana Hospital Association, Iowa Hospital Association, Kansas Hospital Association, Kentucky Cabinet for Health and Family Services, Louisiana Department of Health, Maine Health Data Organization, Maryland Health Services Cost Review Commission, Massachusetts Center for Health Information and Analysis, Michigan Health & Hospital Association, Minnesota Hospital Association, Mississippi State Department of Health, Missouri Hospital Industry Data Institute, Montana Hospital Association, Nebraska Hospital Association, Nevada Department of Health and Human Services, New Hampshire Department of Health & Human Services, New Jersey Department of Health, New Mexico Department of Health, New York State Department of Health, North Carolina Department of Health and Human Services, North Dakota, Ohio Hospital Association, Oklahoma State Department of Health, Oregon Association of Hospitals and Health Systems, Oregon Office of Health Analytics, Pennsylvania Health Care Cost Containment Council, Rhode Island Department of Health, South Carolina Revenue and Fiscal Affairs Office, South Dakota Association of Healthcare Organizations, Tennessee Hospital Association, Texas Department of State Health Services, Utah Department of Health, Vermont Association of Hospitals and Health Systems, Virginia Health Information, Washington State Department of Health, West Virginia Department of Health and Human Resources, West Virginia Health Care Authority, Wisconsin Department of Health Services, Wyoming Hospital Association; Marguerite Barrett, M.L. Barrett, Inc; Molly Bailey, Truven-IBM Watson; Minya Sheng, Truven-IBM Watson; Linda Schieb, CDC.

TABLE 3. Expected number of Million Hearts–preventable events and hospitalization costs among adults aged ≥18 years during 2017–2021, nationally and by state — United States*

State	Expected event totals, in thousands				Expected hospitalization costs, in US$ (2016) billions
	Treat-and-release ED visits	Acute hospitalizations	Deaths	Total mutually exclusive events	
United States	2,231.3	11,843.8	2,214.0	16,289.1	173.7
Alabama	48.4†	255.5§	44.1	347.9¶	3.8§
Alaska	2.8†	14.7	2.6	20.1¶	0.4
Arizona	39.9	200.9	35.5	276.3	2.9
Arkansas	24.7	118.1	34.5	177.3	1.2
California	241.4	1,088.6	229.0	1,558.9	22.3
Colorado	23.5†	122.1	26.5	172.0¶	2.0
Connecticut	9.6	131.0	21.1	161.7	2.2
Delaware	6.2†	32.9§	6.1	45.3¶	0.5§
District of Columbia	4.9	40.2	4.0	49.1	0.7
Florida	113.9	945.2	147.7	1,206.8	11.8
Georgia	94.2	374.7	74.6	543.5	4.8
Hawaii	9.7	50.4	8.9	69.0	0.9
Idaho	11.4†	60.8§	11.7	83.8¶	0.9§
Illinois	74.1	458.2	93.0	625.4	6.7
Indiana	56.4	270.9	50.7	377.9	3.6
Iowa	28.7	96.0	20.7	145.4	1.3
Kansas	22.7	92.4	21.2	136.3	1.2
Kentucky	52.8	197.9	40.9	291.6	2.9
Louisiana	39.0†	201.7	38.5	279.3¶	2.4
Maine	17.0	55.3	9.9	82.3	0.9
Maryland	41.7	199.6	38.9	280.2	2.5
Massachusetts	19.6	254.8	39.5	314.0	4.1
Michigan	84.7†	457.2	81.6	623.5¶	5.9
Minnesota	31.1	159.4	28.0	218.4	2.7
Mississippi	25.8†	126.5	32.7	185.0¶	1.5
Missouri	48.5	270.2	56.5	375.3	3.7
Montana	8.7	27.9	7.2	43.8	0.4
Nebraska	11.7	52.6	11.9	76.2	0.8
Nevada	19.5	93.3	15.2	128.0	1.3
New Hampshire	7.6†	40.9§	8.1	56.6¶	0.6§
New Jersey	50.1	328.9	55.2	434.2	5.1

See table footnotes on next page.

Corresponding Author: Matthew Ritchey, mritchey@cdc.gov, 770-488-7232.

[1]Division for Heart Disease and Stroke Prevention, CDC; [2]Center for Delivery, Organization and Markets, Agency for Healthcare Research and Quality, Rockville, Maryland.

All authors have completed and submitted the ICMJE form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

References

1. Frieden TR, Berwick DM. The "Million Hearts" initiative—preventing heart attacks and strokes. N Engl J Med 2011;365:e27. https://doi.org/10.1056/NEJMp1110421
2. Benjamin EJ, Virani SS, Callaway CW, et al.; American Heart Association Council on Epidemiology and Prevention Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2018 update: A report from the American Heart Association. Circulation 2018;137:e67–492. https://doi.org/10.1161/CIR.0000000000000558
3. CDC. Vital signs: avoidable deaths from heart disease, stroke, and hypertensive disease - United States, 2001–2010. MMWR Morb Mortal Wkly Rep 2013;62:721–7.
4. Vaughan AS, Ritchey MD, Hannan J, Kramer MR, Casper M. Widespread recent increases in county-level heart disease mortality across age groups. Ann Epidemiol 2017;27:796–800. https://doi.org/10.1016/j.annepidem.2017.10.012
5. Millon Hearts. Million Hearts 2022—preventing 1 million heart attacks and strokes by 2022. Washington, DC: US Department of Health and Human Services, CDC; 2018. https://millionhearts.hhs.gov/files/MH-2022-Fact-Sheet.pdf
6. Wall HK, Ritchey MD, Gillespie C, Omura JO, Jamal A, George MG. Vital signs: prevalence of key cardiovascular disease risk factors for Million Hearts 2022—United States, 2011–2016. MMWR Morb Mortal Wkly Rep 2018;67:983–91.
7. Ritchey MD, Loustalot F, Wall HK, et al. Million Hearts: description of the national surveillance and modeling methodology used to monitor the number of cardiovascular events prevented during 2012–2016. J Am Heart Assoc 2017;6:e006021. https://doi.org/10.1161/JAHA.117.006021

TABLE 3. (*Continued*) Expected number of Million Hearts–preventable events and hospitalization costs among adults aged ≥18 years during 2017–2021, nationally and by state — United States*

State	Expected event totals, in thousands				Expected hospitalization costs, in US$ (2016) billions
	Treat-and-release ED visits	Acute hospitalizations	Deaths	Total mutually exclusive events	
New Mexico	9.7†	49.2	12.6	71.5¶	0.7
New York	77.8	692.1	119.3	889.2	11.8
North Carolina	87.8	425.9	73.1	586.7	5.4
North Dakota	5.4	30.2	4.5	40.1	0.5
Ohio	99.4	524.3	95.3	718.9	7.0
Oklahoma	28.2†	143.6	32.4	204.1¶	1.8
Oregon	24.3†	128.7	27.3	180.3¶	2.1
Pennsylvania	110.7†	606.3	103.7	820.6¶	8.0
Rhode Island	7.2	45.6	6.6	59.3	0.6
South Carolina	52.7	207.3	38.9	298.8	2.6
South Dakota	6.6	28.2	7.1	41.9	0.4
Tennessee	68.1	327.2	57.3	452.6	3.8
Texas	207.2	917.2	167.6	1,291.9	13.4
Utah	11.6	53.5	14.6	79.8	0.9
Vermont	4.9	17.5	3.4	25.9	0.3
Virginia	57.2†	306.6	54.4	418.2¶	4.1
Washington	41.4†	223.8	40.0	305.2¶	3.9
West Virginia	17.4†	93.9	16.3	127.7¶	1.3
Wisconsin	38.7	192.2	40.0	270.9	2.9
Wyoming	4.8	11.9	3.7	20.4	0.2

Sources: Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project State Emergency Department Databases (from all states except Alabama, Alaska, Colorado, Delaware, Idaho, Louisiana, Michigan, Mississippi, New Hampshire, New Mexico, Oklahoma, Oregon, Pennsylvania, Virginia, Washington and West Virginia; ED data for Mississippi and Oregon are regularly collected, but 2016 data were not available at time of this report) and State Inpatient Databases (from all states except Alabama, Delaware, Idaho, and New Hampshire); National Center for Health Statistics' National Vital Statistics System Mortality Data.

Abbreviation: ED = emergency department.

* State-level estimates for the number of Million Hearts–preventable events (those targeted for prevention by the initiative) and hospitalization costs expected to occur during 2017–2021 were calculated in two ways. For states with complete 2016 data (ED, hospitalization, and mortality estimates), the overall age-specific mutually exclusive rates for 2016 were applied to the projected state population estimates during 2017–2021 and summed to determine the expected event totals; the 2016 mean state- and age-specific cost per hospitalization was applied to the expected hospitalization event total to estimate expected costs. For states with incomplete 2016 data, it was assumed that the proportional relationship across their ED, hospitalization, and mortality rates was the same as the average calculated among states with complete data. If a state was missing 2016 hospitalization data, the national age-specific average cost per hospitalization event was applied to their expected age-specific hospitalization event totals and summed. Expected overall U.S. event totals and costs during 2017–2021 equals the sum of the state-level estimates; this method differs from the method being used to officially track these estimates at the national level.

† ED rate was missing, therefore, an estimate was used.

§ Hospitalization rate and cost per hospitalization information were missing, therefore, estimates were used.

¶ Calculated by using estimated ED visit rates and, where applicable, estimated hospitalization rates and summing those resultant event counts with the known death counts.

8. Heidenreich PA, Albert NM, Allen LA, et al.; American Heart Association Advocacy Coordinating Committee; Council on Arteriosclerosis, Thrombosis and Vascular Biology; Council on Cardiovascular Radiology and Intervention; Council on Clinical Cardiology; Council on Epidemiology and Prevention; Stroke Council. Forecasting the impact of heart failure in the United States: a policy statement from the American Heart Association. Circ Heart Fail 2013;6:606–19. https://doi.org/10.1161/HHF.0b013e318291329a
9. Yang Q, Tong X, Schieb L, et al. Vital signs: recent trends in stroke death rates—United States, 2000–2015. MMWR Morb Mortal Wkly Rep 2017;66:933–9. https://doi.org/10.15585/mmwr.mm6635e1
10. Sidney S, Quesenberry CP Jr, Jaffe MG, et al. Recent trends in cardiovascular mortality in the United States and public health goals. JAMA Cardiol 2016;1:594–9. https://doi.org/10.1001/jamacardio.2016.1326
11. Wakim R, Ritchey M, Hockenberry J, Casper M. Geographic variations in incremental costs of heart disease among Medicare beneficiaries, by type of service, 2012. Prev Chronic Dis 2016;13:E180. https://doi.org/10.5888/pcd13.160209
12. The Community Guide. Physical activity: Built environment approaches combining transportation system interventions with land use and environmental design. Atlanta, GA: The Community Guide; 2016. https://www.thecommunityguide.org/findings/physical-activity-built-environment-approaches
13. Diabetes Prevention Program (DPP) Research Group. The Diabetes Prevention Program (DPP): description of lifestyle intervention. Diabetes Care 2002;25:2165–71. https://doi.org/10.2337/diacare.25.12.2165
14. Proia KK, Thota AB, Njie GJ, et al.; Community Preventive Services Task Force. Team-based care and improved blood pressure control: a community guide systematic review. Am J Prev Med 2014;47:86–99. https://doi.org/10.1016/j.amepre.2014.03.004
15. Ades PA, Keteyian SJ, Wright JS, et al. Increasing cardiac rehabilitation participation from 20% to 70%: A road map from the Million Hearts Cardiac Rehabilitation Collaborative. Mayo Clin Proc 2017;92:234–42. https://doi.org/10.1016/j.mayocp.2016.10.014
16. Frieden TR, Wright JS, Conway PH. Is rapid health improvement possible? Lessons from the Million Hearts Initiative. Circulation 2017;135:1677–80. https://doi.org/10.1161/CIRCULATIONAHA.117.027461

Vital Signs: Prevalence of Key Cardiovascular Disease Risk Factors for Million Hearts 2022 — United States, 2011–2016

Hilary K. Wall, MPH[1]; Matthew D. Ritchey, DPT[1]; Cathleen Gillespie, MS[1]; John D. Omura, MD[2]; Ahmed Jamal, MBBS[3]; Mary G. George, MD[1]

Abstract

Introduction: Despite decades-long reductions in cardiovascular disease (CVD) mortality, CVD mortality rates have recently plateaued and even increased in some subgroups, and the prevalence of CVD risk factors remains high. Million Hearts 2022, a 5-year initiative, was launched in 2017 to address this burden. This report establishes a baseline for the CVD risk factors targeted for reduction by the initiative during 2017–2021 and highlights recent changes over time.

Methods: Risk factor prevalence among U.S. adults was assessed using data from the National Health and Nutrition Examination Survey, National Survey on Drug Use and Health, and National Health Interview Survey. Multivariate analyses were performed to assess differences in prevalence during 2011–2012 and the most recent cycle of available data, and across subgroups.

Results: During 2013–2014, the prevalences of aspirin use for primary and secondary CVD prevention were 27.4% and 74.9%, respectively, and of statin use for cholesterol management was 54.5%. During 2015–2016, the average daily sodium intake was 3,535 mg/day and the prevalences of blood pressure control, combustible tobacco use, and physical inactivity were 48.5%, 22.3%, and 29.1%, respectively. Compared with 2011–2012, significant decreases occurred in the prevalences of combustible tobacco use and physical inactivity; however, a decrease also occurred for aspirin use for primary or secondary prevention. Disparities in risk factor prevalences were observed across age groups, genders, and racial/ethnic groups.

Conclusions and Implications for Public Health Practice: Millions of Americans have CVD risk factors that place them at increased risk for having a cardiovascular event, despite the existence of proven strategies for preventing or managing CVD risk factors. A concerted effort to implement these strategies will be needed to prevent one million acute cardiovascular events during the 5-year initiative.

Introduction

Despite steady declines in CVD mortality rates over approximately the last 40 years, heart disease and stroke remain the first and fifth leading causes of death in the United States, respectively, and their associated mortality rates have recently begun to plateau in the general population and even increase among some subpopulations. (*1*–*3*) Furthermore, CVD annually accounts for approximately $330 billion in direct and indirect costs in the United States: approximately one in seven health care dollars is spent on CVD (*4*). To address this burden, in 2012, the U.S. Department of Health and Human Services launched Million Hearts, a national initiative co-led by CDC and the Centers for Medicare & Medicaid Services, with the goal of preventing one million acute cardiovascular events over 5 years. Because important groundwork and progress were made during the first 5 years (*5,6*), Million Hearts 2022 was launched in 2017 to accelerate the implementation of effective strategies to improve cardiovascular health.

During 2017–2021, Million Hearts 2022 priorities are keeping adults healthy through community-based strategies that reduce combustible tobacco use, sodium intake, and physical inactivity as well as optimizing health care for those with and at risk for CVD through clinical strategies that improve appropriate aspirin use, blood pressure control, cholesterol management, tobacco cessation, and participation in cardiac rehabilitation.* Million Hearts 2022 also has a special focus on selected priority populations at risk, including blacks/African Americans with hypertension, adults aged 35–64 years for whom heart disease mortality rates are rising, adults who have had a previous heart attack or stroke, and persons with mental health or substance use disorders who use tobacco (*7*). This report uses several national surveillance systems to provide baseline data and describe recent changes for key CVD risk factors for which accelerated progress must be made to achieve national goals.

* Although participation in cardiac rehabilitation is an evidence-based strategy for preventing secondary CVD-related events, it is not considered a key CVD risk factor. Therefore the participation data are not included in this report.

Methods

Data for this report were gathered from three national surveillance systems: the National Health and Nutrition Examination Survey (NHANES[†]), the National Survey on Drug Use and Health (NSDUH[§]), and the National Health Interview Survey (NHIS[¶]). The details for all three surveys have been published previously (*8*–*10*).

NHANES is a complex survey of a multistage probability sample of the civilian, noninstitutionalized U.S. population that combines interviews and physical examinations. Data from NHANES from 2011 to 2014 were used to calculate prevalence estimates for aspirin use for primary CVD prevention[**] among adults aged 50–59 years, aspirin use for secondary CVD prevention[††] among adults aged ≥40 years, combined aspirin use "as appropriate"[§§] among adults aged ≥40 years, and statin use among eligible adults aged ≥21 years.[¶¶] Mean daily sodium intake (mg/day)[***] among adults aged ≥18 years and blood pressure control[†††] estimates among adults aged ≥18 years with hypertension were calculated using 2011–2016 NHANES data.

NSDUH is an annual nationwide survey that collects information through face-to-face household interviews about the use of illicit drugs, alcohol, and tobacco among the noninstitutionalized U.S. population aged ≥12 years. Data from the 2011–2016 NSDUH were combined into 2-year cycles to estimate the prevalence of current combustible tobacco use[§§§] among adults aged ≥18 years.

NHIS is an annual, nationally representative, in-person survey of the noninstitutionalized U.S. civilian population. Data from the 2011–2016 NHIS were combined into 2-year cycles

[†] During 2011–2016, unweighted examination response rates ranged from 58.7% to 69.5%. https://www.cdc.gov/nchs/nhanes.htm.

[§] During 2011–2016, weighted interview response rates ranged from 71.2% to 74.4%. https://datafiles.samhsa.gov/study/national-survey-drug-use-and-health-nsduh-2011-nid13563; https://datafiles.samhsa.gov/study/national-survey-drug-use-and-health-nsduh-2012-nid13601; https://datafiles.samhsa.gov/study/national-survey-drug-use-and-health-nsduh-2013-nid13555; https://datafiles.samhsa.gov/study/national-survey-drug-use-and-health-nsduh-2014-nid13618; https://datafiles.samhsa.gov/study/national-survey-drug-use-and-health-nsduh-2015-nid16893; https://datafiles.samhsa.gov/study/national-survey-drug-use-and-health-nsduh-2016-nid17184.

[¶] During 2011–2016, the final response rate for the sample adult component ranged from 79.7%–81.7%. https://www.cdc.gov/nchs/nhis.htm.

[**] The U.S. Preventive Services Task Force recommends initiating low-dose aspirin use for the primary prevention of CVD in adults aged 50–59 years who have no history of CVD, a ≥10% 10-year atherosclerotic CVD (ASCVD) risk, and are not at increased risk for bleeding (https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/aspirin-to-prevent-cardiovascular-disease-and-cancer). Aspirin use in NHANES was defined by self-report or aspirin identified in the prescription medication data files. Participants who were taking an anticoagulant but not taking aspirin/antiplatelets were excluded as being at increased risk for bleeding. Participants who reported that they stopped taking aspirin because of side effects were excluded. During 2011–2014, among 2,776 adults aged 50–59 years examined in NHANES with complete data to determine aspirin eligibility, 338 met the criteria for aspirin use for primary prevention.

[††] Aspirin use for secondary event prevention is recommended for adults aged ≥40 years with a history of CVD, defined as self-reported angina, coronary heart disease, heart attack, or stroke. Aspirin use in NHANES was defined by self-report or aspirin identified in the prescription medication data files. During 2011–2014, among 11,184 adults aged ≥40 years examined in NHANES with complete data to determine aspirin eligibility, 913 met the criteria for aspirin use for secondary prevention.

[§§] "Aspirin when appropriate" is defined as primary or secondary prevention use among eligible adults. During 2011–2014, 1,251 adults ≥40 years were included in the aspirin when appropriate analyses.

[¶¶] The 2013 ACC/AHA guideline recommends statin treatment for persons 1) with clinical atherosclerotic CVD (ASCVD); 2) with low-density lipoprotein cholesterol (LDL-C) ≥190 mg/dL; 3) aged 40–75 years with diabetes, LDL-C 70–189 mg/dL, and without clinical ASCVD; or 4) aged 40–75 years without clinical ASCVD or diabetes with LDL-C 70–189 mg/dL, and estimated 10-year ASCVD risk ≥7.5% (https://www.ahajournals.org/doi/abs/10.1161/01.cir.0000437738.63853.7a; https://www.ahajournals.org/doi/abs/10.1161/01.cir.0000437741.48606.98). Statin use was identified using the NHANES prescription medication data files. During 2011–2014, among 4,358 non-pregnant adults aged ≥21 years in the morning fasting subsample in NHANES with complete data to determine statin eligibility, 1,823 met the criteria for statin use.

[***] Dietary sodium intake is estimated from the NHANES Day 1 dietary recall interviews (https://www.ars.usda.gov/ba/bhnrc/fsrg). During 2011–2016, 15,698 adults aged ≥18 years had a complete and reliable Day 1 dietary recall and were included in the sodium analyses.

[†††] Defined among adults with hypertension as systolic BP of <140 mm Hg and diastolic BP of <90 mm Hg, based on the average of up to three measurements. ACC/AHA released a new hypertension management guideline in November 2017 that uses 130/80 mm Hg to define blood pressure control (https://professional.heart.org/professional/ScienceNews/UCM_496965_2017-Hypertension-Clinical-Guidelines.jsp). Here, 140/90 mm Hg is used to define control because that was the standard, as recommended for the general population by the Seventh Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, when these data were collected (Chobanian A V, Bakris G,Black H, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. JAMA 2003;289:2560-2572). Among the participants, approximately 95% had two or three blood pressure measurements during a single physical examination at the mobile examination center. For the remainder with only one blood pressure measurement, that single measurement was used in place of an average. During 2011–2016, of the 16,457 nonpregnant adults aged ≥18 years examined in NHANES with complete blood pressure and medication data, 5,765 were defined as hypertensive and included in the blood pressure analyses.

[§§§] Combustible tobacco use includes the use of cigarettes, cigars, or pipes. The percentage of adults aged ≥18 years who reported smoking cigarettes on at least 1 day during the preceding 30 days and ≥100 cigarettes in their lifetime, or who reported smoking cigars or a pipe on at least 1 day during the preceding 30 days. During 2011–2016, of the 242,283 persons aged ≥18 years included in the NSDUH population, 241,799 were included in the current combustible tobacco use analyses.

to estimate the prevalence of physical inactivity[¶¶¶] among adults aged ≥18 years.

Up to three survey cycles (2011–2012, 2013–2014, and 2015–2016) were examined using sex-, age-, and race/ethnicity-adjusted regression analyses. Sex-, age-, and race/ethnicity-adjusted t-tests were used to examine prevalence changes comparing 2011–2012 with the most recent data cycle and differences between sex, age, and racial/ethnic groups within the most recent data cycle. Results were considered significant for p-values <0.05.

Results

Clinical Strategies. During 2013–2014, the prevalences of recommended aspirin use for primary and secondary CVD prevention were 27.4% and 74.9%, respectively, with a significant decrease from 2011–2012 for primary prevention (43.4%) but not for secondary prevention (Table 1) (Figure 1). Combined, the prevalence of aspirin use "when appropriate" was 60.8%, which represents a significant decline from 69.2%, during 2011–2012 (Figure 1) and equates to an estimated 9.0 million persons not taking aspirin as recommended. The prevalence of aspirin use for secondary prevention was higher among adults aged ≥65 years (81.4%) than among those aged 40–64 years (63.2%), and among non-Hispanic whites (whites) (77.9%) compared with Hispanics (51.5%). The overall prevalence of recommended aspirin use when appropriate was higher among adults aged ≥65 years than among those aged 40–64 years.

During 2015–2016, the prevalence of blood pressure (BP) control was 48.5%, with no significant changes occurring during 2011–2012 (Figure 1). This equates to an estimated 40.2 million persons with uncontrolled hypertension (Supplementary Figure, https://stacks.cdc.gov/view/cdc/58116). The prevalence of BP control was higher among adults aged 45–64 years (53.8%) than among those aged 18–44 years (40.0%) and ≥65 years (45.9%), and among whites (50.9%) than among non-Hispanic blacks (blacks) (44.3%).

The prevalence of cholesterol management through statin use among eligible adults during 2013–2014 was 54.5%, with no significant change occurring during 2011–2012 (Figure 1). Prevalence was higher among persons aged ≥65 years (63.5%) than among those aged 45–64 years (50.3%), and among whites (58.3%) than among Hispanics (33.7%). An estimated 39.1 million adults are not managing their CVD risk through recommended statin use.

Though the prevalence of BP control was higher among adults aged 35–64 years (a Million Hearts priority population) (52.9%) than among those aged ≥65 years (45.9%), still approximately half do not have their condition under control. The prevalence of statin use when indicated among persons aged 35–64 years (48.1%) was lower than that among those aged ≥65 years (63.5%) (Supplementary Table, https://stacks.cdc.gov/view/cdc/58119).

Community Risk Factors. Despite a significant decline in use of combustible tobacco products, from 25.1% of adults in 2011–2012, to 22.3% during 2015–2016, an estimated 54.1 million adult users of combustible tobacco products could benefit from cessation interventions (Figure 2). During 2015–2016, the prevalence of combustible tobacco use was higher among men (26.7%) than among women (18.1%), decreased with increasing age after age 25–44 years, and varied by race/ethnicity. Prevalence was higher among whites (24.0%) than among Hispanics (16.0%) and non-Hispanic Asians (10.3%); however, persons of "other race/ethnicity," which includes American Indians and Alaska Natives, reported the highest prevalence (30.8%) of combustible tobacco use (Table 2).

During 2015–2016, the mean daily sodium intake among adults was 3,535 mg/day, with no significant change occurring from 2011–2012 (Figure 2). Sodium intake was higher among men (4,095 mg/day) than among women (3,013 mg/day) and decreased with increasing age, from 3,809 mg/day for persons aged 18–44 years to 3,524 mg/day for those aged 45–64 years, and 2,947 mg/day among adults aged ≥65 years.

During 2015–2016, the prevalence of physical inactivity was 29.1%, a small but statistically significant decrease from 30.9% during 2011–2012 (Figure 2). This represents an estimated 70.7 million adults who currently partake in no leisure time physical activity. The prevalence of physical inactivity was higher among women (30.7%) than among men (27.3%), increased with increasing age, and was higher among blacks (36.9%) and Hispanics (36.1%) than among whites (26.4%).

Among the Million Hearts priority population of adults aged 35–64 years, the prevalence of combustible tobacco product use and average daily sodium intake were higher than those among adults aged ≥65 years, while the prevalence of physical inactivity was lower (Supplementary Table, https://stacks.cdc.gov/view/cdc/58119).

Conclusion and Comment

To reach the Million Hearts 2022 goal of preventing one million acute cardiovascular events over 5 years, substantial progress is needed in reducing CVD-related risk factors. To achieve needed progress, Million Hearts 2022 has set clinical

[¶¶¶] The *2008 Physical Activity Guidelines for Americans* (https://www.health.gov/PAGuidelines/) recommend that all adults should avoid inactivity and that some physical activity is better that none. NHIS questions ask about frequency of participation in light to moderate-intensity and vigorous-intensity leisure-time physical activities for at least 10 minutes. Questions are phrased in terms of current behavior and lack a specific reference period. Physical inactivity is defined as reporting no light to moderate or vigorous leisure-time physical activity for at least 10 minutes. During 2011–2016, of the 205,493 adults aged ≥18 years included in the NHIS population, 202,941 were included in the physical inactivity analyses.

TABLE 1. Current prevalence of Million Hearts 2022 clinical strategies to prevent cardiovascular disease among adults — United States, 2013–2014 and 2015–2016

Clinical strategy/Demographic group	% (SE)	(95% CI)	No. (millions)*	t-test p-value†
Aspirin use§ when appropriate for primary or secondary prevention¶ among adults aged ≥40 years — NHANES, 2013–2014				
Total	**60.8 (2.1)**	**(56.5–64.9)**	**14.0**	—
Sex				
Male	58.0 (2.8)	(52.2–63.5)	8.5	reference
Female	65.6 (3.3)	(58.6–72.0)	5.4	0.566
Age group (yrs)				
40–64	43.7 (3.3)	(37.1–50.4)	5.4	reference
65–74	78.9 (4.3)	(68.9–86.3)	4.6	<0.001
≥65	81.4 (2.7)	(75.3–86.2)	8.8	<0.001
≥75	84.8 (3.1)	(77.4–90.1)	4.3	<0.001
Race/Ethnicity				
White, non-Hispanic	65.9 (2.1)	(61.5–70.1)	10.7	reference
Black, non-Hispanic	51.0 (5.3)	(40.5–61.5)	1.8	0.621
Asian, non-Hispanic	42.2 (8.8)	(26.0–60.2)	0.4	0.016
Hispanic	45.4 (3.6)	(38.3–52.6)	0.9	0.061
Other	56.2 (15.7)	(26.1–82.3)	0.2	0.348
Aspirin use§ when appropriate for primary prevention¶ among adults aged 50–59 years — NHANES, 2013–2014				
Total	**27.4 (4.1)**	**(20.0–36.3)**	**1.9**	—
Sex				
Male	27.6 (4.4)	(19.7–37.1)	1.6	reference
Female	26.6 (6.0)	(16.3–40.2)	0.3	0.688
Race/Ethnicity				
White, non-Hispanic	27.9 (4.1)	(20.3–36.9)	1.1	reference
Black, non-Hispanic	28.8 (6.8)	(17.2–44.0)	0.6	0.809
Asian, non-Hispanic	—**	—**	—**	—**
Hispanic	32.4 (9.7)	(16.4–54.0)	0.2	0.617
Other	—**	—**	—**	—**
Aspirin use§ when appropriate for secondary prevention¶ among adults aged ≥40 years — NHANES, 2013–2014				
Total	**74.9 (1.8)**	**(71.1–78.4)**	**12.1**	—
Sex				
Male	78.0 (2.5)	(72.6–82.5)	6.9	reference
Female	71.2 (3.6)	(63.6–77.8)	5.2	0.277
Age group (yrs)				
40–64	63.2 (4.5)	(53.9–71.5)	3.5	reference
65–74	78.9 (4.3)	(69.1–86.2)	4.6	0.108
≥65	81.4 (2.7)	(75.4–86.1)	8.8	0.018
≥75	84.8 (3.1)	(77.5–90.0)	4.3	0.004
Race/Ethnicity				
White, non-Hispanic	77.9 (1.7)	(74.2–81.1)	9.6	reference
Black, non-Hispanic	80.9 (4.6)	(70.3–88.4)	1.2	0.266
Asian, non-Hispanic	64.3 (8.4)	(46.5–78.8)	0.4	0.116
Hispanic	51.5 (4.4)	(42.8–60.2)	0.7	<0.001
Other	*57.4 (17.4)*††	*(24.9–84.6)*††	0.2	0.242
Blood pressure control§§ among adults aged ≥18 years with hypertension¶¶ — NHANES, 2015–2016				
Total	**48.5 (2.1)**	**(44.4–52.6)**	**37.9**	—
Sex				
Male	45.2 (2.7)	(40.0–50.6)	16.9	reference
Female	51.6 (2.7)	(46.4–56.8)	21.1	0.036
Age group (yrs)				
18–24	—**	—**	—**	—**
25–44	41.6 (3.1)	(35.6–47.8)	4.4	0.012
18–44	40.0 (3.1)	(34.1–46.1)	4.6	0.004
45–64	53.8 (2.8)	(48.1–59.3)	18.1	reference
65–74	51.5 (3.6)	(44.5–58.4)	8.7	0.307
≥65	45.9 (3.1)	(39.8–52.1)	14.0	0.009
≥75	38.4 (3.3)	(32.1–45.0)	5.2	<0.001

See table footnotes on next page.

TABLE 1. (*Continued*) Current prevalence of Million Hearts 2022 clinical strategies to prevent cardiovascular disease among adults — United States, 2013–2014 and 2015–2016

Clinical strategy/Demographic group	% (SE)	(95% CI)	No. (millions)*	t-test p-value†
Race/Ethnicity				
White, non-Hispanic	50.9 (2.8)	(45.4–56.4)	26.7	reference
Black, non-Hispanic	44.3 (1.6)	(41.2–47.5)	5.1	<0.001
Asian, non-Hispanic	38.2 (4.1)	(30.4–46.6)	1.3	0.012
Hispanic	44.2 (3.0)	(38.3–50.3)	3.9	0.126
Other	46.5 (6.7)	(33.8–59.6)	1.0	0.493
Cholesterol management: statin use* among eligible adults††† aged ≥21 years — NHANES, 2013–2014**				
Total	**54.5 (1.8)**	**(50.9–58.1)**	**46.9**	—
Sex				
Male	51.5 (2.1)	(47.3–55.7)	23.8	reference
Female	58.1 (2.5)	(53.0–63.0)	23.1	0.089
Age group (yrs)§§				
21–24	—**	—**	—**	—**
25–44	37.7 (5.7)	(27.0–49.8)	2.6	0.083
21–44	35.7 (5.4)	(25.6–47.2)	2.7	0.028
45–64	50.3 (2.5)	(45.4–55.3)	21.8	reference
65–74	52.7 (3.0)	(46.5–58.8)	11.8	0.787
≥65	63.5 (2.2)	(59.0–67.8)	22.3	<0.001
≥75	86.2 (3.2)	(78.2–91.6)	10.7	<0.001
Race/Ethnicity				
White, non-Hispanic	58.3 (2.1)	(54.0–62.6)	35.8	reference
Black, non-Hispanic	44.3 (4.0)	(36.3–52.5)	4.6	0.013
Asian, non-Hispanic	49.2 (4.0)	(41.2–57.2)	2.0	0.092
Hispanic	33.7 (3.2)	(27.6–40.4)	2.8	<0.001
Other	—**	—**	—**	—**

Source: NHANES, National Center for Health Statistics, CDC.

Abbreviations: CI = confidence interval; NHANES = National Health and Nutrition Examination Survey; SE = standard error.

* Population counts are calculated using the American Community Survey 2013 or 2015 annual Public Use Microdata Sample files, the latest available file after data collection in the 2013–2014 and 2015–2016 survey cycles, respectively. https://wwwn.cdc.gov/nchs/nhanes/ResponseRates.aspx.

† P-values adjusted for sex, age group, and race/ethnicity using logistic regression.

§ Aspirin use was defined by any of the following: an answer of "yes" to the question "Doctors and other health care providers sometimes recommend that you take a low-dose aspirin each day to prevent heart attacks, strokes, or cancer. Have you ever been told to do this?" and an answer of "yes" or "sometimes" to the question "Are you/ now following this advice?"; an answer of "yes" to the question "On your own, are you now taking a low-dose aspirin each day to prevent heart attacks, strokes, or cancer?" Aspirin identified in the Rx medication data files. Participants who reported taking an anticoagulant (as identified in the prescription medication files) but not taking aspirin were excluded.

¶ Primary prevention: includes examined adults aged 50–59 years for whom aspirin is recommended by the U.S. Preventive Services Task Force, without a history of cardiovascular (CVD) and with a 10-year atherosclerotic CVD (ASCVD) risk ≥10%. (Bibbins-Domingo K. Aspirin Use for the Primary Prevention of Cardiovascular Disease and Colorectal Cancer: U.S. Preventive Services Task Force Recommendation Statement. Ann Intern Med 2016;164:836–45; U.S. Preventive Services Task Force (USPSTF) Recommendation Summary: https://www.uspreventiveservicestaskforce.org/Page/Document/UpdateSummaryFinal/aspirin-to-prevent-cardiovascular-disease-and-cancer: ASCVD risk score is calculated based on the equations published in Goff DC Jr, Lloyd-Jones DM, et al. 2013 ACC/AHA guideline on the assessment of cardiovascular risk: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation. 2014;129:S49–73.) Secondary prevention: includes examined adults aged ≥40 years with a history of cardiovascular disease. A history of CVD is defined as an answer of "yes" to any of the following questions: "Has a doctor or other health professional ever told you that you had angina, also called angina pectoris?", "Has a doctor or other health professional ever told you that you had coronary heart disease?", "Has a doctor or other health professional ever told you that you had a heart attack (also called myocardial infarction)?", "Has a doctor or other health professional ever told you that you had a stroke?"

** Statistically unreliable estimates (relative standard error >40%) are suppressed.

†† Estimates are statistically unstable by National Center for Health Statistics standards (relative standard error >30%).

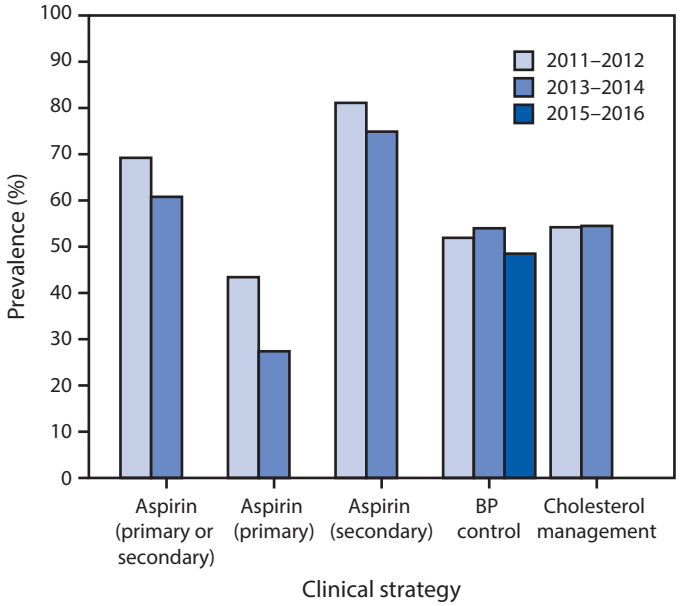
§§ Blood pressure (BP) control defined as an average systolic BP <140 mm Hg and an average diastolic BP <90 mm Hg. Calculated among adults with hypertension. Includes non-pregnant examined adults aged ≥18 years with ≥1 complete blood pressure measurement and information to determine BP-lowering medication use.

¶¶ Hypertension is defined as an average systolic BP ≥140 mm Hg, or an average diastolic BP ≥90 mm Hg, or self-reported current use of BP-lowering medication. Current use of BP-lowering medication is defined as an answer of "yes" to the questions: "Because of your high blood pressure/hypertension, have you ever been told to take prescribed medicine?" and "Are you currently taking medication to lower your blood pressure?"

*** Statin use is defined using the prescription medication files.

††† Includes non-pregnant fasting adults (≥21 years) for whom a statin is recommended, based on their risk for ASCVD, as defined in: Stone NJ, Robinson J, Lichtenstein AH, et al. 2013 ACC/AHA guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation 2014;129:S1–45.

FIGURE 1. Prevalence of Million Hearts 2022 clinical strategies*,†,§ to prevent cardiovascular disease among adults¶, — United States, 2011–2012, 2013–2014, and 2015–2016**



Source: National Health and Nutrition Examination Survey, National Center for Health Statistics, CDC.
Abbreviation: BP = blood pressure.

* Aspirin use was defined by an answer of "yes" to the question "Doctors and other health care providers sometimes recommend that you take a low-dose aspirin each day to prevent heart attacks, strokes, or cancer. Have you ever been told to do this?" and an answer of "yes" or "sometimes" to the question "Are you/ now following this advice?"; an answer of "yes" to the question "On your own, are you now taking a low-dose aspirin each day to prevent heart attacks, strokes, or cancer?"; or aspirin identified in the prescription medication data files. Participants who reported taking an anticoagulant in the prescription medication files but not taking aspirin were excluded. Aspirin use for primary prevention includes examined adults aged 50–59 years without a history of cardiovascular disease (CVD) and with an American College of Cardiology/American Heart Association 10-year atherosclerotic CVD risk score ≥10%. Aspirin use of secondary prevention includes examined adults aged ≥40 years with a history of CVD.

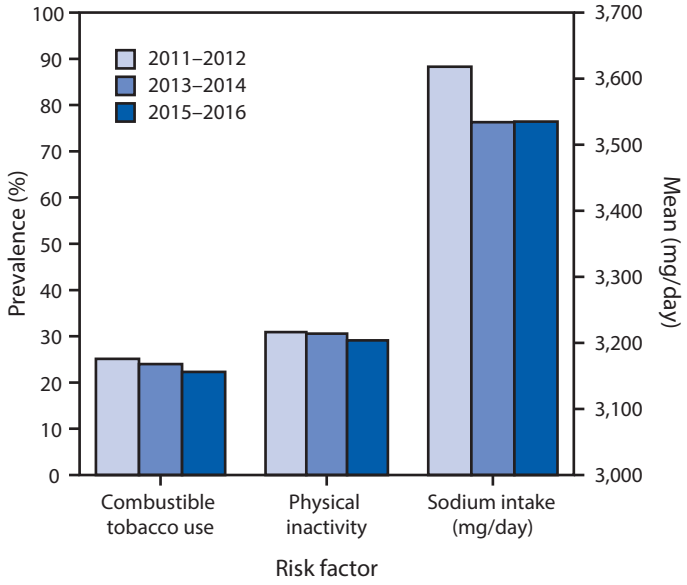
† BP control was defined as an average systolic BP <140 mm Hg and an average diastolic BP <90 mm Hg among adults aged ≥18 years with hypertension. Hypertension is defined as an average systolic BP ≥140 mm Hg, or an average diastolic BP ≥90 mm Hg, or self-reported current use of BP-lowering medication.

§ Cholesterol management is defined as current statin use, based on the prescription medication data files, among fasting adults aged ≥21 years for whom statin therapy is recommended.

¶ For aspirin (primary or secondary), t-test p-value <0.01 comparing 2013–2014 with 2011–2012, adjusted for sex, age group, and race/ethnicity.

** For aspirin (primary), t-test p-value <0.05 comparing 2013–2014 with 2011–2012, adjusted for sex and race/ethnicity.

FIGURE 2. Prevalence of Million Hearts 2022 community risk factors*,†,§ for cardiovascular disease among adults¶ — United States, 2011–2012, 2013–2014, and 2015–2016



Source: National Survey on Drug Use and Health; Substance Abuse and Mental Health Services Administration; National Health and Nutrition Examination Survey; National Center for Health Statistics; CDC; National Health Interview Survey (NHIS).

* Combustible tobacco use was defined as current use of combustible tobacco products (cigarettes, cigars, or pipe) among adults (aged ≥18 years) with complete data to determine tobacco use.

† The *2008 Physical Activity Guidelines for Americans* (http://www.health.gov/PAGuidelines/) recommend that all adults should avoid inactivity and that some physical activity is better that none. NHIS questions ask about frequency of participation in light to moderate-intensity and vigorous-intensity leisure-time physical activities for at least 10 minutes. Questions are phrased in terms of current behavior and lack a specific reference period. Physical inactivity is defined as reporting no light to moderate or vigorous leisure-time physical activity for at least 10 minutes.

§ Sodium intake (mg/day) was estimated among adults aged ≥18 years with a complete and reliable first day 24-hour dietary recall (collected in-person at the mobile examination center).

¶ For combustible tobacco use and physical inactivity, t-test p-values <0.01 comparing 2015–2016 with 2011–2012, adjusted for sex, age group, and race/ethnicity.

targets of 80% performance on the "ABCS" of CVD prevention: aspirin when appropriate, blood pressure control, cholesterol management, and smoking cessation. At the community level, a 20% reduction in the prevalence of combustible tobacco product use and of physical inactivity and a 20% reduction in mean daily sodium intake are targeted. These indicators, along with cardiac rehabilitation participation, are the focus of Million Hearts 2022; progress in reaching indicator targets has been shown to have a substantial effect on preventing acute cardiovascular events (*11,12*).

The data in this report serve as a baseline for Million Hearts 2022. These findings suggest that in addition to universal strategies aimed at the entire population with and at risk for CVD, there is a need to focus action on high-burden, high-risk subsets of the population. For example, opportunities for risk factor prevention and management among younger adults are of particular importance given the increase in heart disease mortality observed from 2010 to 2015 among adults aged 35–64 years in approximately half of U.S. counties (*3*). Compared with adults aged ≥65 years, younger adults were less likely to be using aspirin or taking a statin when indicated and were more likely to use combustible tobacco and have an elevated daily sodium intake. Furthermore, only approximately half of adults aged 35–64 years

with hypertension have their BP under control. If the population deficits for each risk factor in this analysis (e.g., 9.0 million persons who are not taking aspirin as recommend) are summed, they represent approximately 213 million opportunities for better risk factor prevention and management, many of which might be present in the same person. More than half of these opportunities are among adults aged 35–64 years.

Additional demographic disparities in risk factor prevalence present opportunities to develop and implement culturally and linguistically tailored and effective interventions. For example, compared with whites, Hispanics were less likely to use aspirin for secondary prevention or take a statin when indicated, blacks were less likely to have their blood pressure under control, and persons of "other" racial/ethnic groups, including American Indians and Alaska Natives, were more likely to use combustible tobacco products. Other studies confirm the existence of these disparities (*13*–*15*).

Included in the Million Hearts 2022-recommended clinical strategies are self-measured blood pressure monitoring with clinical support,**** standardized treatment protocols,†††† reduced out-of-pocket costs§§§§ and adherence approaches¶¶¶¶ for medications, clinician-driven tobacco assessment and treatment,***** increasing awareness of the effect of particle pollution (including tobacco smoke, automobile or diesel exhaust, and wood smoke)††††† on persons with known heart disease, and using clinical data to identify persons with undiagnosed conditions.§§§§§ Community-based strategies include comprehensive smoke-free policies,¶¶¶¶¶ evidence-based tobacco cessation campaigns,****** sodium reduction strategies,††††† built environment approaches§§§§§§ to increase physical activity, increased access to places for physical activity,¶¶¶¶¶¶ and peer support programs.******* Public and private partners, such as the Agency for Healthcare Research and Quality's EvidenceNOW initiative,††††††† state and local departments of health, the National Association of Community Health Centers, and Target:BP§§§§§§§ from the American Heart Association and the American Medical Association, are actively implementing these strategies.

Summary

What is already known about this topic?

The decline in cardiovascular disease (CVD) mortality rate has begun to plateau in the general population and has increased among some subpopulations; the prevalence of CVD risk factors remains high. Million Hearts 2022 was launched to focus the nation on high-impact, evidence-based strategies to prevent one million acute cardiovascular events over five years.

What is added by this report?

During 2015–2016, adult sodium intake averaged 3,535 mg/day and the prevalences of blood pressure control, combustible tobacco use, and physical inactivity were 48.5%, 22.3% and 29.1%, respectively. Compared with 2011–2012, significant improvements were observed in combustible tobacco use and physical inactivity, but the prevalence of aspirin use to prevent CVD declined.

What are the implications for public health practice?

A concerted effort to implement evidence-based strategies is needed to achieve the Million Hearts 2022 goal.

The findings in this report are subject to at least five limitations. First, some data used in this analysis are self-reported and subject to recall and social desirability biases. Second, when the data assessing aspirin use for primary CVD prevention were collected, multiple clinical guidelines existed; definitions from the current U.S. Preventive Services Task Force recommendation, published in 2016, were retrospectively applied for this analysis. Third, the American College of Cardiology and American Heart Association's (ACC/AHA) cholesterol management guideline, released in November 2013 with a focus on high-intensity statin use (treatment that lowers low-density lipoprotein cholesterol by approximately ≥50%) among eligible persons at high risk for cardiovascular events, was retrospectively applied to the 2011–2012 data. NHANES data allow for reporting only on general statin use and not statin intensity, which might result in overestimating the prevalence of the statin-eligible population meeting recommendations. Fourth, Million Hearts focuses on the "ABCS," which include smoking cessation through assessment and treatment in a clinical setting. However, population-level data for this indicator do not exist so only combustible tobacco use prevalence can be monitored, but not clinical actions that support cessation. Finally, as with many national data collection efforts, there is a 2–3 year data lag for some indicators. As a result, incongruous data cycles are reported in this analysis.

**** https://millionhearts.hhs.gov/tools-protocols/smbp.html.
†††† https://millionhearts.hhs.gov/tools-protocols/protocols.html.
§§§§ https://www.thecommunityguide.org/findings/cardiovascular-disease-reducing-out-pocket-costs-cardiovascular-disease-preventive-services; https://www.thecommunityguide.org/findings/tobacco-use-and-secondhand-smoke-exposure-reducing-out-pocket-costs-evidence-based-cessation.
¶¶¶¶ https://millionhearts.hhs.gov/tools-protocols/medication-adherence.html.
***** https://millionhearts.hhs.gov/files/Tobacco-Cessation-Action-Guide.pdf.
††††† https://millionhearts.hhs.gov/tools-protocols/tools/particle-pollution.html.
§§§§§ https://millionhearts.hhs.gov/tools-protocols/hiding-plain-sight/index.html.
¶¶¶¶¶ https://www.thecommunityguide.org/findings/tobacco-use-and-secondhand-smoke-exposure-smoke-free-policies.
****** https://www.thecommunityguide.org/findings/tobacco-use-and-secondhand-smoke-exposure-mass-reach-health-communication-interventions; https://www.cdc.gov/tobacco/campaign/tips/index.html
†††††† https://www.cdc.gov/vitalsigns/sodium.
§§§§§§ https://www.thecommunityguide.org/findings/physical-activity-built-environment-approaches.
¶¶¶¶¶¶ https://www.thecommunityguide.org/findings/physical-activity-creating-or-improving-places-physical-activity.
******* https://www.thecommunityguide.org/findings/physical-activity-social-support-interventions-community-settings.
††††††† https://www.ahrq.gov/evidencenow/index.html.
§§§§§§§ https://targetbp.org/.

TABLE 2. Current prevalence of Million Hearts 2022 community risk factors for cardiovascular disease among adults — United States, 2015–2016

Risk factor/Demographic group	% (SE)	(95% CI)	No. (millions)*	t-test p-value†
Combustible tobacco use among adults aged ≥18 years§ — NSDUH, 2015–2016				
Total	**22.3 (0.2)**	**(21.9–22.7)**	**54.1**	—
Sex				
Male	26.7 (0.3)	(26.1–27.3)	31.3	reference
Female	18.1 (0.2)	(17.6–18.6)	22.8	<0.001
Age group¶ (yrs)				
18–24	24.4 (0.4)	(23.7–25.1)	7.5	<0.001
25–44	27.4 (0.3)	(26.8–28.0)	22.7	<0.001
18–44	26.6 (0.2)	(26.1–27.1)	30.2	<0.001
45–64	23.0 (0.4)	(22.2–23.7)	19.1	reference
65–74	13.5 (0.6)	(12.4–14.6)	3.7	<0.001
≥65	10.4 (0.4)	(9.5–11.3)	4.8	<0.001
≥75	5.3 (0.5)	(4.4–6.2)	1.0	<0.001
Race/Ethnicity				
White, non-Hispanic	24.0 (0.3)	(23.4–24.6)	37.7	reference
Black, non-Hispanic	24.7 (0.6)	(23.6–25.8)	7.0	0.349
Asian, non-Hispanic	10.3 (0.8)	(8.9–11.9)	1.4	<0.001
Hispanic	16.0 (0.4)	(15.2–16.7)	6.0	<0.001
Other	30.8 (1.0)	(28.9–32.8)	1.9	<0.001

See table footnotes on next page.

Heart disease and stroke are leading causes of death in the United States; their risk factors are prevalent in the general population and are particularly high among certain subgroups. Evidence-based strategies for preventing acute cardiovascular events exist, with 213 million opportunities for better risk factor prevention and management. It will require a concerted national implementation effort to prevent one million acute cardiovascular events by 2022.

Acknowledgments

Chandler McClellan, Substance Abuse and Mental Health Services Administration; Janet S. Wright, CDC.

Corresponding author: Hilary K. Wall, hwall@cdc.gov, 770-488-8172.

[1]Division for Heart Disease and Stroke Prevention, CDC; [2]Division of Nutrition, Physical Activity, and Obesity, CDC; [3]Office on Smoking and Health, CDC.

All authors have completed and submitted the ICMJE form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

References

1. Mensah GA, Wei GS, Sorlie PD, et al. Decline in cardiovascular mortality: possible causes and implications. Circ Res 2017;120:366–80. https://doi.org/10.1161/CIRCRESAHA.116.309115
2. Yang Q, Tong X, Schieb L, et al. Vital Signs: Recent trends in stroke death rates—United States, 2000–2015. MMWR Morb Mortal Wkly Rep 2017;66:933–9. https://doi.org/10.15585/mmwr.mm6635e1
3. Vaughan AS, Ritchey MD, Hannan J, Kramer MR, Casper M. Widespread recent increases in county-level heart disease mortality across age groups. Ann Epidemiol 2017;27:796–800. https://doi.org/10.1016/j.annepidem.2017.10.012
4. Benjamin EJ, Virani SS, Callaway CW, et al.; American Heart Association Council on Epidemiology and Prevention Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2018 update: a report from the American Heart Association. Circulation 2018;137:e67–492. https://doi.org/10.1161/CIR.0000000000000558
5. Frieden TR, Wright JS, Conway PH. Is rapid health improvement possible? Lessons from the Million Hearts Initiative. Circulation 2017;135:1677–80. https://doi.org/10.1161/CIRCULATIONAHA.117.027461
6. Ritchey MD, Loustalot F, Wall HK, et al. Million Hearts: description of the national surveillance and modeling methodology used to monitor the number of cardiovascular events prevented during 2012–2016. J Am Heart Assoc 2017;6:e006021. https://doi.org/10.1161/JAHA.117.006021
7. Wright JS. Million Hearts 2022: focusing action for impact. Presented at CDC Public Health Grand Rounds, Atlanta, GA; February 20, 2018. https://www.cdc.gov/grand-rounds/pp/2018/20180220-million-hearts-2022.html
8. CDC. National Health and Nutrition Examination Survey Data. Hyattsville, MD: US Department of Health and Human Services, CDC; 2018. https://www.cdc.gov/nchs/nhanes/index.htm
9. SAMHSA. National Survey on Drug Use and Health Data. Rockville, MD: US Department of Health and Human Services, SAMHSA; 2018. https://www.samhsa.gov/data/data-we-collect/nsduh-national-survey-drug-use-and-health
10. CDC. National Health Interview Survey Data. Hyattsville, MD: US Department of Health and Human Services, CDC; 2018. https://www.cdc.gov/nchs/nhis/index.htm
11. Danaei G, Ding EL, Mozaffarian D, et al. The preventable causes of death in the United States: comparative risk assessment of dietary, lifestyle, and metabolic risk factors. PLoS Med 2009;6:e1000058. https://doi.org/10.1371/journal.pmed.1000058
12. Farley TA, Dalal MA, Mostashari F, Frieden TR. Deaths preventable in the U.S. by improvements in use of clinical preventive services. Am J Prev Med 2010;38:600–9. https://doi.org/10.1016/j.amepre.2010.02.016
13. Whelton PK, Einhorn PT, Muntner P, et al.; National Heart, Lung, and Blood Institute Working Group on Research Needs to Improve Hypertension Treatment and Control in African Americans. Research needs to improve hypertension treatment and control in African Americans. Hypertension 2016;68:1066–72. https://doi.org/10.1161/HYPERTENSIONAHA.116.07905
14. Qato DM, Lee TA, Durazo-Arvizu R, et al. Statin and aspirin use among Hispanic and Latino adults at high cardiovascular risk: findings from the Hispanic Community Health Study/Study of Latinos. J Am Heart Assoc 2016;5:e002905. https://doi.org/10.1161/JAHA.115.002905
15. Odani S, Armour BS, Graffunder CM, Garrett BE, Agaku IT. Prevalence and disparities in tobacco product use among American Indians/Alaska Natives—United States, 2010–2015. MMWR Morb Mortal Wkly Rep 2017;66:1374–8. https://doi.org/10.15585/mmwr.mm6650a2

TABLE 2. (*Continued*) Current prevalence of Million Hearts 2022 community risk factors for cardiovascular disease among adults — United States, 2015–2016

Risk factor/Demographic group	% (SE)	(95% CI)	No. (millions)*	t-test p-value†
Physical inactivity among adults aged ≥18 years¶ — NHIS, 2015–2016				
Total	**29.1 (0.4)**	**(28.3–29.8)**	**70.7**	—
Sex				
Male	27.3 (0.4)	(26.4–28.2)	31.9	reference
Female	30.7 (0.5)	(29.9–31.6)	38.7	<0.001
Age group¶ (yrs)				
18–24	22.5 (0.9)	(20.9–24.3)	6.9	<0.001
25–44	23.6 (0.5)	(22.6–24.5)	19.5	<0.001
18–44	23.3 (0.5)	(22.4–24.2)	26.4	<0.001
45–64	30.1 (0.5)	(29.0–31.2)	25.0	reference
65–74	34.2 (0.7)	(32.9–35.6)	9.3	<0.001
≥65	41.2 (0.6)	(40.0–42.3)	19.1	<0.001
≥75	51.2 (0.8)	(49.5–52.8)	9.8	<0.001
Race/Ethnicity				
White, non-Hispanic	26.4 (0.4)	(25.6–27.3)	41.5	reference
Black, non-Hispanic	36.9 (0.8)	(35.3–38.6)	10.5	<0.001
Asian, non-Hispanic	24.6 (1.4)	(22.0–27.5)	3.3	0.916
Hispanic	36.1 (0.9)	(34.3–38.0)	13.6	<0.001
Other	24.5 (1.3)	(22.1–27.0)	1.5	0.828
Risk factor/Demographic group	**Mean (SE)**	**(95% CI)**	**No. (millions)***	**p-value†**
Average dietary sodium intake (mg/day) among adults aged ≥18 years — NHANES, 2015–2016**				
Total	**3,535 (41)**	**(3,452–3,618)**	**N/A**	—
Sex				
Male	4,095 (65)	(3,964–4,226)	N/A	reference
Female	3,013 (38)	(2,936–3,089)	N/A	<0.001
Age group¶ (yrs)				
18–24	3,733 (109)	(3,515–3,951)	N/A	0.1205
25–44	3,834 (75)	(3,683–3,985)	N/A	<0.001
18–44	3,809 (68)	(3,673–3,946)	N/A	<0.001
45–64	3,524 (50)	(3,424–3,625)	N/A	reference
65–74	3,092 (96)	(2,899–3,284)	N/A	<0.001
≥65	2,947 (66)	(2,815–3,078)	N/A	<0.001
≥75	2,733 (92)	(2,549–2,918)	N/A	<0.001
Race/Ethnicity				
White, non-Hispanic	3,515 (54)	(3,406–3,624)	N/A	reference
Black, non-Hispanic	3,364 (60)	(3,243–3,484)	N/A	0.0047
Asian, non-Hispanic	3,831 (114)	(3,601–4,062)	N/A	0.0632
Hispanic	3,582 (65)	(3,450–3,713)	N/A	0.3540
Other	3,726 (283)	(3,156–4,296)	N/A	0.6184

Sources: NSDUH; Substance Abuse and Mental Health Services Administration; NHANES; National Center for Health Statistics; CDC National Health Interview Survey (NHIS); NCHS; CDC.

Abbreviations: CI = confidence interval; N/A = not applicable; NHANES = National Health and Nutrition Examination Survey; NSDUH = National Survey on Drug Use and Health; SE = standard error.

* Population counts are calculated using the American Community Survey 2013 or 2015 annual Public Use Microdata Sample files, the latest available file after data collection in the 2013–2014 and 2015–2016 survey cycles, respectively. https://wwwn.cdc.gov/nchs/nhanes/ResponseRates.aspx.

† P-values adjusted for sex, age group, and race/ethnicity using logistic regression.

§ Includes current use of combustible tobacco products (cigarettes, cigars, or pipes) among adults (≥18 years). Current cigarette smoking defined as an answer of "yes" to the question "Have you smoked at least 100 cigarettes in your entire life?" and an answer of "Within the past 30 days" to the question "How long has it been since you last smoked part or all of a cigarette?" Current cigar smoking defined as an answer of "Within the past 30 days" to the question "How long has it been since you last smoked part or all of any type of cigar?" Current pipe smoking defined as an answer of "yes" to the question "During the past 30 days, have you smoked tobacco in a pipe, even once?"

¶ The *2008 Physical Activity Guidelines for Americans* (https://www.health.gov/PAGuidelines/) recommend that all adults should avoid inactivity and that some physical activity is better that none. NHIS questions ask about frequency of participation in light to moderate-intensity and vigorous-intensity leisure-time physical activities for at least 10 minutes. Questions are phrased in terms of current behavior and lack a specific reference period. Physical inactivity is defined as reporting no light to moderate or vigorous leisure-time physical activity for at least 10 minutes.

** Includes adults (aged ≥18 years) with a complete and reliable 1st day 24-hour dietary recall (collected in-person at the mobile examination center). Sodium values are not adjusted for salt added during food preparation or at the table.

Progress Toward Poliovirus Containment Implementation — Worldwide, 2017–2018

Jacqueline Fournier-Caruana, PhD[1]; Nicoletta Previsani, PhD[1]; Harpal Singh, MD, PhD[1]; Liliane Boualam, MPH[1]; Joseph Swan[1]; Anna Llewellyn, PhD[2]; Roland W. Sutter, MD[1,2]; Michel Zaffran, MEng[1]

Substantial progress has been made since the World Health Assembly (WHA) resolved to eradicate poliomyelitis in 1988 (*1*). Among the three wild poliovirus (WPV) types, type 2 (WPV2) was declared eradicated in 2015, and type 3 (WPV3) has not been reported since 2012 (*1*). In 2017 and 2018, only Afghanistan and Pakistan have reported WPV type 1 (WPV1) transmission (*1*). When global eradication of poliomyelitis is achieved, facilities retaining poliovirus materials need to minimize the risk for reintroduction of poliovirus into communities and reestablishment of transmission. Poliovirus containment includes biorisk management requirements for laboratories, vaccine production sites, and other facilities that retain polioviruses after eradication; the initial milestones are for containment of type 2 polioviruses (PV2s). At the 71st WHA in 2018, World Health Organization (WHO) Member States adopted a resolution urging acceleration of poliovirus containment activities globally, including establishment by the end of 2018 of national authorities for containment (NACs) to oversee poliovirus containment (*2*). This report summarizes containment progress since the previous report (*3*) and outlines remaining challenges. As of August 2018, 29 countries had designated 81 facilities to retain PV2 materials; 22 of these countries had established NACs. Although there has been substantial progress, intensification of containment measures is needed.

Background

The Global Polio Eradication Initiative continues to make progress toward polio eradication. Only 22 cases from a single serotype (WPV1) were reported in 2017 from Afghanistan and Pakistan, two of the three countries with endemic poliovirus transmission (*1*). Nigeria did not detect WPV cases in 2017 (*1*).

The last reported indigenous WPV2 case was detected in 1999 (*1*). After the global certification of WPV2 eradication in 2015, the type 2 vaccine component was synchronously withdrawn from use worldwide in May 2016 by switching from trivalent oral poliovirus vaccine (tOPV, containing vaccine virus types 1, 2, and 3) to bivalent OPV (bOPV, containing types 1 and 3). Although the global switch was implemented without major issues in most countries, the detection of vaccine-derived poliovirus type 2 (VDPV2) (poliovirus strains that have mutated from the vaccine virus and reverted to neurovirulence because of unusually prolonged circulation in populations with low immunity levels) has necessitated the distribution of 126 million doses of monovalent type 2 OPV (mOPV2) for outbreak control in 11 countries (Cameroon, Chad, Democratic Republic of the Congo, Ethiopia, Kenya, Mozambique, Niger, Nigeria, Pakistan, Somalia, and Syria) (*1*,*4*,*5*) (Figure). In 2018, outbreaks in the Democratic Republic of the Congo, the Horn of Africa (Ethiopia, Kenya, and Somalia), and northern Nigeria have required further use of the mOPV2 global stockpile.*

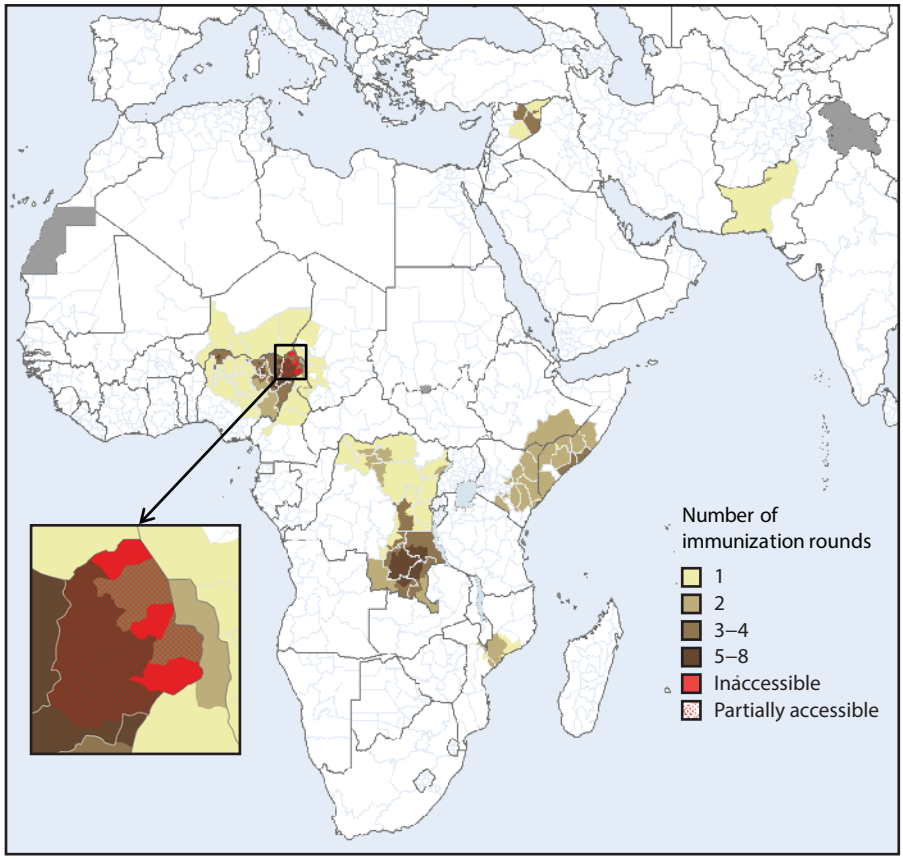
Since the global withdrawal of type 2-containing OPVs in 2016, PV2 (WPV2, VDPV2, and OPV2) must be retained under stringent containment conditions (*6*). Containment is intended to minimize the risk for release of polioviruses from facilities, which would permit occurrence of paralytic disease and reestablishment of transmission.

Guidance and Oversight

The WHO Global Action Plan to minimize poliovirus facility–associated risk after type-specific eradication of wild polioviruses and sequential cessation of oral poliovirus vaccine use (GAPIII) (*7*) defines the biorisk management standards to be followed by facilities retaining poliovirus materials. Implementation of these standards begins with the establishment of national inventories for facilities retaining PV2 materials. The Containment Certification Scheme to support the WHO Global Action Plan for Poliovirus Containment (GAPIII-CCS) (*8*) defines the recommended mechanisms for verifying compliance with global poliovirus containment requirements within poliovirus essential facilities (PEFs). The implementation of poliovirus containment is complicated by the potential for facilities to retain materials that might incidentally contain polioviruses (e.g., biological specimens such as fecal, respiratory, or sewage samples collected at a time and place where WPVs were circulating or where OPV2 was in use). To help facilities identify, eliminate, and minimize risks for handling and storing such samples, WHO in 2018 issued guidance to minimize risks for facilities that collect, handle, or store materials potentially containing infectious polioviruses (*9*). Facilities with a high probability of handling or storing such samples include those working with enteric disease agents

* http://polioeradication.org/polio-today/polio-now/this-week.

FIGURE. Areas where monovalent oral poliovirus vaccine type 2 (mOPV2) has been used for prevention and control of circulating vaccine-derived poliovirus type 2 transmission,* by number of immunization rounds planned or conducted — worldwide, 2016–2018†



* In Mozambique, mOPV2 was used in response to a type 2 ambiguous vaccine-derived poliovirus (a vaccine-derived poliovirus isolate from a person with or without acute flaccid paralysis and with no known immunodeficiency, or from environmental samples, without evidence for circulation).
† Data as of August 8, 2018, and subject to change.

(e.g., rotavirus, *Salmonella*, or hepatitis viruses), respiratory disease agents (e.g., influenza virus, *Mycobacterium tuberculosis*, or measles virus), or that are involved with nutrition research or environmental studies. All 194 WHO Member States are requested to implement the guidance and complete reports on PV2 material by April 2019.

Infrastructure and mechanisms for poliovirus containment governance were established to support national and global containment implementation and certification processes.† At the 71st WHA in May 2018, WHO Member States unanimously adopted Resolution WHA71.16 (*2*), which urged international commitment to expedite full implementation of GAPIII requirements worldwide. After adoption of the resolution, countries are expected to complete PV2 inventories, destroy unneeded PV2 materials, and begin inventories for WPV1 and WPV3 materials in accordance with WHO guidance. In addition, countries must reduce to a minimum the number of facilities designated to retain polioviruses, appoint a NAC by the end of 2018, and formally engage these designated PEFs in the containment certification process no later than the end of 2019.

The Global Commission for the Certification of Eradication of Poliomyelitis (GCC) is the oversight body for containment until the certification of global eradication of poliomyelitis. The GCC Containment Working Group reviews PEF containment certification applications submitted by NACs to ensure that GAPIII requirements are met, according to the GAPIII-CCS process. The Containment Advisory Group serves as the advisory body to the Director-General of WHO and issues regular reports on technical issues related to the implementation of GAPIII.§ The Strategic Advisory Group of Experts on immunization provides recommendations on polio immunization policies and coverage targets in accordance with the population immunity requirements (secondary safeguards) of GAPIII (*10*). The Containment Management Group manages and coordinates GPEI partner support of global containment activities, including the recent development of a framework for containment risk assessment and risk ranking for PEFs. In October 2018, the Expert Committee on Biological Standardization is expected to endorse the revised WHO Technical Report Series 926, which provides guidelines for the safe production and quality control of poliomyelitis vaccines in the containment era.¶ The revised Technical Report Series 926 and GAPIII will be closely aligned.

Progress

To prevent reintroduction of poliovirus and reestablishment of transmission, the number of facilities designated to retain PV2 materials will need to be reduced to the minimum necessary to perform critical national and international functions (e.g., vaccine production, diagnosis, and research). However, early counts of designated PEFs included well over 100 facilities worldwide. To address this issue, country visits have been made, and governments will continue to be urged to carefully consider the implications of designating facilities to retain

† http://polioeradication.org/who-we-are/governance-and-structure.

§ http://polioeradication.org/tools-and-library/policy-reports/advisory-reports/containment-advisory-group.
¶ http://www.who.int/biologicals/BS.2018.2350_Poliomyelitis_vaccine_Guidelines.pdf.

poliovirus materials and, where needed, to encourage the establishment of NACs. As of August 2018, a total of 81 PEFs had been designated by governments in 29 countries to retain PV2 materials, including 22 that had reported the establishment of their NACs (Table), compared with reports from 2017, when 86 facilities within 30 countries were planning to move forward with PEF designation and only 18 NACs had been established (*3*).

NACs are the authorities for auditing facilities and issuing containment certificates. This three-certificate process is overseen by the GCC through the Containment Working Group and includes a certificate of participation (i.e., official recognition as a PEF), interim certificate of containment (i.e., indication of not achieving all GAPIII requirements during the PV2 period while addressing the need for full compliance with GAPIII), and certificate of containment (i.e., full compliance with GAPIII requirements). To date, the GCC has endorsed one certificate of participation submitted according to the GAPIII-CCS process by the NAC of Sweden.** All remaining applications for certificate of participation must be submitted for the approval by the GCC Containment Working Group by the end of 2019.

To strengthen the auditing capacity of NACs and to create a pool of international GAPIII auditors, WHO continues to provide biorisk management and GAPIII auditor trainings throughout the six WHO regions. In addition, WHO and global partners are providing regional and national level training in the implementation of the guidance for retaining potentially infectious poliovirus materials.

** http://polioeradication.org/news-post/sweden-takes-important-first-step-to-demonstrate-containment-of-type-2-poliovirus.

Discussion

Substantial progress toward poliovirus containment has been made during 2017–2018, including reduction in the number of designated PEFs, establishment of the majority of NACs, and the initiation of the containment certification process. In addition, WHO and global partners have implemented containment trainings in all six WHO regions, global polio advisory groups have made recommendations to facilitate GAPIII implementation, and the 2018 WHA resolution has prioritized global poliovirus containment.

Poliovirus containment is a national responsibility, and it is expected that the number of designated PEFs will be further reduced as countries carefully determine whether the programs, funding, and other resources needed to achieve and maintain full compliance with GAPIII requirements are a national or international priority. The implementation of containment activities, such as completion of national PV2 inventories, establishment of NACs, and certification of PEFs, has required more time than had been anticipated. This extended timeline resulted from many factors, including delayed submission of PV2 inventories, training and retention of qualified GAPIII-CCS auditors, and extensive PEF preparations required to meet GAPIII standards. In addition, many countries do not have established legislation to provide NACs with legal authority to enforce GAPIII, or existing national biosafety regulations are not consistent with GAPIII requirements. The identification of potentially infectious poliovirus materials in nonpolio facilities is an enormous global undertaking that places a burden on facilities that were never intended to handle polioviruses. Continued global engagement, education, and technical body oversight; a robust communication strategy; and enhanced political will are required to resolve these issues.

TABLE. Number of designated poliovirus-essential facilities (PEFs) retaining poliovirus type 2 (PV2)* and National Authorities for Containment (NACs), by World Health Organization (WHO) regions — Worldwide, 2018 †

WHO region	No. of countries	No. of NACs	No. of PEFs	Type of PV2 materials retained			Type of facility		
				WPV2	Both WPV2/ VDPV2 and OPV2/ Sabin2	Only OPV2/ Sabin2	Salk-IPV§ production sites	Sabin-IPV§¶ production sites	Diagnostic or research laboratories
AFR	1	1	1	0	1	0	0	0	1
AMR	6	5	19	7	4	8	1	0	18
EMR	2	2	2	0	0	2	0	1	1
EUR	13	8	40	7	23	10	5	2	33
SEAR	2	2	3	1	0	2	0	1	2
WPR	5	4	16	0	4	12	0	11	5
Total	29	22	81	15	32	34	6	15	60

Abbreviations: AFR = African Region; AMR = Region of the Americas; EMR = Eastern Mediterranean Region; EUR = European Region; IPV = inactivated polio vaccine; OPV2 = type 2 oral poliovirus vaccine; SEAR = South-East Asia Region; VDPV2 = type 2 vaccine–derived poliovirus; WPR = Western Pacific Region; WPV2 = type 2 wild poliovirus.

* Includes WPV2/circulating VDPV2 and OPV2/Sabin2 (attenuated live type 2 poliovirus strains used in oral vaccines, including vaccine seed stocks and infectious vaccine production materials as well as viruses closely related to attenuated vaccine viruses recovered from fecal and respiratory specimens or sewage samples).

† Data as of August 28, 2018, and subject to change.

§ Salk-IPV is a vaccine made from wild poliovirus strains that are inactivated; Sabin-IPV is an inactivated vaccine made from attenuated live poliovirus strains.

¶ Includes potential future producers in different clinical and preclinical phases of Sabin-IPV development.

Summary

What is already known about this topic?

Wild poliovirus type 2 was certified eradicated in 2015. All type 2 polioviruses must now be destroyed or safely and securely contained to minimize the risk for reintroduction into communities and reestablishment of transmission.

What is added by this report?

Twenty-nine countries have designated 81 facilities for the retention of needed poliovirus type 2 materials to perform critical national or international functions under certified conditions, including vaccine production, diagnosis, and research.

What are the implications for public health practice?

If not securely contained, release of the virus could result in reestablishment of endemic or epidemic poliovirus transmission. Further measures will be needed to ensure effective containment by the time the world is certified polio-free.

Poliovirus containment is a global effort that is integral to polio eradication. In the coming year, all countries are expected to complete their inventories and destroy or transfer unneeded PV2 materials and initiate the inventory and destruction or transfer of unneeded WPV1 and WPV3 materials. Countries also need to carefully weigh the risks and benefits of designating facilities for the retention of poliovirus materials and the need to comply with the primary (facility), secondary (population immunity), and tertiary (sanitation and hygiene) safeguards. Importantly, countries hosting PEFs must establish NACs and begin the certification process following the GAPIII-CCS process. Further intensification of measures will be needed to ensure that effective containment will be in place by the time the world is certified polio-free.

Acknowledgments

Poliovirus Containment Focal Points, Regional Offices, World Health Organization; Jeffrey Partridge, Bill and Melinda Gates Foundation; Steven Wassilak, Global Immunizations Division, Center for Global Health, CDC; M. Steven Oberste, Division of Viral Diseases, National Center for Immunizations and Respiratory Diseases, CDC.

Corresponding author: Roland W. Sutter, sutterr@who.int, 41-79-475-5523.

[1]Polio Eradication, World Health Organization, Geneva, Switzerland; [2]Center for Global Health, CDC.

All authors have completed and submitted the ICMJE form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

References

1. Khan F, Datta SD, Quddus A, et al. Progress toward polio eradication—worldwide, January 2016–March 2018. MMWR Morb Mortal Wkly Rep 2018;67:524–8. https://doi.org/10.15585/mmwr.mm6718a4
2. World Health Organization. World Health Assembly Resolution WHA71.16. Poliomyelitis—containment of polioviruses. Geneva, Switzerland: World Health Organization; 2018. http://apps.who.int/gb/ebwha/pdf_files/WHA71/A71_R16-en.pdf
3. Previsani N, Singh H, St Pierre J, et al. Progress toward containment of poliovirus type 2—worldwide, 2017. MMWR Morb Mortal Wkly Rep 2017;66:649–52. https://doi.org/10.15585/mmwr.mm6624a5
4. Mbaeyi C, Wadood ZM, Moran T, et al. Strategic response to an outbreak of circulating vaccine-derived poliovirus type 2—Syria, 2017–2018. MMWR Morb Mortal Wkly Rep 2018;67:690–4. https://doi.org/10.15585/mmwr.mm6724a5
5. Eboh VA, Makam JK, Chitale RA, et al. Notes from the field: widespread transmission of circulating vaccine-derived poliovirus identified by environmental surveillance and immunization response—Horn of Africa, 2017–2018. MMWR Morb Mortal Wkly Rep 2018;67:787–9. https://doi.org/10.15585/mmwr.mm6728a6
6. World Health Organization. World Health Assembly Resolution WHA68.3. Poliomyelitis. Geneva, Switzerland: World Health Organization; 2015. http://apps.who.int/gb/ebwha/pdf_files/WHA68-REC1/A68_R1_REC1-en.pdf
7. World Health Organization. WHO global action plan to minimize poliovirus facility-associated risk after type-specific eradication of wild polioviruses and sequential cessation of oral polio vaccine use—GAPIII. Geneva, Switzerland: World Health Organization; 2015. http://apps.who.int/iris/handle/10665/208872
8. World Health Organization. Containment certification scheme to support the WHO global action plan for poliovirus containment (GAPIII-CCS). Geneva, Switzerland: World Health Organization; 2017. http://polioeradication.org/polio-today/preparing-for-a-polio-free-world/containment/containment-resources/
9. Global Polio Eradication Initiative. Guidance to minimize risks for facilities collecting, handling or storing materials potentially infectious for polioviruses. Geneva, Switzerland: World Health Organization; 2018. http://polioeradication.org/wp-content/uploads/2018/06/polio-containment-guidance-for-non-poliovirus-facilities-20180614-en.pdf
10. World Health Organization. Meeting of the Strategic Advisory Group of Experts on immunization, April 2018—conclusions and recommendations. Wkly Epidemiol Rec 2018;93:335–7. http://www.who.int/wer/2018/wer9323/en/

Notes from the Field

Acquisition of Delamanid Under a Compassionate Use Program for Extensively Drug-Resistant Tuberculosis — United States, 2017

Alfred A. Lardizabal, MD[1]; Anum N. Khan, MPH[2,3]; Sapna Bamrah Morris, MD[3]; Neela D. Goswami, MD[3]

On April 10, 2017, a middle-aged man from Eastern Europe was evaluated at a hospital with cough, chest pain, weakness, and weight loss. A sputum sample was smear-positive for acid-fast bacilli (AFB), and chest radiograph and chest computerized tomography scan showed bilateral pulmonary, cavitary disease with vertebral involvement. He was given standard first-line therapy (HRZE): isoniazid, rifampin, pyrazinamide, and ethambutol. Among three of the patient's family members evaluated as part of the contact investigation, his wife tested positive for tuberculosis (TB) infection via QuantiFERON-TB Gold In-Tube test and was treated for latent TB infection with 4 months of rifampin.*

Two weeks after initiating treatment, the patient developed a rash, and further TB medical consultation was sought. HRZE was discontinued, and he was started on levofloxacin and linezolid before being discharged from the hospital. Sputum was sent to CDC for Molecular Detection of Drug Resistance testing (https://www.cdc.gov/tb/topic/laboratory/default.htm), which identified mutations consistent with resistance to HRZE, fluoroquinolones, and the injectable aminoglycosides amikacin, kanamycin, and capreomycin. Drug susceptibility testing by 7H11 agar proportion at the National Jewish Health Mycobacteriology Laboratory (Denver, Colorado) confirmed resistance to HRZE, streptomycin, kanamycin, amikacin, capreomycin, ethionamide, and ciprofloxacin/ofloxacin, and reported susceptibility to cycloserine, para-aminosalicyclic acid (PAS), linezolid, clofazimine, and bedaquiline. Given the limited treatment options, the patient began a regimen of bedaquiline, clofazimine, linezolid, PAS, and cycloserine. In light of the extensively drug-resistant (XDR) disease and potential for limited drug tolerability, inclusion of delamanid, which is not yet approved by the Food and Drug Administration (FDA), was recommended by a CDC-funded TB Center of Excellence (TB COE) and the CDC's Division of TB Elimination.

Delamanid, a nitro-imidazole, is a new anti-TB drug developed to address some of the adverse reactions and related adherence difficulties associated with currently available medications for treating drug-resistant TB. Multiple delamanid trials have evaluated safety, tolerability, and early bactericidal activity (*1*,*2*). Delamanid use, in combination with World Health Organization (WHO)–recommended drugs for drug-resistant TB, has shown improvement in treatment outcomes (*3*–*5*) and effectiveness against XDR TB, for which treatment options are limited (*6*). A U.S. physician, in conjunction with a TB COE and CDC's Division of Tuberculosis Elimination, collaborated to acquire delamanid for this patient with XDR TB through a compassionate use program.

Per pharmaceutical manufacturer instructions, the proposed regimen and monitoring protocols were reviewed and approved by the European Respiratory Society/WHO Consilium, after which the treating physician was instructed to file an emergency investigational new drug application for single-patient expanded-access with FDA. Within 1 day of submission of the forms, FDA approved the emergency investigational new drug application for delamanid. The treating physician completed a company-sponsored 90-minute pharmacovigilance training webinar via teleconference. After requirements were fulfilled, medications were shipped. A 6-month supply of delamanid arrived within 5 days of application approval, and the patient was started on delamanid in late August. The patient's initial symptoms, which included fatigue, anorexia, and cough, improved within the first month of treatment. His sputum smear converted to negative on August 22 and culture converted to negative October 31. The patient is continuing on a 24-month treatment plan at this time with continued clinical improvement and no reported adverse effects.

The process from application filing to delamanid initiation took 4 weeks. The pharmaceutical company provided clear instructions, contact information for concerns faced by the physician during treatment, and assistance completing FDA single-patient expanded-access forms. Physicians and state or local TB providers considering use of delamanid for their TB patients can seek guidance from CDC's Division of Tuberculosis Elimination or their regional CDC-funded TB COE.† Prompt access to this new anti-TB drug increased therapeutic options for this patient with XDR disease.

* https://www.cdc.gov/tb/topic/treatment/ltbi.htm.

† CDC's Division of Tuberculosis Elimination can be reached at 404-639-8120. Local CDC-funded TB COEs can be found at https://www.cdc.gov/tb/education/tb_coe/default.htm.

Acknowledgments

Deborah Handler, Frank Romano.

Corresponding author: Neela D. Goswami, nef7@cdc.gov, 404-718-5614.

[1]Global Tuberculosis Institute at Rutgers University, Brunswick, New Jersey; [2]Rollins School of Public Health, Emory, Atlanta, Georgia; [3]Division of Tuberculosis Elimination, CDC.

All authors have completed and submitted the ICMJE form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

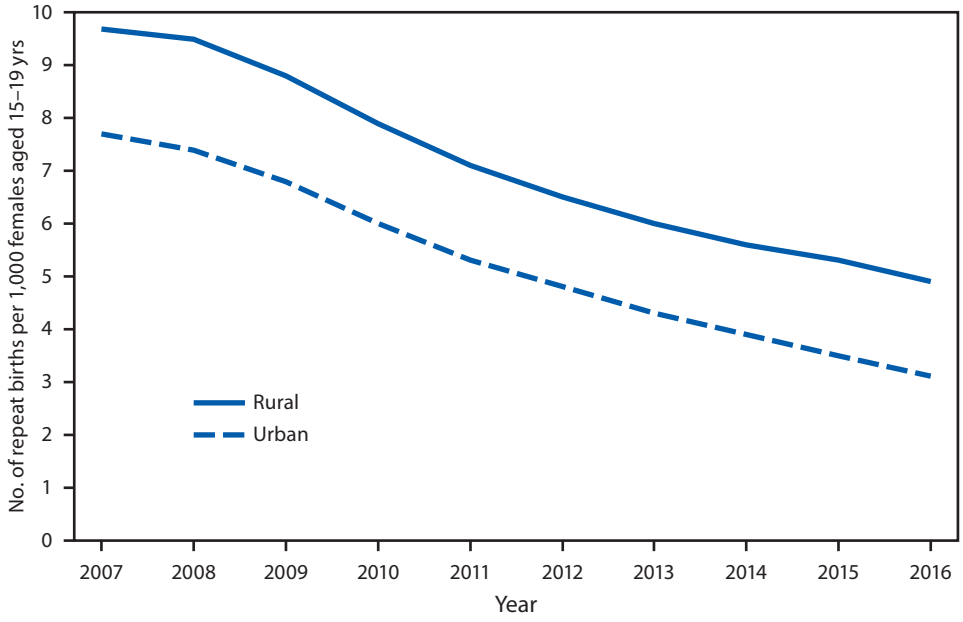
References

1. Gler MT, Skripconoka V, Sanchez-Garavito E, et al. Delamanid for multidrug-resistant pulmonary tuberculosis. N Engl J Med 2012;366:2151–60. https://doi.org/10.1056/NEJMoa1112433
2. Gupta R, Wells CD, Hittel N, Hafkin J, Geiter LJ. Delamanid in the treatment of multidrug-resistant tuberculosis. Int J Tuberc Lung Dis 2016;20:33–7. https://doi.org/10.5588/ijtld.16.0125
3. Hafkin J, Hittel N, Martin A, Gupta R. Early outcomes in MDR-TB and XDR-TB patients treated with delamanid under compassionate use. Eur Respir J 2017;50:1700311. https://doi.org/10.1183/13993003.00311-2017
4. Kuksa L, Barkane L, Hittel N, Gupta R. Final treatment outcomes of multidrug- and extensively drug-resistant tuberculosis patients in Latvia receiving delamanid-containing regimens. Eur Respir J 2017;50:1701105. https://doi.org/10.1183/13993003.01105-2017
5. Wells CD, Gupta R, Hittel N, Geiter LJ. Long-term mortality assessment of multidrug-resistant tuberculosis patients treated with delamanid. Eur Respir J 2015;45:1498–501. https://doi.org/10.1183/09031936.00176314
6. Gupta R, Geiter LJ, Wells CD, Gao M, Cirule A, Xiao H. Delamanid for extensively drug-resistant tuberculosis. N Engl J Med 2015;373:291–2. https://doi.org/10.1056/NEJMc1415332

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Repeat* Birth Rates for Teens,† by Urbanization Level of County§ — National Vital Statistics System, 2007–2016



* Repeat births are second and higher-order births. Birth order refers to the number of children born alive to the mother. Births recorded with no birth order stated are proportionately distributed across birth order categories.
† The number of repeat births to females aged 15–19 years per 1,000 females aged 15–19 years.
§ Urbanization level is based on maternal county of residence. Counties were classified according to their metropolitan status using the National Center for Health Statistics Urban–Rural Classification Scheme. https://www.cdc.gov/nchs/data_access/urban_rural.htm.

From 2007 to 2016, the rate for repeat births for females aged 15–19 years significantly declined in both rural and urban counties. Repeat birth rates declined 49% in rural counties (from 9.7 in 2007 to 4.9 in 2016) and 60% in urban counties (from 7.7 in 2007 to 3.1 in 2016). However, the rate in rural counties was significantly higher than the rate in urban counties for each year from 2007 through 2016.

Source: National Vital Statistics System, Natality, 2007–2016. https://www.cdc.gov/nchs/nvss/births.htm.

Reported by: Brady E. Hamilton, PhD, boh5@cdc.gov, 301-458-4653; Danielle M. Ely, PhD.

The *Morbidity and Mortality Weekly Report (MMWR)* Series is prepared by the Centers for Disease Control and Prevention (CDC) and is available free of charge in electronic format. To receive an electronic copy each week, visit *MMWR* at *https://www.cdc.gov/mmwr/index.html*.

Readers who have difficulty accessing this PDF file may access the HTML file at *https://www.cdc.gov/mmwr/index2018.html*. Address all inquiries about the *MMWR* Series, including material to be considered for publication, to Executive Editor, *MMWR* Series, Mailstop E-90, CDC, 1600 Clifton Rd., N.E., Atlanta, GA 30329-4027 or to mmwrq@cdc.gov.

ISSN: 0149-2195 (Print)