Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Weekly / Vol. 63 / No. 23
June 13, 2014

National Cancer Survivors Conference — June 18–20, 2014

Each year on National Cancer Survivors Day (held June 1 this year), CDC and its partners celebrate advances in cancer survivorship and reflect on the challenges facing approximately 13.4 million cancer survivors nationally. This year, CDC's Division of Cancer Prevention and Control Survivorship Workgroup celebrates its 10th anniversary of public health work in cancer survivorship through research, surveillance, programs, systems, and environmental changes. CDC also conducts economic research to understand cancer survivorship and its impact on medical costs, out-of-pocket costs, lost productivity, employment, health insurance, and access to care (*1–3*).

To promote cancer survivorship as a growing public health concern, CDC is cosponsoring the 7th Biennial Cancer Survivorship Research Conference, "Advancing Survivorship Care Through Multilevel Collaborations," June 18–20, 2014, in Atlanta, Georgia (http://www.cancer.org/subsites/survivorship2014).

CDC supports states and tribal organizations in setting goals for survivorship in their comprehensive cancer control plans. The National Cancer Survivorship Resource Center (http://www.cancer.org/survivorshipcenter) also provides cancer survivorship materials that promote healthy behaviors to reduce the effects of cancer and its treatment. Additional information is available at http://www.cdc.gov/cancer/survivorship.

References

1. Ekwueme DU, Yabroff KR, Guy GP, et al. Medical costs and productivity losses of cancer survivors—United States, 2008–2011. MMWR 2014;63:505–10.
2. Guy GP, Yabroff KR, Ekwueme DU, et al. Estimating the health and economic burden of cancer among those diagnosed as adolescents and young adults. Health Aff 2014;33:1024–31.
3. Dowling EC, Chawla N, Forsythe LP, et al. Lost productivity and burden of illness in cancer survivors with and without other chronic conditions. Cancer 2013;119:3393–401.

Medical Costs and Productivity Losses of Cancer Survivors — United States, 2008–2011

Donatus U. Ekwueme, PhD[1,2], K. Robin Yabroff, PhD[2,3], Gery P. Guy, Jr., PhD[1,2], Matthew P. Banegas, PhD[2,3], Janet S. de Moor, PhD[2,3], Chunyu Li, PhD, MD[1,2], Xuesong Han, PhD[2,4], Zhiyuan Zheng, PhD[2,4], Anita Soni, PhD[2,5], Amy Davidoff, PhD[2,5], Ruth Rechis, PhD[2,6], Katherine S. Virgo, PhD[2,7] (Author affiliations at end of text)

The number of persons in the United States with a history of cancer has increased from 3 million in 1971 to approximately 13.4 million in 2012, representing 4.6% of the population (*1,2*). Given the advances in early detection and treatment of cancer and the aging of the U.S. population, the number of cancer survivors is projected to increase by >30% during the next decade, to approximately 18 million (*2,3*). Cancer survivors face many challenges with medical care follow-up, managing the long-term and late effects of treatments (*4*), monitoring for recurrence, and an increased risk for additional cancers (*4,5*). These survivors also face economic challenges, including limitations in work and daily activities, obtaining health insurance coverage and accessing health care, and increasing medical care costs. To estimate annual medical costs and productivity losses among male and female cancer survivors and persons without a

INSIDE

511 Progress Toward Measles Elimination — Eastern Mediterranean Region, 2008–2012
516 Notes from the Field: Knowledge, Attitudes, and Practices Regarding Antimalarial Chemoprophylaxis in U.S. Peace Corps Volunteers — Africa, 2013
518 Announcement
519 QuickStats

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

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

cancer history, CDC, along with other organizations, analyzed data from the 2008–2011 Medical Expenditure Panel Survey (MEPS), sponsored by the Agency for Healthcare Research and Quality. The results indicate that the economic burden of cancer survivorship is substantial among all survivors. For male cancer survivors, during 2008–2011, average annual medical costs and productivity losses resulting from health problems per person and adjusted to 2011 dollars were significantly higher among cancer survivors than among persons without a cancer history, by $4,187 and $1,459, respectively; for females, the estimated annual costs per person were $3,293 and $1,330 higher among cancer survivors than among persons without a cancer history, respectively. These findings suggest the need to develop and evaluate health and employment intervention programs aimed at improving outcomes for cancer survivors and their families.

For this report, data from the 2008–2011 MEPS (annual response rate = 53.5%–59.3%) and the 2011 MEPS Experiences with Cancer Survivorship Survey (*6*) (response rate = 90.0%) were analyzed. MEPS is an annual nationally representative survey of the U.S. civilian noninstitutionalized population that collects detailed information on demographic characteristics, health status, income, employment, and health-care expenditures. In 2011, cancer survivors (persons who self-report a cancer history) were asked to complete a supplemental questionnaire about the economic burden of cancer (*6*). Persons who only reported nonmelanoma skin cancer were not included in the cancer survivors group. All data were analyzed using statistical software, accounting for the complex survey design to obtain nationally representative estimates. Medical costs (total annual medical expenditures) and productivity loss among cancer survivors were estimated adjusting for age, sex, race/ethnicity, number of MEPS priority conditions, marital status, and education.

Total annual medical costs, stratified by sex, were estimated using annual medical expenditures among cancer survivors and persons without a cancer history. The estimated total annual medical costs were also examined by source of payment and service type. Lost productivity was estimated by assessing employment disability (being unable to work because of illness or injury), health-related missed work days, and days spent in bed because of ill-health, stratified by sex. Multivariable logistic regression was used to estimate the percentage of those unable to work because of illness or injury, adjusting for age, sex, race/ethnicity, number of MEPS priority conditions, and education. Negative binomial regression was used to estimate missed work days and days in bed. All medical costs and productivity losses were adjusted to 2011 dollars.

Indicators of productivity loss among cancer survivors were also examined using data from the 2011 MEPS Experiences with Cancer Survivorship Survey, stratified by sex. The percentage of cancer survivors employed at any time since their diagnosis, changes in work because of cancer, and limitations in physical and mental tasks at work, productivity at work, and daily activities outside of work were estimated using multivariable logistic regression, adjusting for age, sex, race/ethnicity, and number of MEPS priority conditions.

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 2014;63:[inclusive page numbers].

What is already known on this topic?

Cancer survivors have increased risk for additional cancers and often experience lasting and late effects of treatment. The economic burden of illness, including medical expenditures and productivity losses, can be significant because half of the estimated 13.4 million cancer survivors are of working age.

What is added by this report?

From 2008 to 2011, male cancer survivors incurred average annual medical expenditures of approximately $8,000 per person and per capita productivity loss of $3,700. For female, the estimates were $8,400 for annual medical expenditures and $4,000 for per capita productivity loss. Among men, these estimates were nearly two times higher and for women they were one-and-half times higher than among persons without a cancer history. Nearly 32% of survivors experienced limitations in their usual daily activities outside of work because of cancer and, among those employed, an estimated 42% had to make changes to their work hours and duties.

What are the implications for public health practice?

As the population of cancer survivors increases, the economic impact of cancer for patients, families, employers, the health-care system, and society overall is expected to grow. Given the increased health-care needs and medical costs of cancer survivors, continued access to health care and ways to reduce disruptions in work and daily activities are important when survivors complete their cancer treatment. Such efforts could reduce the economic burden caused by cancer and could help maximize employment opportunities and productivity among cancer survivors.

Cancer survivors were more likely to be female, non-Hispanic white, in fair/poor health and insured and to have multiple chronic conditions compared with persons without a cancer history (Table 1). During 2008–2011, male cancer survivors had mean annual medical expenditures of $8,091, compared with $3,904 among males without a cancer history (Table 2). Female survivors had mean annual medical expenditures of $8,412, compared with $5,119 among females without a cancer history. Among survivors, private health insurance was the largest source of payment ($3,003 and $3,899 for males and females, respectively), followed by Medicare. Ambulatory care medical services accounted for the largest share ($2,640 and $3,187) among survivors, followed by inpatient care ($1,722 and $1,843).

Among male cancer survivors, the per capita mean annual productivity loss was $3,719, compared with $2,260 among males without a cancer history (Table 2). For female survivors, the per capita mean annual productivity loss was $4,033, compared with $2,703 among those without a cancer history. Employment disability accounted for about 75% of productivity loss among male and female survivors.

Nearly one third of cancer survivors experienced limitations in their ability to perform usual daily activities outside of work, and 12% had impeded ability to perform mental tasks associated with usual daily activities (Table 3). Among cancer survivors who were employed at any time since diagnosis, cancer and its treatment interfered with physical tasks (25%) and mental tasks (14%) required by the job, with nearly 25% of cancer survivors feeling less productive at work. Although males were more likely than females to have been employed since their diagnosis (62% and 55%, respectively), among those employed, females were significantly more likely to make changes in work because of cancer than males (48% and 34%, respectively).

Discussion

The results of this analysis indicate that overall, cancer survivors had total annual medical expenditures estimated at $4,187 more for males and $3,293 more for females, compared with those of persons without a cancer history. These estimates were adjusted for age, sex, race/ethnicity, number of MEPS priority conditions, marital status, and education. These findings add to the growing concerns about the costs of cancer treatment and their negative impact on cancer survivors and their families. For example, a recent study reported that persons diagnosed with cancer are at higher risk for bankruptcy than those without a cancer history (*7*). In 2012, the National Cancer Policy Forum of the Institute of Medicine (IOM) convened a workshop, "Delivering Affordable Cancer Care in the 21st Century" (*8*), to discuss the drivers of current and projected costs of cancer care and potential ways to curtail these costs and maintain high-quality care. In 2009, before the IOM workshop, the American Society of Clinical Oncology published a guidance statement on the cost of cancer care (*9*). Overall, these efforts underscore the growing recognition by medical professionals, including clinical oncologists, of the important role they play in reducing the cost of cancer care for cancer survivors. A 2013 IOM publication, *Delivering High-Quality Cancer Care: Charting a New Course for a System in Crisis*,* highlighted the importance of information about cancer costs and of quantifiying the economic issues encountered by cancer survivors and their families.

Many cancer survivors return to work and remain productive. However, for nearly a third of survivors, cancer and the lasting and late effects of treatment interfere with usual daily activities outside of work. Many of these survivors are in poor health. These survivors might be returning to work to maintain adequate health insurance coverage and to pay for cancer-related services not covered by insurance. For instance, approximately 10% of survivors aged <65 years in this analysis were uninsured (and therefore likely have incurred a larger personal financial burden) and might experience financial barriers

*Additional information available at http://www.iom.edu/reports/2013/delivering-high-quality-cancer-care-charting-a-new-course-for-a-system-in-crisis.aspx.

TABLE 1. Characteristics of cancer survivors and persons without a cancer history — Medical Expenditure Panel Survey (MEPS), United States, 2008–2011

	2011 MEPS Experiences with, Cancer Survivorship survey		2008–2011 Core MEPS survey			
	Cancer survivor (n = 1,202)		Cancer survivor (n = 6,722)		No history of cancer (n = 86,865)	
Characteristic	%*	(95% CI)	%	(95% CI)	%	(95% CI)
Age at interview (yrs)						
18–39	4.5	(3.3–6.0)	7.1	(6.2–8.2)	41.8	(40.8–42.7)
40–44	3.3	(2.5–4.5)	4.1	(3.4–4.8)	9.3	(9.0–9.7)
45–49	5.3	(4.0–6.9)	5.4	(4.7–6.1)	9.5	(9.1–9.8)
50–54	8.8	(6.9–11.1)	8.2	(7.0–9.6)	9.9	(9.5–10.4)
55–59	10.0	(8.1–12.2)	10.1	(9.1–11.1)	8.3	(8.0–8.6)
60–64	13.6	(11.6–15.6)	12.7	(11.4–14.0)	6.9	(6.5–7.2)
65–69	14.6	(12.3–17.1)	12.4	(11.0–13.9)	4.7	(4.5–5.0)
70–74	12.9	(11.0–15.2)	11.6	(10.5–12.8)	3.3	(3.1–3.5)
75–79	9.3	(7.5–11.5)	10.3	(9.2–11.5)	2.6	(2.4–2.8)
≥80	17.8	(14.8–21.2)	18.2	(16.1–20.6)	3.7	(3.4–4.0)
Sex						
Men	42.5	(39.3–45.8)	41.8	(40.0–43.6)	49.0	(48.6–49.4)
Women	57.5	(54.3–60.7)	58.2	(56.4–60.0)	51.0	(50.6–51.4)
Race/Ethnicity						
White, non-Hispanic	85.9	(83.5–88.0)	84.8	(83.3–86.2)	66.1	(64.2–67.9)
Black, non-Hispanic	6.6	(5.4–8.0)	6.9	(6.1–7.9)	11.9	(10.7–13.3)
Hispanic	5.1	(3.8–6.7)	5.3	(4.5–6.1)	14.9	(13.4–16.6)
Other, non-Hispanic	2.5	(1.6–3.7)	3.0	(2.2–4.0)	7.1	(6.1–8.2)
Education						
Less than high school diploma	13.0	(10.9–15.5)	15.6	(14.2–17.0)	16.9	(16.2–17.7)
High school diploma	29.8	(26.8–32.9)	31.7	(30.0–33.5)	29.5	(28.7–30.3)
Some college or more	57.1	(53.6–60.5)	52.5	(50.4–54.5)	53.2	(52.1–54.3)
Marital status						
Married	57.2	(53.4–60.9)	57.7	(54.9–60.4)	52.8	(51.8–53.7)
Not married	42.8	(39.1–46.6)	42.3	(39.6–45.1)	47.2	(46.3–48.2)
MEPS priority conditions†						
0	15.8	(13.6–18.4)	16.0	(14.4–17.6)	46.7	(46.0–47.5)
1	18.6	(16.0–21.5)	19.2	(17.7–20.7)	22.6	(22.1–23.0)
2	21.9	(18.7–25.4)	21.3	(19.9–22.9)	14.1	(13.7–14.5)
≥3	43.8	(40.2–47.4)	43.5	(41.7–45.3)	16.6	(16.1–17.1)
Health status						
Excellent/Very good	41.4	(38.0–44.9)	39.6	(37.8–41.3)	60.0	(59.1–60.8)
Good	33.7	(30.7–36.9)	32.2	(30.7–33.7)	27.8	(27.2–28.5)
Fair/Poor	24.9	(22.3–27.6)	28.1	(26.4–29.8)	12.2	(11.8–12.6)
Health insurance or coverage						
Age <65 yrs, any private	75.2	(70.8–79.1)	74.9	(72.6–77.1)	70.7	(69.5–71.9)
Age <65 yrs, public only	15.8	(12.6–19.5)	14.8	(13.0–16.7)	10.4	(9.8–11.1)
Age <65 yrs, uninsured	9.1	(6.6–12.2)	10.3	(9.0–11.8)	18.9	(17.9–19.9)
Age ≥65 yrs, Medicare and private	62.9	(58.5–67.1)	55.0	(52.1–57.8)	49.9	(47.8–51.8)
Age ≥65 yrs, Medicare and public	5.9	(4.2–8.3)	6.3	(5.2–7.6)	7.9	(7.1–8.9)
Age ≥65 yrs, Medicare only	30.4	(26.4–34.7)	37.8	(35.2–40.5)	40.8	(39.0–42.6)

Abbreviation: CI = confidence interval.

* Percentages are weighted using the MEPS Experiences with Cancer Survey weight.

† In addition to cancer, MEPS priority conditions include arthritis, asthma, diabetes, emphysema, coronary heart disease, hypertension, stroke, high cholesterol, angina, and heart attack.

to needed care than survivors who have some source of payment for medical services. The provisions of the Affordable Care Act are expected to help improve this situation by increasing access to health insurance for millions of persons living in the United States, including cancer survivors. Further, approximately 30% of survivors are disabled and not able to return to work or have decreased ability to work because of limitations in cognitive, mental, and physical functioning and psychological distress (*10*). These survivors are more likely to incur higher productivity losses than persons without a cancer history. These challenges, particularly those related to employment, might differ for men and women, as presented in this report.

The findings in this report are subject to at least five limitations. First, because of inadequate sample size, these analyses were not stratified by cancer site or by time since diagnosis. Second, other aspects of economic burden of illness were not

TABLE 2. Annual medical expenditures and lost productivity* among cancer survivors and persons without a cancer history — Medical Expenditure Panel Survey (MEPS), United States, 2008–2011†

Characteristic	Men					Women				
	Cancer survivor		No history of cancer			Cancer survivor		No history of cancer		
	Adjusted mean	(95% CI)	Adjusted mean	(95% CI)	p-value	Adjusted mean	(95% CI)	Adjusted mean	(95% CI)	p-value
Per capita mean annual medical expenditures										
Total expenditures	**$8,091**	**(7,208–8,974)**	**$3,904**	**(3,741–4,066)**	**<0.001**	**$8,412**	**(7,789–9,036)**	**$5,119**	**(4,955–5,284)**	**<0.001**
Source of payment										
Out of pocket	$751	(686–816)	$600	(579–620)	<0.001	$973	(904–1,042)	$833	(807–860)	<0.001
Private health insurance	$3,003	(2,561–3,446)	$1,588	(1,495–1,681)	<0.001	$3,899	(3,384–4,414)	$2,100	(1,993–2,207)	<0.001
Medicare	$1,845	(1,556–2,134)	$1,025	(950–1,100)	<0.001	$1,816	(1,651–1,981)	$1,356	(1,270–1,442)	<0.001
Medicaid	$556	(305–808)	$294	(236–352)	0.005	$720	(566–875)	$484	(442–525)	0.001
Other	$752	(602–903)	$486	(444–527)	<0.001	$671	(552–789)	$402	(370–435)	<0.001
Service type										
Ambulatory care	$2,640	(2,344–2,936)	$1,151	(1,102–1,200)	<0.001	$3,187	(2,896–3,478)	$1,689	(1,621–1,758)	<0.001
Inpatient care	$1,722	(1,433–2,011)	$1,289	(1,193–1,385)	0.002	$1,843	(1,615–2,072)	$1,535	(1,441–1,628)	0.003
Prescription medications	$1,343	(1,138–1,549)	$1,077	(899–1,116)	<0.001	$1,650	(1,479–1,820)	$1,186	(1,141–1,231)	<0.001
Other services	$745	(641–848)	$646	(607–685)	0.072	$917	(819–1,015)	$827	(779–874)	0.071
Per capita mean annual lost productivity										
Total productivity loss	**$3,719**	**(3,123–4,315)**	**$2,260**	**(2,103–2,419)**	**<0.001**	**$4,033**	**(3,519–4,545)**	**$2,703**	**(2,536–2,871)**	**<0.001**
Source of productivity loss										
Employment disability	$2,831	(2,433–3,228)	$1,862	(1,739–1,986)	<0.001	$2,961	(2,616–3,305)	$2,109	(1,978–2,241)	<0.001
Missed work days among employed persons	$597	(461–734)	$267	(252–283)	<0.001	$686	(585–787)	$393	(374–413)	<0.001
Lost household productivity	$291	(229–353)	$131	(112–150)	<0.001	$386	(318–453)	$201	(184–217)	<0.001

Abbreviation: CI = confidence interval.

* Adjusted to 2011 dollars.

† Estimates are adjusted predicted margins, pooling the MEPS survey weights, based on participants with no missing information for each response. Participants with the responses of "inapplicable," "refused," "not ascertained," or "value assigned, but not collected" were excluded from the analysis. Regression models were adjusted for age (18–39, 40–44, 45–49, 50–54, 55–59, 60–64, 65–69, 70–74, 75–79, and ≥80 years), sex (male or female), marital status (married or not married), race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, or non-Hispanic other), MEPS priority conditions (arthritis, asthma, diabetes, emphysema, coronary heart disease, hypertension, stroke, high cholesterol, angina, and heart attack), and education (less than high school diploma, high school diploma, or some college or more).

included, such as the time spent receiving medical care, productivity losses for caregivers, and intangible costs associated with pain and suffering from cancer and its treatment. Therefore, the reported medical and productivity costs represent only a portion of the total economic burden of cancer to society, survivors, and their families. Third, this analysis relied on self-report of cancer diagnosis, which was not verified by medical records, and household-reported survey data, which are subject to measurement errors (e.g., underreporting). Fourth, because the 2008–2011 MEPS response rates were <60%, the findings might reflect, in part, nonresponse bias. Finally, because the MEPS priority conditions were based on a count of 10 conditions, some of the burden attributable to cancer could be attributed to unmeasured comorbid conditions.

The data presented in this report summarize efforts of a new collaborative group, the Health Economics Research on Cancer Workgroup, to promote health economics research on cancer. The workgroup is composed of scientists from CDC, the National Cancer Institute, Agency for Healthcare Research and Quality, the American Cancer Society, Emory University, and the Livestrong Foundation. The workgroup seeks to address key research gaps identified in IOM reports (*4*), including the need for national estimates of the burden of cancer, examining the financial impact of cancer on survivors and their families, and patterns of employment. Findings from these studies will provide invaluable information to help improve the quality of the cancer survivorship experience and reduce the burden of cancer in the United States.

With the projected increase in the number of cancer survivors, the economic burden of cancer will also likely increase (*3*). Therefore, public health decision-makers, professional medical organizations, and other stakeholders might want to focus their efforts on factors that can help to reduce the burden of cancer in the general population, including the recurrence of cancer in cancer survivors. Some of these factors might include primary prevention efforts, such as quitting smoking, being physically active, and maintaining a healthy weight. The economic data presented in this report investigating the economic consequences

TABLE 3. Indicators of productivity loss in cancer survivors — Medical Expenditure Panel Survey (MEPS) Experiences with Cancer Survivorship Survey, United States, 2011*

Indicator	Total† No.	Total† %	Total† (95% CI)	Men %	Men (95% CI)	Women %	Women (95% CI)	p-value
Cancer interfered with usual daily activities outside of work								
Yes	369	31.6	(28.9–34.3)	30.4	(25.6–35.2)	32.5	(28.6–36.4)	0.54
No	759	68.4	(65.6–71.1)	69.6	(64.8–74.4)	67.5	(63.6–71.4)	
Cancer interfered with ability to perform mental tasks as part of usual daily activities								
Yes	154	11.6	(9.7–13.6)	10.2	(6.9–13.5)	12.5	(9.6–15.4)	0.35
No	982	88.4	(86.4–90.4)	89.8	(86.5–93.1)	87.5	(84.6–90.4)	
At any time from when you were first diagnosed with cancer until now, were you employed								
Yes	676	58.3	(54.9–61.9)	62.4	(57.3–67.6)	55.1	(50.9–59.4)	0.02
No	505	41.6	(8.1–45.1)	37.6	(32.4–42.7)	44.9	(40.6–49.1)	
Any change in work (extended paid time off, unpaid time off, change in hours, duties, employment status) because of cancer§								
Yes	285	42.1	(37.9–46.2)	33.7	(26.7–40.7)	48.2	(42.3–54.1)	0.01
No	344	57.9	(53.8–62.1)	66.3	(59.3–73.3)	51.8	(45.9–57.7)	
Cancer interfered with ability to perform physical tasks required by job§								
Yes	168	25.1	(20.9–29.2)	26.1	(19.1–33.1)	24.2	(19.7–28.8)	0.08
No	414	65.6	(61.0–70.1)	68.0	(60.6–75.5)	63.3	(58.1–68.5)	
No physical tasks	57	9.4	(6.8–11.9)	5.9	(2.6–9.2)	12.4	(8.4–16.5)	
Cancer interfered with mental tasks required by job§								
Yes	103	14.4	(11.4–17.3)	11.5	(6.7–16.3)	16.3	(12.3–20.3)	0.17
No	545	85.6	(82.7–88.6)	88.5	(83.7–93.2)	83.7	(79.7–87.7)	
Ever felt less productive at work§								
Yes	169	24.7	(21.0–28.3)	22.2	(15.4–29.0)	26.4	(21.7–31.1)	0.36
No	479	75.3	(71.7–79.0)	77.8	(71.0–84.6)	73.6	(68.9–78.3)	

Abbreviation: CI = confidence interval.

* Estimates are adjusted predicted margins, and 95% CIs using the MEPS Experiences with Cancer survey weight, based on participants with no missing information for each response. Participants with the responses of "inapplicable," "refused," "not ascertained," or "value assigned, but not collected" were excluded from the analysis.

† Regression models were adjusted for age (18–39, 40–44, 45–49, 50–54, 55–59, 60–64, 65–69, 70–74, 75–79, and ≥80 years), sex (male or female), marital status (married or not married), race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, or non-Hispanic other), MEPS priority conditions (arthritis, asthma, diabetes, emphysema, coronary heart disease, hypertension, stroke, high cholesterol, angina, and heart attack), and education (less than high school diploma, high school diploma, or some college or more).

§ Estimates are based on participants who responded "yes" to the question, "At any time from when you were first diagnosed with cancer until now, were you working for pay at a job or business?"

of surviving cancer highlight the need to develop comprehensive intervention programs to improve the quality of the cancer survivorship experience and decrease the economic burden of cancer survivorship in the United States.

[1]Division of Cancer Prevention and Control, National Center for Chronic Disease Prevention and Health Promotion, CDC; [2]Health Economics Research on Cancer Workgroup; [3]National Cancer Institute, Bethesda, Maryland; [4]American Cancer Society, Atlanta, Georgia; [5]Agency for Healthcare Research and Quality, Rockville, Maryland; [6]Livestrong Foundation, Austin, Texas; [7]Emory University, Atlanta, Georgia (Corresponding author: Donatus U. Ekwueme, dce3@cdc.gov, 770-488-3182)

References

1. Howlander N, Noone AM, Krapcho M, et al., eds. SEER cancer statistics review, 1975–2011. Bethesda, MD: National Cancer Institute; 2014. Available at http://seer.cancer.gov/statfacts/html/all.html.
2. De Moor JS, Mariotto AB, Parry C, et al. Cancer survivors in the United States: prevalence across the survivorship trajectory and implications for care. Cancer Epidemiol Biomarkers Prev 2013;22:561–70.
3. Mariotto AB, Yabroff KR, Shao Y, Feuer EJ, Brown ML. Projections of the cost of cancer care in the United States: 2010–2020. J Natl Cancer Inst 2011;103:117–28.
4. Hewitt M, Greenfield S, Stovall E, eds. From cancer patient to cancer survivor: lost in transition. Washington, DC: National Academies Press; 2006.
5. Ng AK, Travis LB. Second primary cancers: an overview. Hematol Oncol Clin North Am 2008;22:271–89.
6. Yabroff KR, Dowling E, Rodriguez J, et al. The Medical Expenditure Panel Survey (MEPS) experiences with cancer survivorship supplement. J Cancer Surviv 2012;6:407–19.
7. Ramsey S, Blough D, Kirchhoff A, et al. Washington state cancer patients found to be at greater risk for bankruptcy than people without a cancer diagnosis. Health Aff 2013;32:61143–52.
8. Institute of Medicine. Delivering affordable cancer care in the 21st century: workshop summary. Washington, DC: National Academies Press; 2013. Available at http://www.iom.edu/reports/2013/delivering-affordable-cancer-care-in-the-21st-century.aspx.
9. Meropol NJ, Schrag D, Smith TJ, et al. American Society of Clinical Oncology guidance statement: the cost of cancer care. J Clin Oncol 2009;23:3868–74.
10. Dowling EC, Chawla N, Forsythe LP, et al. Lost productivity and burden of illness in cancer survivors with and without other chronic conditions. Cancer 2013;119:3393–401.

Progress Toward Measles Elimination — Eastern Mediterranean Region, 2008–2012

Nadia Teleb, MD[1], Emmaculate Lebo, MBChB[2], Hinda Ahmed, PhD[1], Abdel Rahman Hossam[1], El Tayeb El Sayed, MD[1], Alya Dabbagh, PhD[3], Peter Strebel, MBBS[3], Paul Rota, PhD[4], James Alexander, MD[2] (Author affiliations at end of text)

In 1997, the 22 countries in the World Health Organization (WHO) Eastern Mediterranean Region (EMR)* adopted a goal of measles elimination by 2010† (*1*). To achieve this goal, the WHO Regional Office for the Eastern Mediterranean Region (EMRO) developed a four-pronged strategy: 1) achieve ≥95% vaccination coverage of children with the first dose of measles-containing vaccine (MCV1) in every district of each country through routine immunization services, 2) achieve ≥95% vaccination coverage with the second dose of measles-containing vaccine (MCV2) in every district of each country either through a routine 2-dose vaccination schedule or through supplementary immunization activities (SIAs),§ 3) conduct high-quality, case-based surveillance in all countries, and 4) provide optimal clinical case management, including supplementing diets with vitamin A (*1*). Although significant progress was made toward measles elimination in the EMR during 1997–2007, the measles elimination goal was not reached by the target date of 2010, and the date was revised to 2015. This report updates previous reports (*2–4*) and summarizes the progress made toward measles elimination in EMR during 2008–2012. From 2008 to 2012, large outbreaks occurred in countries with a high incidence of measles,¶ and reported annual measles cases in EMR increased from 12,186 to 36,456. To achieve measles elimination in EMR, efforts are needed to increase 2-dose vaccination coverage, especially in countries with high incidence of measles and in conflict-affected countries, and to implement innovative strategies to reach populations at high risk in areas with poor access to vaccination services or with civil strife.

Immunization Activities

Of the 23 EMR countries in 2012, administration of MCV1 was recommended at age 9 months in 12 (52%) countries and at age 12–15 months in 11 (48%) (Table 1). Twenty (87%) countries had measles vaccination schedules with at least 2 MCV doses. Reported vaccination coverage with MCV1 and MCV2 is calculated annually for each country by dividing the total number of doses administered to children in the targeted age group by the estimated population of children in that age group based on the most recent census (i.e., administrative coverage). Additionally, WHO and the United Nations Children's Fund (UNICEF) estimated MCV1 coverage annually for each country using reported MCV1 coverage and available survey results (*5*). Estimated MCV1 coverage in EMR increased from 83% in 2008 to 85% in 2010 and then declined to 83% in 2012 (Table 1, Figure).

In 2012, estimated MCV1 coverage was unavailable for one of the 23 EMR countries, <90% (range = 46%–85%) in 10 (43%) countries, 90%–94% in two (9%) countries, and ≥95% in 10 (43%) countries (Table 1). Of the 10 countries with ≥95% MCV1 coverage, five reported ≥95% coverage in all districts. In 2012, among the 20 countries with a routine ≥2-dose schedule, reported MCV2 coverage was ≥95% in 11 (55%), 50%–94% in six (30%), and <50% in three (15%). During 2008–2012, a total of 186,760,207 doses of measles vaccine were given to children in 93 measles SIAs conducted in 15 EMR countries (Table 2). Of these SIAs, 38 (41%) had reported administrative coverage of ≥95%.

Case-Based Surveillance Activities

Measles case-based surveillance includes individual case investigation and blood specimen collection for laboratory testing (*6*). Confirmation of measles is made by laboratory findings, an epidemiologic link,** or clinical diagnosis (*6*). By the end of 2012, nationwide measles case-based surveillance

* The 22 EMR countries were Afghanistan, Bahrain, Djibouti, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, United Arab Emirates, West Bank and Gaza Strip, and Yemen. For this report, the geographic regions West Bank and Gaza Strip are considered to constitute one country. In July 2011, South Sudan became an independent nation, for a total of 23 states in the region.

† Measles elimination is defined as the absence of endemic measles cases for a period of ≥12 months, in the presence of adequate surveillance. One indicator of measles elimination is a sustained measles incidence of less than one case per 1 million population.

§ Initial nationwide catch-up SIAs in EMR countries target all children aged 9 months–14 years, with the goal of eliminating susceptibility to measles in the general population. Periodic follow-up SIAs target all children born since the last SIA. Follow-up SIAs generally are conducted nationwide every 2–4 years and target children aged 9–59 months, with the goals of eliminating any measles susceptibility that has developed in recent birth cohorts and protecting children who did not respond to their first measles vaccination.

¶ Countries with high incidence of measles were Afghanistan, Djibouti, Pakistan, Somalia, South Sudan, Sudan, and Yemen.

** An epidemiologic link is defined as a clinical case of measles that has not been confirmed by a laboratory but that is geographically and temporally related (with dates of rash onset occurring 7–21 days apart) to a laboratory-confirmed case.

TABLE 1. Recommended 2012 national routine measles vaccination* schedule, estimated coverage with the first dose of measles-containing vaccine,† number of measles cases and measles cases, per 1 million population, by country — World Health Organization (WHO) Eastern Mediterranean Region, 2008 and 2012

Country/Area	Age at first dose	Age at second dose	Age at third dose	2008 % coverage with MCV1§	2008 No. of measles cases (JRF)§	2008 Measles cases per 1 millon population	2012 % coverage with MCV1§	2012 No. of measles cases (JRF)§	2012 Measles cases per 1 millon population
Afghanistan	9 mos¶	18 mos¶		59	1,599	59.2	68**	2,787	93.4
Bahrain	12 mos	5 yrs		99	2	1.8	99	0	0.0
Djibouti	9 mos¶	15 mos¶		73	143	176.5	83**	709	824.4
Egypt	12 mos	18 mos		92	668	8.8	93**	245	3.0
Iran	12 mos	18 mos		98	127	1.7	98	332	4.3
Iraq	9 mos¶	15 mos	4 yrs	76	5,494	186.7	69**	15	0.5
Jordan	9 mos¶	12 mos	18 mos	95	2	0.3	98	3	0.4
Kuwait	12 mos	2 yrs	12 yrs††	99	66	24.4	99	27	8.3
Lebanon	9 mos¶	12 mos	4–5 yrs	79	24	5.7	80**	9	1.9
Libya	12 mos	18 mos		98	8	1.4	98	320	52.0
Morocco	9 mos¶	None		96	1,455	47.0	99	668	20.5
Oman	12 mos	18 mos		98	18	6.9	99	13	3.9
Pakistan	9 mos¶	15 mos¶		81	1,129	6.8	83**	8,046	44.9
West Bank/Gaza Strip	12 mos	18 mos		96	0	0.0	N/A	0	0.0
Qatar	12 mos	18 mos		96	0	0.0	97	160	78.0
Saudi Arabia	9 mos¶	12 mos	6 yrs	97	158	5.4	98	294	10.4
Somalia	9 mos¶	None		34	1,081	118.3	46**	9,983	979.2
South Sudan	9 mos¶	None					62**	1,952	180.1
Sudan§§	9 mos¶	18 mos¶		79	129	3.8	85**	8,523	229.1
Syria	12 mos	18 mos		81	19	0.9	61**	13	0.6
Tunisia	15 mos¶	6 yrs¶	12 yrs††	98	2	0.2	96	48	4.4
UAE	12 mos	5–6 yrs		92	55	8.1	94**	132	14.3
Yemen	9 mos¶	18 mos¶		73	7	0.3	71**	2,177	91.3
Region overall				**83**	**12,186**	**21.4**	**83****	**36,456**	**59.5**

Abbreviations: MCV1 = first dose of measles-containing vaccine; JRF = Joint Reporting Form; N/A = not available; UAE = United Arab Emirates.
* A combined measles, mumps, and rubella (MMR) vaccine is used except where noted.
† By age 12 months or later if first dose was scheduled after age 12 months. Data are from WHO and United Nations Children's Fund (UNICEF) estimates.
§ Data available at http://www.who.int/immunization/monitoring_surveillance/data/subject/en.
¶ Single-antigen measles vaccine used, except in Tunisia, which uses monovalent measles vaccine at 15 months and measles-rubella vaccine at 6 years.
** Vaccination coverage was below the regional goal of ≥95% in 2012.
†† Third measles dose is given to girls at age 12 years (MMR vaccine in Kuwait and measles-rubella vaccine in Tunisia).
§§ Includes partial data for South Sudan.

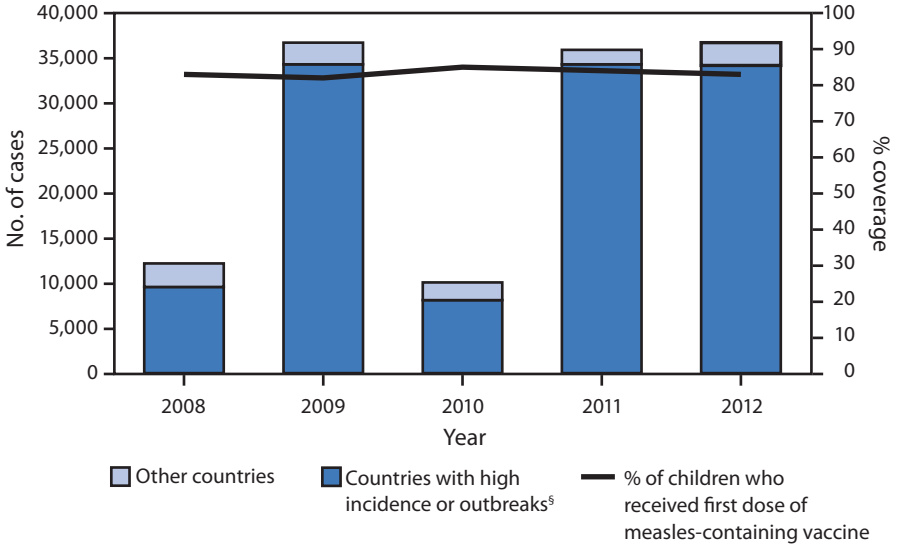
was established in all EMR countries except Somalia, South Sudan, and Pakistan, which had case-based surveillance at sentinel sites. Case-based surveillance was established nationwide in Djibouti; however, measles case information and surveillance performance indicators have not been reported from Djibouti to EMRO since February 2012.

An EMR Measles and Rubella Laboratory Network was established as part of the WHO Global Measles and Rubella Laboratory Network, with a national laboratory in each country and regional reference laboratories in Oman and Tunisia. National laboratories perform confirmatory testing of specimens from persons with suspected cases of measles using an enzyme-linked immunosorbent assay to detect measles-specific immunoglobulin M. In 2012, 18 (78%) of the 23 national laboratories also had capacity to perform measles virus isolation and polymerase chain reaction testing for viral detection. In 2012, 21 (91%) of the 23 national laboratories participated in and passed the laboratory proficiency panel testing and achieved accreditation by the Global Measles and Rubella Laboratory Network.

WHO global standards are used in EMR to monitor national case-based surveillance performance (*7*).†† In 2012, among 19 countries with reported performance indicators, 15 (79%) met the target of two or more discarded cases per 100,000 population, 15 (79%) met the target for adequacy of case investigation, 18 (95%) met the target for adequacy of specimen collection, and 14 (74%) met the target for adequacy of viral detection of outbreaks. Timeliness of transport to the

†† These indicators include ensuring that 1) two or more nonmeasles suspected cases per 100,000 persons per year are detected and reported (to monitor the sensitivity of the surveillance system), 2) ≥80% of suspected measles cases have an adequate investigation initiated within 48 hours of notification with essential data elements collected (to monitor adequacy of investigation), 3) ≥80% of suspected cases have adequate specimens collected and tested in a proficient laboratory (to monitor adequacy of testing), 4) ≥80% of confirmed outbreaks have adequate specimens collected for viral detection in a proficient laboratory (to monitor virus transmission), 5) ≥80% of specimens are received by a laboratory within 5 days of collection (to monitor timely specimen transport), and 6) ≥80% of laboratory test results are reported within 4 days (to monitor timely testing and reporting).

FIGURE. Number of reported measles cases,* by country's measles status, and estimated percentage of children who received their first dose of measles-containing vaccine† — World Health Organization (WHO) Eastern Mediterranean Region, 2008–2012



* Confirmed cases of measles reported to WHO and the United Nations Children's Fund (UNICEF) through the Joint Reporting Form Regional Office for the Eastern Mediterranean Region.
† By age 12 months or later if first dose was scheduled after age of 12 months. Data are from WHO and UNICEF estimates.
§ Countries with high incidence or outbreaks were Afghanistan, Djibouti, Iraq, Pakistan, Somalia, South Sudan, Sudan, and Yemen.

laboratory and timeliness of laboratory reporting targets were achieved by 12 (63%) and 17 (89%) countries, respectively.

Measles-Incidence and Measles Virus Genotypes

From 2008 to 2012, the annual number of EMR measles cases increased from 12,186 to 36,456, with an increase in measles incidence from 21.4 to 59.5 cases per million population. Large measles outbreaks occurred in countries with conflict and insecurity or with a high incidence of measles (Figure), including Djibouti (709 cases, 2012), Iraq (35,822 cases, 2008–2009), Pakistan (16,753 cases, 2010–2012), Somalia (27,281 cases, 2011–2012), South Sudan (3,208 cases, 2011–2012), Sudan (14,139 cases, 2011–2012), and Yemen (4,843 cases, 2011–2012). In addition, outbreaks with >1,500 measles cases were reported annually in Afghanistan during 2008–2012. In 2012 in EMR, >90% of measles cases occurred in those eight countries, which together had a measles incidence of 105.3, compared with 7.9 per million population in the other countries. In 2012, six countries with strong surveillance systems (i.e., Bahrain, Egypt, Oman, the West Bank and Gaza Strip, Syria, and Tunisia) reported a measles incidence of fewer than five cases per 1 million population.

During 2008–2012, genotype B3 was reported from 15 of 16 EMR countries that reported genotype results and was the predominant measles virus genotype detected. In contrast, genotype D4 was the predominant strain circulating during 2003–2007 (*3*).

Discussion

Since EMR countries first resolved to eliminate measles, substantial progress has been made. During 2000–2012, measles incidence decreased 34%, from 90 to 59.5 per 1 million population, and estimated measles mortality decreased 52%, from 53,900 to 25,800 deaths per year (*8*). However, during 2008–2012, regional progress stagnated, and the number of reported measles cases increased more than two-fold, mainly because of large outbreaks in several countries. During 2008–2012, >80% of reported measles cases were from Afghanistan, Djibouti, Iraq, Pakistan, Somalia, South Sudan, Sudan, and Yemen. Increased civil conflict and insecurity in several countries since 2011 coincided with an increase in reported measles cases. With the resurgence of measles in some EMR countries, the region's target of measles elimination by 2015 is not likely to be achieved.

Countries in the EMR face several challenges in achieving measles elimination. To achieve the "herd immunity" needed to interrupt endemic measles transmission, 2 doses of MCV with ≥95% coverage are needed. Routine MCV1 coverage remains suboptimal (83%) and, although 20 countries introduced MCV2 into the routine schedule, only half of these reported ≥95% MCV2 coverage. In addition, numerous SIAs were conducted; however, high coverage (≥95%) was not achieved in some countries. To prevent an accumulation of susceptible persons and subsequent measles outbreaks, a routine MCV2 dose should be introduced in all EMR countries and follow-up SIAs need to be conducted periodically until routine 2-dose coverage of ≥95% with both MCV1 and MCV2 is achieved and maintained in every district.

In certain countries where measles incidence remains high (notably Afghanistan, Pakistan, Somalia, South Sudan, Sudan, and Yemen), major challenges to implementing measles elimination activities exist, including civil unrest and armed conflict, competing public health priorities, and natural disasters. Unpredictable mass population displacements and resettlements complicate the delivery of routine vaccination services and planning of SIAs. Conducting SIAs in conflict settings and in areas with no local government requires establishing close linkages with local communities. Vaccination teams and civilian populations are at risk for violence during these SIAs, and vaccination coverage often is suboptimal.

TABLE 2. Measles supplementary immunization activities (SIAs),* by country/area, target age group, type of SIA, and number and percentage of targeted children vaccinated — World Health Organization (WHO) Eastern Mediterranean Region, 2008–2012

Country/Area	Year	Target age group	Type of SIA	Targeted children vaccinated	
				No.	(%)†
Afghanistan	2009	9–36 mos	Follow-up	3,000,777	(108)
	2011	9–59 mos	Mop-up	224,074	(98)
	2011	9–59 mos	Mop-up	200,470	(90)
	2011	9 mos–10 yrs	Mop-up	1,005,966	(96)
	2012	9 mos–10 yrs	Follow-up	6,194,612	(104)
	2012	9 mos–10 yrs	Follow-up	5,326,038	(103)
Djbouti	2008	9 mos–15 yrs	Catch-up	184,638	(86)
	2011	9–24 mos	Follow-up	4,866	(86)
	2012	9–59 mos	Follow-up	90,603	(95)
	2012	6–15 yrs	Catch-up	23,605	(94)
Egypt	2008	10–20 yrs	Catch-up	18,375,015	(99)
	2009	2–11 yrs	Catch-up	17,843,885	(104)
Iran	2010	9 mos–12 yrs	Mop-up	117,009	(99)
	2012	9 mos–12 yrs	Mop-up	142,730	(97)
Iraq	2008	7–36 mos	Mop-up	52,673	(108)
	2008	12–59 mos	Mop-up	198,075	(96)
	2008	9–59 mos	Mop-up	38,046	(70)
	2008	9–59 mos	Mop-up	154,369	(98)
	2009	6 yrs	Catch-up	1,070,243	(90)
	2009	9–60 mos	Follow-up	180,699	(99)
	2009	6–59 mos	Follow-up	4,513,438	(96)
	2009	5–12 yrs	Follow-up	5,380,608	(88)
	2010	9–59 mos	Follow-up	2,603,752	(93)
	2010	9 mos–12 yrs	Mop-up	117,009	(99)
	2011	18–24 yrs	Catch-up	1,849,139	(40)
	2012	6 mos–5 yrs	Follow-up	4,733,889	(94)
Jordan	2012	9–59 mos	Mop-up	163,001	(90)
Kuwait	2010	1–7 yrs	Follow-up	272,829	(75)
Lebanon	2008	9 mos–15 yrs	Catch-up	705,117	(77)
Libya	2008	1–15 yrs	Mop-up	36,480	(100)
	2008	1–6 yrs	Mop-up	1,550	(100)
	2009	12 mos–6 yrs	Follow-up	748,345	(98)
Morocco	2008	9 mos–14 yrs	Catch-up	4,665,375	(99)
Pakistan	2008	9 mos–13 yrs	Catch-up	35,315,375	(103)
	2010	9 mos–13 yrs	Mop-up	4,159,306	(81)
	2010	9 mos–13 yrs	Mop-up	1,583,340	(93)
	2010	6 mos–59 mos	Mop-up	7,998,260	(96)
	2011	6–59 mos	Follow-up	1,229,618	(93)
	2011	6–59 mos	Follow-up	5,098,071	(99)
	2011	6–59 mos	Follow-up	784,337	(90)
	2011	9–59 mos	Follow-up	1,744,206	(86)
	2011	9–59 mos	Follow-up	205,551	(91)
	2011	9–59 mos	Follow-up	547,716	(98)
	2012	9 mos–9 yrs	Follow-up	1,954,175	(102)
Qatar	2011	12 mos–20 yrs	Follow-up	150,112	(77)
Saudi Arabia	2011	6–18 yrs	Catch-up	4,900,677	(97)
	2011	9 mos–6 yrs	Catch-up	3,369,639	(97)
Somalia	2008	9 mos–15 yrs	Mop-up	142,654	(95)
	2008	9 mos–15 yrs	Mop-up	138,205	(58)
	2009	9–59 mos	Follow-up	119,117	(82)
	2009	9–59 mos	Follow-up	325,622	(90)
	2009	9–59 mos	Follow-up	214,864	(87)
	2009	9–59 mos	Follow-up	276,994	(73)

TABLE 2. (*Continued*) Measles supplementary immunization activities (SIAs),* by country/area, target age group, type of SIA, and number and percentage of targeted children vaccinated — World Health Organization (WHO) Eastern Mediterranean Region, 2008–2012

Country/Area	Year	Target age group	Type of SIA	Targeted children vaccinated	
				No.	(%)†
Somalia	2009	9–59 mos	Follow-up	137,699	(95)
	2009	9–59 mos	Follow-up	835,927	(82)
	2009	9–59 mos	Follow-up	909,687	(85)
	2010	9–59 mos	Follow-up	291,966	(86)
	2010	9–59 mos	Follow-up	327,591	(86)
	2010	9–59 mos	Follow-up	1,137,268	(92)
	2011	9–59 mos	Mop-up	75,197	(89)
	2011	6 mos–15 yrs	Mop-up	71,653	(80)
	2011	9–59 mos	Follow-up	151,279	(89)
	2011	9–59 mos	Follow-up	323,986	(85)
	2011	6 mos–14 yrs	Mop-up	1,056,287	(36)
	2011	6 mos–15 yrs	Mop-up	656,226	(88)
	2011	6 mos–15 yrs	Mop-up	74,300	(86)
	2011	6 mos–14 yrs	Mop-Up	626,625	(93)
	2012	6–59 mos	Follow-up	509,042	(87)
	2012	<5 yrs	Follow-up	886,033	(87)
	2012	9–59 mos	Follow-up	872,230	(91)
Sudan	2008	9–59 mos	Follow-up	2,728,011	(97)
	2008	6 mos–14 yrs	Catch-up	150,619	(83)
	2008	9 mos–5 yrs	Follow-up	142,511	(94)
	2010	9–59 mos	Mop-up	313,359	(97)
	2010	9–59 mos	Follow-up	1,763,398	(95)
	2011	9 mos–15 yrs	Mop-up	64,063	(67)
	2011	9–59 mos	Follow-up	1,020,921	(105)
	2011	9–59 mos	Follow-up	1,456,371	(102)
	2011	9–59 mos	Follow-up	1,433,328	(92)
	2011	9–59 mos	Mop-up	68,994	(78)
South Sudan	2008	6 mos–14 yrs	Catch-up	132,282	(66)
	2011	6–59 mos	Follow-up	678,503	(102)
	2011	6–59 mos	Follow-up	502,258	(92)
	2011	6–59 mos	Follow-up	146,644	(99)
	2011	6 mos–14 yrs	Follow-up	186,459	(93)
	2012	6–59 mos	Follow-up	1,708,418	(90)
Syria	2008	11–15 yrs	Catch-up	1,610,305	(100)
	2012	12–59 mos	Follow-up	768,086	(60)
Yemen	2009	9–59 mos	Mop-up	621,671	(93)
	2009	9–59 mos	Follow-up	3,246,804	(96)
	2010	6 mos–15 yrs	Mop-up	455,517	(76)
	2011	6 mos–15 yrs	Mop-up	26,241	(85)
	2011	6–59 mos	Mop-up	130,905	(65)
	2012	6 mos–10 yrs	Follow-up	7,984,779	(93)
Region overall				**186,760,207**	

* SIAs generally are carried out using two approaches. An initial nationwide catch-up SIA targets all children aged 9 months to 14 years; it has the goal of eliminating susceptibility to measles in the general population. Periodic follow-up SIAs then target all children born since the last SIA. Follow-up SIAs generally are conducted nationwide every 2–4 years, targeting children aged 9–59 months; their goals are to eliminate measles susceptibility that has developled in recent birth cohort and to protect chidren who did not respond to the first measles vaccination. The exact age range for follow-up SIAs depends on the age-specific incidence of measles, coverage with 1 dose of measles-containing vaccine, and the time since the last SIA.

† The percentage of the population vaccinated can exceed 100% because of underestimation of the size of the target population or data quality issues.

During 2008–2012, measles case-based surveillance was implemented in all but three EMR countries, with the support of a well-established global and regional laboratory network. Measles case-based surveillance performance indicators showed that the majority of countries met surveillance standards. However, targets for surveillance indicators have not been met in all countries. Monitoring and strengthening surveillance performance could help rapidly identify and characterize

What is already known on this topic?

Reported measles cases in the World Health Organization's Eastern Mediterranean Region (EMR) decreased by 70%, from 146 per 1 million population in 1998 to 44 per 1 million in 2006. During 2000–2006, estimated measles deaths decreased by 73%. However, the goal of measles elimination by 2010 was not achieved, and the target date was revised to 2015.

What is added by this report?

During 2008–2012, estimated first-dose coverage with measles-containing vaccine in EMR was unchanged overall at 83%; approximately 200 million children were vaccinated during supplementary immunization activities (SIAs), and 38 (41%) of the 93 SIAs conducted had ≥95% national level administrative coverage. However, an increased number of measles cases were reported in 2012, a total of 36,456 compared with 12,196 in 2008. The increase was primarily caused by large measles outbreaks in countries with a high incidence of measles.

What are the implications for public health practice?

Successful implementation of all components of the EMR measles elimination strategy will be needed to achieve the regional goal of measles elimination by 2015. Efforts must be strengthened at the regional and national level to increase coverage with 2 doses of measles-containing vaccine, conduct high-quality SIAs, and use innovative strategies to reach high-risk populations living in areas with poor access or with civil strife.

outbreaks, guide response activities, and provide evidence for refining elimination strategies. Efforts also should be made to maintain sensitive, timely, and complete measles case-based surveillance in areas with conflict and insecurity.

The findings in this report are subject to at least two limitations. First, routine MCV1 and MCV2 administrative coverage and vaccination coverage during SIAs are likely to include errors resulting from inaccurate estimates of the size of the target population, inaccurate reporting of doses delivered, and inclusion of SIA doses given to children outside the target group. Second, underestimation in surveillance data can occur, because not all persons with suspected measles seek care and not all of those who seek care are reported.

To achieve measles elimination, the key strategies outlined in the Global Vaccine Action Plan and the Measles and Rubella Initiative Strategic Plan need to be implemented in all EMR countries (*9,10*). Efforts should focus on increasing MCV1 and MCV2 vaccination coverage and ensuring that routine immunization services and SIAs reach at-risk populations who reside in areas with poor access to vaccination services or with civil strife.

[1]Vaccine Preventable Diseases and Immunization, WHO Regional Office for the Eastern Mediterranean, Cairo, Egypt; [2]Global Immunization Division, Center for Global Health, CDC; [3]Department of Immunization, Vaccines, and Biologicals, WHO, Geneva, Switzerland; [4]Division of Viral Diseases, National Center for Immunization and Respiratory Diseases, CDC (Corresponding author: Emmaculate Lebo, elebo@cdc.gov, 404-718-4522)

References

1. World Health Organization. Measles: regional strategy for measles elimination. Geneva, Switzerland: World Health Organization; 1999.
2. CDC. Progress toward measles elimination—Eastern Mediterranean Region, 1980–1998. MMWR 1999;48:1081–6.
3. CDC. Progress toward measles mortality reduction and elimination—Eastern Mediterranean Region, 1997–2007. MMWR 2008;57:262–7.
4. Naouri B, Ahmed H, Bekhit R, Teleb N, Mohsni E, Alexander JP Jr. Progress towards measles elimination in the Eastern Mediterranean Region. J Infect Dis 2011;204(Suppl 1):S289–98.
5. Burton A, Monasch R, Lautenbach B, et al. WHO and UNICEF estimates of national infant immunization coverage: methods and processes. Bull World Health Organ 2009;87:535–41.
6. Regional Office for the Eastern Mediterranean Region. Field guidelines for surveillance of measles, rubella and congenital rubella syndrome. Cairo, Egypt: World Health Organization; 2011.
7. World Health Organization. Framework for verifying elimination of measles and rubella. Wkly Epidemiol Rec 2013;88:89–99.
8. World Health Organization. Global control and regional elimination of measles, 2000–2012. Wkly Epidemiol Rec 2014;89:45–52.
9. World Health Organization. Global vaccine action plan: report by the Secretariat. Geneva, Switzerland: World Health Organization; 2012. Available at http://www.who.int/immunization/global_vaccine_action_plan/GVAP_doc_2011_2020/en.
10. World Health Organization. Global measles and rubella strategic plan: 2012–2020. Geneva, Switzerland: World Health Organization; 2012. Available at http://www.who.int/immunization/newsroom/Measles_Rubella_StrategicPlan_2012_2020.pdf.

Notes from the Field

Knowledge, Attitudes, and Practices Regarding Antimalarial Chemoprophylaxis in U.S. Peace Corps Volunteers — Africa, 2013

Keren Z. Landman, MD[1,2], Kathrine R. Tan, MD[2], Paul M. Arguin, MD[2] (Author affiliations at end of text)

Long-term travelers to areas where malaria is endemic are at risk for this potentially fatal disease; however, malaria can be prevented through the use of insecticide-treated bednets, mosquito repellents, and chemoprophylaxis. Three options for chemoprophylaxis are available in the Africa region: mefloquine, doxycycline, and atovaquone-proguanil. These options differ by dosing regimen, cost, and side effect profile (*1*) (Table). Long-term adverse effects of these drugs have been reported rarely.

Peace Corps volunteers (PCVs) are among the long-term travelers for whom chemoprophylaxis is often recommended. The U.S. Peace Corps provides comprehensive health care to PCVs, including chemoprophylaxis to PCVs serving where malaria is endemic, and works to continually improve PCVs' understanding of health risks and the risks and benefits of antimalaria chemoprophylaxis. PCV adherence to malaria chemoprophylaxis is required by Peace Corps policy, and nonadherence can lead to termination from Peace Corps service (*2*). Peace Corps medical officers (PCMOs) are nonvolunteer health-care workers who provide primary care to PCVs. Because of concern about increasing numbers of cases of severe malaria among PCVs, CDC investigated PCVs' and PCMOs' knowledge, attitudes, and practices regarding chemoprophylaxis to develop recommendations to improve adherence.

During August 19–September 30, 2013, anonymized Internet surveys assessing knowledge about, experience with, and perceptions of malaria and chemoprophylaxis were administered to PCVs and PCMOs serving in 18 African countries where antimalarial chemoprophylaxis is uniformly recommended. PCVs reporting taking daily medications at any time each day or taking weekly medications with no more than 8 days between doses were defined as adherent. Survey data were analyzed to identify opportunities for program improvement.

Responses were received from 974 PCVs and 47 PCMOs, yielding response rates of 42% and 90%, respectively. A total of 447 (47%) PCVs reported being prescribed mefloquine, whereas 391 (41%) were prescribed doxycycline, and 120 (13%) were prescribed atovaquone-proguanil. Adherence was reported by 612 (73%) PCVs and was highest among those prescribed atovaquone-proguanil (92 [88%]); 277 (82%) of those prescribed doxycycline and 243 (62%) of those prescribed mefloquine reported adherence. The most common reasons for nonadherence were forgetting to take chemoprophylaxis (576 [90%]), usually during in-country travel (287 [50%]); fear of long-term adverse effects (349 [54%]); and current adverse effects (324 [51%]). A total of 228 (23%) PCVs were not worried about malaria, mostly because they believed malaria was a minor illness (192 [84%]). Twenty-six (76%) of responding PCMOs indicated Peace Corps policy regarding chemoprophylaxis improved their ability to prevent malaria, and 44 (94%) appropriately indicated that known side effects were important reasons for changing chemoprophylaxis.

TABLE. Drugs for malaria chemoprophylaxis in travelers to Africa

Prophylaxis	Dosing	Cost per month*	Side effect profile
Mefloquine	Weekly	$53	Neuropsychiatric
Doxycycline	Daily (with food)	$32	Skin/gastrointestinal, vaginal candidiasis
Atovaquone-proguanil	Daily	$236	Few side effects

* Source: Adachi K, Coleman MS, Khan N, et al. Economics of malaria prevention in US travelers to West Africa. Clin Infect Dis 2014;58:11–21.

The findings in this report are subject to at least four limitations. First, the response rate among PCVs was only 42%, and nonresponse bias might have affected the results. For example, PCVs without strong feelings about chemoprophylaxis or preventive medicine might have been less likely to participate. Second, because the survey was administered using the Internet, selection bias might have occurred (e.g., selecting for PCVs in urban areas or those with Internet-enabled mobile devices). Third, because PCVs knew they were expected to be adherent to chemoprophylaxis, social desirability bias might have occurred. Finally, the exclusion of respondents from countries with geographically heterogeneous recommendations regarding chemoprophylaxis might have selected for PCVs exposed to fewer conflicting recommendations about the need for chemoprophylaxis.

In this survey, chemoprophylaxis adherence was reported by 73% of PCVs, and 54% and 51% of nonadherent PCVs reported fears of long-term adverse effects and current side effects, respectively. PCMOs recognized that chemoprophylaxis should be changed for known side effects. Changing chemoprophylaxis because of side effects might improve adherence, and the Peace Corps has already made changes to its policy that simplify this process and strengthen PCVs' and PCMOs' malaria education. For example, in December 2012, policy was changed from recommending mefloquine

as first-line chemoprophylaxis to recommending all options equally. Additionally, the training curriculum delivered by PCMOs to PCVs has been updated and standardized (Barry G. Simon, MD, Peace Corps, personal communication, August 2013). Further interventions might include reminders for PCVs, additional education about chemoprophylaxis safety and malaria risk, and continued support for improved PCV-PCMO communication.

Since 1961, seven PCVs have died from malaria infections acquired during Peace Corps service, and malaria case rates among PCVs have reached as high as 18 cases per 100 volunteer years during the period 2009–2012 (*3*). CDC has previously assisted Peace Corps by serving as a reference laboratory for the diagnosis of malaria by blood smear and the diagnosis of mefloquine prophylaxis failure by determining blood mefloquine levels (*4*). CDC continues to work with Peace Corps toward improving PCV knowledge about and adherence to malaria chemoprophylaxis.

[1]EIS officer, CDC; [2]Malaria Branch, Division of Parasitic Diseases and Malaria, Center for Global Health, CDC (Corresponding author: Keren Landman, klandman@cdc.gov, 404-718-4796)

References

1. Chen LH, Wilson ME, Schlagenhauf P. Prevention of malaria in long-term travelers. JAMA 2006;296:2234–44.
2. Peace Corps Office of Health Services. Technical guideline 840: prevention of malaria. Washington, DC: Peace Corps Office of Health Services; 2013.
3. Peace Corps Office of Health Services. Health of the volunteer [multiple editions]. Washington, DC: Peace Corps Office of Health Services; 2009–2012.
4. Lobel HO, Varma JK, Miani M, et al. Monitoring for mefloquine-resistant *Plasmodium falciparum* in Africa: implications for travelers' health. Am J Trop Med Hyg 1998;59:129–32.

Announcement

Recommendation Regarding Increasing Vaccination Rates Through Use of Immunization Information Systems — Community Preventive Services Task Force

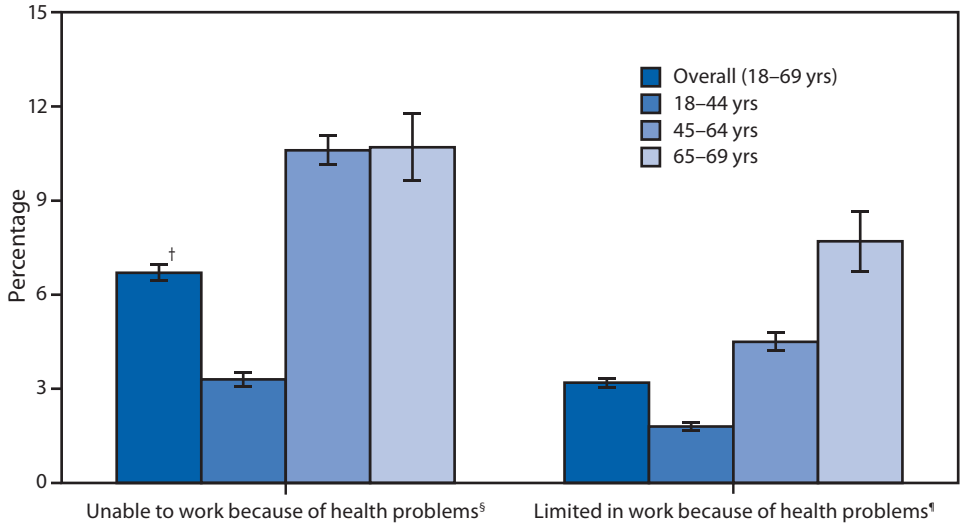
The Community Preventive Services Task Force recently posted new information on its website: "Increasing Appropriate Vaccination: Immunization Information Systems." The information is available at http://www.thecommunityguide.org/vaccines/imminfosystems.html.

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

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage of Adults Aged 18–69 Years With a Limitation in Their Ability to Work Because of Health Problems, by Age Group — National Health Interview Survey,* United States, 2012



* Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population. Persons with unknown work limitation status were excluded from the denominators.
† 95% confidence interval.
§ Based on responses to the question, "Does a physical, mental, or emotional problem now keep [family members aged ≥18 years] from working at a job or business?" Respondents were asked to answer regarding themselves and other family members living in the same household.
¶ For persons able to work, based on responses to the question, "Are [family members aged ≥18 years] limited in the kind or amount of work they can do because of a physical, mental, or emotional problem?" Respondents were asked to answer regarding themselves and other family members living in the same household.

In 2012, approximately 7% of adults aged 18–69 years were unable to work, and approximately 3% were limited in their ability to work because of health problems. Adults aged 45–64 years and 65–69 years were about three times more likely than adults aged 18–44 years to be unable to work because of health problems. The percentage of adults limited in their ability to work because of health problems also increased with age.

Source: Adams PF, Kirzinger WK, Martinez ME. Summary health statistics for the U.S. population: National Health Interview Survey; 2012. Vital Health Stat 2013;10(259).

Reported by: Patricia F. Adams, pfa1@cdc.gov, 301-458-4063; Whitney K. Kirzinger, MPH; Michael E. Martinez, MPH, MHSA.

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*'s free subscription page at *http://www.cdc.gov/mmwr/mmwrsubscribe.html*. Paper copy subscriptions are available through the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402; telephone 202-512-1800.

Data presented by the Notifiable Disease Data Team and 122 Cities Mortality Data Team in the weekly *MMWR* are provisional, based on weekly reports to CDC by state health departments. Address all inquiries about the *MMWR* Series, including material to be considered for publication, to Editor, *MMWR* Series, Mailstop E-90, CDC, 1600 Clifton Rd., N.E., Atlanta, GA 30329-4027 or to *mmwrq@cdc.gov.*

U.S. Government Printing Office: 2014-723-032/01061 Region IV ISSN: 0149-2195