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Prevalence of Sexual Violence Against Children and Use of Social Services — Seven Countries, 2007–2013

Steven A. Sumner, MD[1,2]; James A. Mercy, PhD[1]; Janet Saul, PhD[3]; Nozipho Motsa-Nzuza[4]; Gideon Kwesigabo, PhD[5]; Robert Buluma, MAEPM[6]; Louis H. Marcelin, PhD[7]; Hang Lina[8]; Mary Shawa, PhD[9]; Michele Moloney-Kitts, MSN[10]; Theresa Kilbane, MA[11]; Clara Sommarin, MA[11]; Daniela P. Ligiero, PhD[12]; Kathryn Brookmeyer, PhD[13]; Laura Chiang, MA[1]; Veronica Lea, MPH[1]; Juliette Lee, MPH[1]; Howard Kress, PhD[1]; Susan D. Hillis, PhD[1] (Author affiliations at end of text)

Sexual violence against children erodes the strong foundation that children require for leading healthy and productive lives. Globally, studies show that exposure to violence during childhood can increase vulnerability to a broad range of mental and physical health problems, ranging from depression and unwanted pregnancy to cardiovascular disease, diabetes, and sexually transmitted diseases, including human immunodeficiency virus (HIV) (*1*,*2*). Despite this, in many countries, the extent of sexual violence against children is unknown; estimates are needed to stimulate prevention and response efforts and to monitor progress. Consequently, CDC, as a member of the global public-private partnership known as Together for Girls,* collaborated with Cambodia, Haiti, Kenya, Malawi, Swaziland, Tanzania, and Zimbabwe to conduct national household surveys of children and youth aged 13–24 years to measure the extent of violence against children. The lifetime prevalence of experiencing any form of sexual violence in childhood ranged from 4.4% among females in Cambodia to 37.6% among females in Swaziland, with prevalence in most countries greater than 25.0%. In most countries surveyed, the proportion of victims that received services, including health and child protective services, was ≤10.0%. Both prevention and response strategies for sexual violence are needed.

During 2007–2013, CDC and UNICEF, in partnership with host country governments, communities, and academic institutions developed and administered Violence Against Children Surveys (VACS) in seven countries. The first VACS were administered in Swaziland in 2007; most recently, VACS were administered in Malawi in 2013. Protocols were approved by host country and CDC institutional review boards. VACS are a multistage cluster survey with national coverage, administered by host country survey workers (trained by CDC and local partners) via household, face-to-face interviews. Surveys are initiated at the request of host-country governments. Informed consent/assent is obtained from all participants, special safeguards are incorporated for confidentiality, all participants receive a referral list of available services, and

*Other partners in Together for Girls include host country governments, UNICEF, the President's Emergency Plan for AIDS Relief (PEPFAR), and other organizations. More information is available at http://www.togetherforgirls.org.

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any victims desiring aid are referred for social services. This report focuses on lifetime childhood sexual violence (before age 18 years) among male and female respondents aged 18–24 years. Sexual violence included unwanted touching, unwanted attempted sex, pressured/coerced sex, and forced sex. Sex was specifically defined as vaginal/anal penetration by the penis, hands, fingers, mouth, or objects, or oral penetration by the penis except in Swaziland (penetration of vagina/anus by penis only) and Malawi (oral, vaginal, or anal sex or vaginal/anal object insertion).

Patterns in the prevalence of any form of childhood sexual violence differed by country (Figure). Swaziland had high reported prevalence of sexual violence among females (37.6%). Reported sexual violence among females in Zimbabwe also was high (32.5%), yet Zimbabwe had a considerably lower reported prevalence of sexual violence against males (8.9%). Haiti had high prevalence rates for both males (21.2%) and females (25.7%). Cambodia reported the lowest rates for both females (4.4%) and males (5.6%).

Among respondents who reported childhood sexual violence, the proportion who also reported receiving services, including health care, legal/security aid, or counseling support, was low for both males and females (Table 1). Swaziland had the largest proportion (24.0%) of females receiving services. In a few countries, data were readily available on the proportion of children who sought services in addition to the percentage who received services. In Malawi, 9.6% of female and 5.9% of male victims sought services. In Kenya, 6.8% of females and 2.1% of males attempted to seek services. Finally, in Tanzania, 16.2% of female and 10.8% of male victims sought services. Among all victims in these countries, the proportion receiving services was no higher than 11.7% (female victims in Tanzania).

Completed acts of unwanted sex (i.e., pressured or forced penetrative sex acts) generally were higher among females than males (Table 2). Approximately 17.5% of females in Swaziland reported experiencing an episode of unwanted, completed sex. The lifetime childhood prevalence of unwanted, completed sex also was high among females in Zimbabwe (13.5%), Kenya (11.8%), and Haiti (9.0%).

Discussion

Rates of sexual violence against children are high in many of the countries studied. In most of the countries, >25% of females and >10% of males reported experiencing childhood sexual violence. Furthermore, in approximately 50% of the countries, >10% of females reported experiencing completed, unwanted, penetrative sex. In spite of this, few children sought services after the abuse, and not all who sought services received them.

The findings in this report present the results of a broad international collaboration to address sexual violence; such violence is both a fundamental violation of children's rights and a major risk factor for a wide range of illnesses. The first step in addressing violence against children has been to determine comparable international estimates of the magnitude of the problem. Most previous studies have had some important limitations as they mainly focused on school-based populations;

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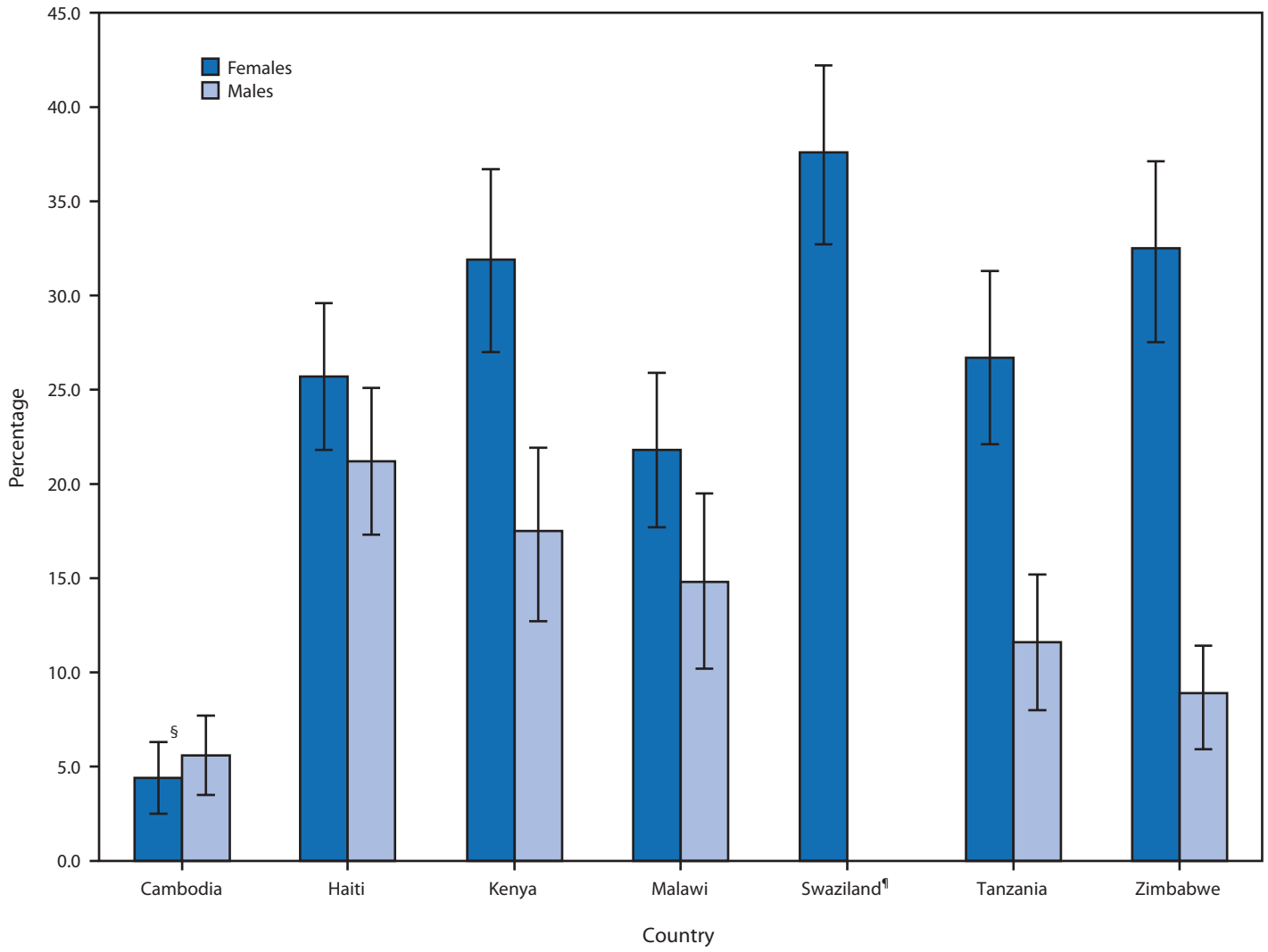
FIGURE. Lifetime prevalence of experiencing any form of sexual violence* before age 18 years among respondents aged 18–24 years, by country†



* Any sexual violence includes unwanted sexual touching, unwanted attempted sex, pressured/coerced sex, or forced sex.
† All numbers represent weighted percentages.
§ 95% confidence interval.
¶ In Swaziland, only females were surveyed.

however, these children might not be fully representative of a nation's youth (*3*).

Accurately quantifying and then addressing sexual violence is integral to achieving several major global health aims, including HIV prevention. The research on child sexual violence presented in this report was conducted in several countries with generalized HIV epidemics that are partnered with the President's Emergency Plan for AIDS Relief. Studies have linked experiencing violence to later high-risk sexual activities, including further sexual exploitation, multiple sex partners, experience or perpetration of rape, unwanted pregnancy, and HIV acquisition (*1*,*4*,*5*). It is essential to target sexual violence as a component of HIV and other disease prevention strategies.

Beyond HIV and other sexually transmitted diseases, experiencing violence as a child has been linked with several noncommunicable diseases including heart disease, cancer, diabetes, and tobacco, alcohol, and drug addiction, among others (*2*). Internationally, recognition of the importance of addressing noncommunicable diseases in low- and middle-income countries is growing (*6*). Experiencing trauma as a child can contribute to biologic changes, such as altered hormonal responses as well as mental illness, such as depression, or other psychological changes like poor social relations and low self-esteem, all of which elevate

TABLE 1. Percentage of persons aged 18–24 years who received services among those who experienced any form of sexual violence when aged <18 years, by country — seven countries, 2007–2013

	Females		Males	
Country	%	(95% CI)	%	(95% CI)
Cambodia	NA	NA	NA	NA
Haiti*	10.0	(1.9–18.1)	6.6	(1.9–11.2)
Kenya	3.4	(0.0–7.0)	0.4	(0.0–1.3)
Malawi†	9.0	(0.0–22.8)	5.9	(0.0–11.7)
Swaziland	24.0	(18.0–30.1)	—§	—§
Tanzania	11.7	(4.6–18.9)	4.9	(0.0–14.1)
Zimbabwe	2.7	(0.4–5.0)	2.4	(0.0–5.5)

Abbreviations: CI = confidence interval; NA = data not available.
* Defined as talking to or receiving services from a professional health care worker, legal personnel, security or police service, or professional counselor.
† Defined as receiving help from a hospital, clinic, police station, helpline, social welfare, or legal office.
§ In Swaziland, only females were surveyed.

TABLE 2. Lifetime prevalence of experiencing unwanted completed sex* before age 18 years among survey respondents aged 18–24 years, by country† — seven countries, 2007–2013

	Females§		Males§	
Country	%	(95% CI)	%	(95% CI)
Cambodia	1.5	(0.3–2.8)	0.2	(0.0–0.5)
Haiti	9.0	(6.3–11.8)	7.6	(5.1–10.1)
Kenya	11.8	(8.5–15.2)	3.6	(1.6–5.6)
Malawi	6.7	(3.7–9.8)	1.9	(0.3–3.6)
Swaziland	17.5	(13.8–21.2)	—¶	—¶
Tanzania	6.1	(3.3–8.8)	2.7	(0.8–4.7)
Zimbabwe	13.5	(10.3–16.6)	1.8	(0.8–2.8)

Abbreviation: CI = confidence interval.
* Unwanted completed sex includes pressured/coerced sex and forced sex.
† Survey years, total survey respondents, and response rates detailed in country reports available at http://www.cdc.gov/violenceprevention/vacs/vacs-reports.html.
§ Numbers represent weighted percentages.
¶ In Swaziland, only females were surveyed.

risk for developing chronic diseases (*7*). Primary prevention of sexual violence can help avert some of these long-lasting and often treatment-resistant consequences.

Despite myriad adverse effects of sexual violence, in this study, most persons who reported experiencing it during childhood did not receive services for their abuse. From a limited number of countries, it appeared that few children even seek services, possibly because they are not aware of service availability, services may not be readily available, or stigma may exist. Although the control of and response to violence traditionally has been seen as the responsibility of law enforcement and social welfare, health sectors can integrate violence prevention and care into routine programmatic activities, building clear links to social services to achieve maximal benefit for various health measures. For example, improved identification of those experiencing violence and the subsequent delivery of counseling, emergency housing, or legal/protection assistance might aid victims. The results of this study provide nationally representative estimates by which countries can measure their progress in reducing childhood violence.

What is already known on this topic?

Preventing sexual violence against children is essential. Childhood victims of sexual violence are at a significantly increased risk for numerous adverse health outcomes ranging from HIV acquisition to poor mental health and chronic disease development.

What is added by this report?

The prevalence of childhood sexual violence among females was ≥25% in five of seven countries surveyed. Among males in four of six countries, there was a prevalence of childhood sexual violence ≥11%. Despite the prevalence, the proportion of victims receiving service was ≤10% in most countries surveyed.

What are the implications for public health practice?

Sexual violence against children is common yet most children go unaided. Countries should work to assess, respond to, and prevent childhood sexual violence. THRIVES, a broad technical package, can help countries identify programs and strategies than can prevent and treat sexual violence.

Research on both the primary prevention of sexual violence and treatment of its consequences largely has focused on awareness-raising and educational interventions or therapy-based approaches (*8*,*9*). The prevention of sexual violence and the promotion of safe, stable, and nurturing relationships and environments for children need more research, as does the assessment of other social, structural/environmental, or clinical approaches. VACS are creating a foundation for such actions. As part of the arrangements to execute VACS, host countries develop response plans based on survey findings. Country-level responses have included legislation, school-based educational curriculum, media outreach, service provision strategies, and an increase in the workforce capacity of clinicians, police, social workers, and teachers, among others. Thus, beyond simply disseminating information, VACS have a built-in mechanism intended to raise awareness, catalyze action, and effect change. THRIVES is a technical package that can help countries in identifying programs and policies that are effective in preventing and responding to violence against children (Box).

The findings in this report are subject to at least four limitations. First, recall bias might be present, particularly for remote episodes of abuse. Second, limited disclosure might have occurred because of the sensitive nature of the subject. Third, children not residing in households (namely, street children) are not included. Lastly, data from some countries might no longer be representative of current levels of violence of services because of the year of data collection.

The Together for Girls public-private partnership, which includes technical expertise from the World Health

BOX. THRIVES,* strategies to help countries reduce violence against children — CDC, 2015

THRIVES represents a select group of complementary strategies that reflect the best available evidence to help countries reduce violence against children. These strategies cross health, social services, education, finance, and justice sectors:

- Training in parenting
  Increase bonding and positive parent-child interactions, and reduce harsh and violent parenting practices.
- Household economic strengthening
  Decrease violence through use of cash transfers and savings/loan programs together with gender norms and/or equity training.
- Reduced violence through protective policies
  Promote laws or regulations (e.g., prohibit sexual abuse/exploitation/violent punishment; regulate alcohol).
- Improved services
  Support counseling services that are effective in reducing trauma-related symptoms.
- Values and norms that protect children
  Change harmful attitudes and beliefs through interventions (e.g., bystander programs, campaigns, small group/community mobilization programs).
- Education and life skills
  Increase school enrollment/attendance and build life skills with programs that empower girls, prevent dating violence, and prevent rape.
- Surveillance and evaluation
  Monitor and evaluate periodically to manage and improve THRIVES-based programs and policies after implementation.

*Additional information available at http://www.cdc.gov/violenceprevention/vacs/resources.html.

Organization, the Joint United Nations Programme on HIV/AIDS, UNICEF, CDC, USAID, the Presidents Emergency Plan for AIDS Relief, and other partners, has identified a multifaceted strategy to begin to address sexual violence (*10*). The first objective is to gather accurate surveillance data. Subsequent important responses identified by the partnership include supporting government and civil society activities to prevent violence, strengthening local government response plans and institutional capacity, improving public awareness, ensuring the creation of appropriate national legislation, mobilizing and promoting community-based strategies, and improving access to and quality of services available to those experiencing violence (*10*). VACS, as a key tool of a broad, international collaboration demonstrates the feasibility of a multisectoral approach to the investigation and prevention of childhood violence.

[1]Division of Violence Prevention, National Center for Injury Prevention and Control, CDC; [2]Epidemic Intelligence Service, CDC; [3]Division of Global HIV/AIDS, Center for Global Health, CDC; [4]Ministry of Health, Swaziland; [5]School of Public Health and Social Sciences, Muhimbili University of Health and Allied Sciences, Tanzania; [6]Kenya National Bureau of Statistics; [7]Interuniversity Institute for Research and Development, Haiti; [8]National Institute of Statistics, Cambodia Ministry of Planning; [9]Malawi Ministry of Gender, Children and Social Welfare; [10]Together for Girls; [11]Child Protection Programme Division, United Nations Children's Fund; [12]Office of the Global AIDS Coordinator, U.S. Department of State; [13]Division of STD Prevention, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention.

Corresponding author: Steven Sumner, SSumner@cdc.gov, 770-488-3742.

References

1. Jewkes R, Sen P, Garcia-Moreno C. Sexual violence [Chapter 6]. In: Krug EG, Dahlberg LL, Mercy JA, Zwi AB, Lozano R, eds. World report on violence and health. Geneva, Switzerland: World Health Organization; 2002:147–82.
2. Felitti VJ, Anda RF, Nordenberg D, et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. Am J Prev Med 1998;14:245–58.
3. Brown DW, Riley L, Butchart A, Meddings DR, Kann L, Harvey AP. Exposure to physical and sexual violence and adverse health behaviours in African children: results from the Global School-based Student Health Survey. Bull World Health Organ 2009;87:447–55.
4. Jewkes R, Fulu E, Roselli T, Garcia-Moreno C. Prevalence of and factors associated with non-partner rape perpetration: findings from the UN Multi-country Cross-sectional Study on Men and Violence in Asia and the Pacific. Lancet Glob Health 2013;1:e208–18.
5. Mimiaga MJ, Noonan E, Donnell D, et al. Childhood sexual abuse is highly associated with HIV risk-taking behavior and infection among MSM in the EXPLORE Study. J Acquir Immune Defic Syndr 2009;51:340–8.
6. Beaglehole R, Ebrahim S, Reddy S, Voûte J, Leeder S; Chronic Disease Action Group. Prevention of chronic diseases: a call to action. Lancet 2007;370:2152–7.
7. Noll JG, Zeller MH, Trickett PK, Putnam FW. Obesity risk for female victims of childhood sexual abuse: a prospective study. Pediatrics 2007;120:e61–7.
8. DeGue S, Valle LA, Holt MK, Massetti GM, Matjasko JL, Tharp AT. A systematic review of primary prevention strategies for sexual violence perpetration. Aggress Violent Behav 2014;19:346–62.
9. Bass JK, Annan J, McIvor Murray S, et al. Controlled trial of psychotherapy for Congolese survivors of sexual violence. N Engl J Med 2013;368:2182–91.
10. Together for Girls. Technical Action Framework. Together for Girls. 2011. Available at http://www.togetherforgirls.org/wp-content/uploads/Together-for-Girls-Technical-Framework.pdf.

Hepatitis B Screening and Prevalence Among Resettled Refugees — United States, 2006–2011

Kevin C. Scott, MD[1]; Eboni M. Taylor, PhD[2]; Blain Mamo, MPH[3]; Nathaniel D. Herr, MD[4]; Peter J. Cronkright, MD[5]; Katherine Yun, MD[6]; Marc Altshuler, MD[1]; Sharmila Shetty, MD[2] (Author affiliations at end of text)

Globally, more than two billion persons have been infected at some time with the hepatitis B virus (HBV) (*1*), and approximately 3.5 million refugees have chronic HBV infection (*2*). The endemicity of HBV varies by region (*3*). Because chronic hepatitis B is infectious and persons with chronic infection benefit from treatment, CDC recommends screening for HBV among all refugees who originate in countries where the prevalence of hepatitis B surface antigen (HBsAg; a marker for acute or chronic infection) is ≥2% or who are at risk for HBV because of personal characteristics such as injection drug use or household contact with an individual with HBV infection (*4*). Currently, almost all refugees are routinely screened for hepatitis B. However, prevalence rates of HBV infection in refugee populations recently resettled in the United States have not been determined. A multisite, retrospective study was performed to evaluate the prevalence of past HBV infection, current infection, and immunity among refugees resettled in the United States; to better characterize the burden of hepatitis B in this population; and to inform screening recommendations. The study incorporated surveillance data from a large state refugee health program and chart reviews from three U.S. sites that conduct medical screenings of refugees. The prevalence of HBV infection (current or past as determined by available titer levels) varied among refugees originating in different countries and was higher among Burmese refugees than among refugees from Bhutan or Iraq. Current or past HBV infection was also higher among adults (aged >18 years) and male refugees. These data might help inform planning by states and resettlement agencies, as well as screening decisions by health care providers.

Data for this study were collected from four sites: the Minnesota Department of Health, the State University of New York-Upstate Medical University (SUNY-Upstate), Thomas Jefferson University, and Yale-New Haven Hospital. The Minnesota Department of Health contributed surveillance data spanning 2008–2011, while each of the clinical sites provided retrospective chart review data from multiyear periods during 2006–2011, based on data availability. HBV prevalence rates among the three largest refugee groups (Bhutanese, Burmese, and Iraqi) that resettled in the United States over this period were specifically evaluated. Institutional review board approval or exemption from review was obtained at each participating site.

On the basis of the hepatitis B antibody and antigen data, the HBV status of refugees was characterized as: 1) active infection, 2) past infection without demonstration of active disease or immunity, 3) past infection with demonstration of immunity, 4) demonstration of immunity without past exposure, or 5) no evidence of past exposure or current immunity (Table 1).

Each site submitted aggregate de-identified data on HBsAg for adults (aged >18 years) and children (aged ≤18 years). Minnesota Department of Health, Thomas Jefferson University, and Yale-New Haven Hospital also submitted data on hepatitis B surface antibody (HBsAb) and hepatitis B core antibody (HBcAb), which permitted more comprehensive evaluation of current HBV status and previous exposure. In addition, both Minnesota Department of Health and Thomas Jefferson University provided information on HBV antibody titers by sex. Data from each site were compiled demographically by age, sex, and country of origin (Table 2).

Data for prevalence of HBV infection in refugees resettled in the United States were analyzed by age, sex, and country of origin using separate Z-tests for population proportions ($p = 0.05$) (Table 3). The 6,175 refugees who received hepatitis B screening at the four sites represent more than 95% of all refugees evaluated at each site during the periods for which data were collected. Approximately 51% of screened refugees for whom sex was reported were male, and 59% of refugees included in the study were adults (aged >18 years) (Table 2). Burmese refugees made up the largest single refugee group (39%), followed by Iraqis (13%), and Bhutanese refugees (10%). Data for other smaller refugee groups, including refugees from Eritrea, Ethiopia, Somalia, and the former Soviet Union, were combined for this study.

TABLE 1. Classification of HBV status and exposure

HBV status	Exposure	HBsAb	HBsAg	HBcAb
Chronic/Acute HBV Infection	Current disease	-	+	+/-
Uncertain Current HBV Status	Past infection	-	-	+
HBV Immune	Past infection	+	-	+
	No known HBV infection	+	-	-
No HBV infection, Non-Immune	No known HBV infection	-	-	-

Abbreviations: HBV = hepatitis B virus; HBsAb = hepatitis B surface antibody; HBsAg = hepatitis B surface antigen; HBcAb = hepatitis B core antibody.

TABLE 2. Demographics of resettled refugees screened at four sites — United States, 2006–2011

Characteristic	MDH		SUNY-Upstate		TJU		YNHH		All Sites	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Total screened	**5,045**	**(100)**	**236**	**(100)**	**657**	**(100)**	**237**	**(100)**	**6,175**	**(100)**
Male*	2,558	(51)	NA	NA	348	(53)	NA	NA	2,906	(51)
Aged >18 yrs	2,920	(58)	94	(40)	479	(73)	150	(63)	3,661	(59)
Country of origin										
Bhutan	431	(8)	94	(40)	117	(18)	2	(1)	644	(10)
Burma	2,177	(43)	96	(41)	125	(19)	0	(0)	2,398	(39)
Iraq	406	(8)	22	(9)	253	(39)	116	(49)	797	(13)
Other†	2,031	(40)	24	(10)	162	(25)	119	(50)	2,336	(38)

Abbreviations: MDH = Minnesota Department of Health; NA = not available; SUNY-Upstate = State University of New York–Upstate Medical University; TJU = Thomas Jefferson University; YNHH = Yale-New Haven Hospital.
* Total for sex includes only data submitted by MDH and TJU.
† Includes all other refugee groups screened at participating sites, including those from Eritrea, Ethiopia, Somalia, and the former Soviet Union.

Data were analyzed for HBV infection status and confirmed past or current infection by country of origin, sex, and age (Table 3). Prevalence of any past HBV infection and of chronic or acute infection was significantly higher for Burmese (36.0% past; 9.4% chronic or acute) and other refugees (15.0%; 5.0%), compared with Bhutanese (5.7%; 0.9%) and Iraqi refugees (3.8%; 0.4%). Prevalence of past HBV infection among male refugees exceeded that for female refugees (23.8% and 19.5%, respectively; p<0.001).

Prevalence of any past HBV or chronic infection was higher in adults than in children (28.6% and 9.5%, respectively; p<0.001). Consistent with the implementation of routine childhood hepatitis B immunization programs for refugees from Bhutan,* Burma,† and Iraq,§ rates of immunity among refugees without confirmed past infection were significantly higher among children than adults (51.8% and 20.9%, respectively; p<0.001).

Discussion

Refugees are almost universally screened for HBV infection on arrival in the United States (>95% of refugees evaluated at participating sites during the study period), in part, because of limited data on the prevalence of HBV infection among different refugee groups. The prevalence of past infection among Burmese, Bhutanese, and Iraqi refugees screened by participating sites at the time of U.S. resettlement was 36.0%, 5.7%, and 3.8%, respectively. Notably, the prevalence of acute or chronic HBV infection in Bhutanese refugees observed in this study more closely tracks rates seen in Nepal than in Bhutan (approximately 1% versus >5% prevalence of active HBV); most of these refugees have been living in refugee camps located in Nepal since the mid-1990s or were born in these camps (*5*). This highlights the importance of countries of transit as well as countries of origin to refugee health. The prevalence of chronic hepatitis B in Iraqi refugees is consistent with that reported for Iraqi refugees in San Diego, California (*6*).

Both active HBV infection and past infection rates were significantly higher among men than women. The reasons for this disparity are unclear, likely multifactorial, and should be explored further. Although HBV exposure among refugee children is lower than among adults, HBV infection remains an important disease among refugee children and should be evaluated in those who arrive from countries with prevalence rates ≥2%. The high rates of immunity (57.2%) among children without past infection with HBV (HBcAb negative) supports the value of overseas immunization programs, including the WHO Expanded Programme on Immunization and the CDC-Bureau of Population, Refugees, and Migration (U.S. State Department) predeparture immunization program for refugees in contributing to reduced susceptibility to, and rates of, HBV infection among refugee populations. Public health officials and health providers can use these results to target outreach efforts and screening for populations found to be at increased risk for HBV infection.

The findings in this report are subject to at least two limitations. First, although the sample is relatively large, it represents only a portion of refugees resettled in the United States during the past 5 years. Although it does contain adequate numbers of refugees from Bhutan, Burma, and Iraq

* The Association of Medical Doctors of Asia-Nepal provides routine immunizations in Nepali refugee camps for Bhutanese refugees, including hepatitis B vaccination. Additional information available at http://www.cdc.gov/immigrantrefugeehealth/pdf/bhutanese-health-profile.pdf.

† Lack of legal recognition, limited health infrastructure, and communication difficulties have historically limited hepatitis B vaccination in Burmese refugees. However, through collaboration between CDC and the U.S. State Department's Bureau of Population, Refugees, and Migration, U.S.-bound Burmese refugees in Malaysia and Thailand have had consistent access to pre-departure hepatitis B vaccination since 9/2013 and 12/2012, respectively. Additional information available at http://www.cdc.gov/immigrantrefugeehealth/guidelines/overseas/interventions/immunizations-schedules.html.

§ Iraq provided universal hepatitis B vaccination before recent conflicts. Hepatitis B vaccination rates among young Iraqi refugees in Syria in 2007 still exceeded 80%, and more than 50% of Iraqi refugees aged <5 years in Jordan had received vaccination. Additional information available at http://www.cdc.gov/immigrantrefugeehealth/pdf/iraqi-refugee-health-profile.pdf.

TABLE 3. Hepatitis B status in resettled refugees screened at four sites* — United States, 2006–2011

Characteristic	Chronic or acute HBV infection (%)	Immune		Non-Immune		Current or past HBV infection§ (%)
		Past infection (%)†	No evidence of infection (%)	Past infection (%)†	No evidence of infection (%)	
All refugees	**5.7**	**12.0**	**33.6**	**3.0**	**41.9**	**20.7**
Sex¶						
Male	7.3**	13.1	34.0	3.4	42.2	23.8**
Female	4.6	12.1	37.2	2.8	43.3	19.5
Unknown	1.9	4.9	10.1	2.5	31.9	9.3
Age (yrs)						
>18	7.3**	16.4	20.9	4.8	47.9	28.6**
≤18	3.4	5.7	51.8	0.4	33.3	9.5
Country of origin						
Bhutan††	0.9	4.0	22.2	0.8	57.5	5.7
Burma††	9.4**	21.8	43.5	4.8	16.7	36.0**
Iraq††	0.4	2.1	22.2	1.3	71.4	3.8
Other††,§§	5.0**	7.6	30.5	2.5	53.5	15.0**

Abbreviation: HBV = hepatitis B virus.

* Data from four sites: Minnesota Department of Health (MDH); State University of New York–Upstate Medical University (SUNY-Upstate); Thomas Jefferson University (TJU); Yale-New Haven Hospital (YNHH).

† Past infection is defined as a positive hepatitis B core antibody, while immunity for the purposes of this study was defined only as confirmed positive hepatitis B surface antibody.

§ Current or past HBV infection includes persons with chronic hepatitis B as well as persons with or without immunity who have documented previous exposure to hepatitis B infection.

¶ Data for sex not available from SUNY-Upstate and YNHH; totals based only on MDH and TJU data.

** Significant at p<0.001.

†† Significant (p<0.001) differences for prevalence of chronic hepatitis B and previous exposure found between the following refugee groups: Bhutan and Burma; Bhutan and other; Iraq and Burma; Iraq and other. No significant differences found between Bhutan and Iraq for prevalence of chronic hepatitis B (p = 0.184) or previous exposure (p = 0.075).

§§ Includes all other refugee groups screened at participating sites.

to enable differentiation of the prevalence of HBV infection among these groups, refugees within each group screened at participating sites might not be representative of the group as a whole. Therefore, these results might not be generalizable to all recently resettled refugees. Second, since resettlement depends on congressional and executive actions, the refugee populations resettled in the future will likely be different from those currently being resettled in the United States. Therefore, additional studies and surveillance efforts will be required to evaluate the prevalence of HBV in these new populations.

Similar heterogeneity in disease prevalence for other diseases (both infectious and noncommunicable) has been demonstrated among other refugee populations. For example, clinically significant vitamin B12 deficiency occurs most commonly among Bhutanese refugees (*7*–*9*), while hypertension and diabetes are prevalent among Iraqi refugees (*6*,*10*). Coupled with these previous findings, data from this analysis highlight the importance of investigating prevalence and evaluating screening guidelines for other diseases based on refugee experience (i.e., both within their countries of origin and resulting from their exposures and lifestyle in transit countries). For local and state public health programs, as well as for refugee communities, such surveillance data hold the promise of making the domestic refugee medical exam more efficient and more useful by identifying the key health concerns of refugees departing from different locations, avoiding missed diagnoses while reducing unnecessary testing, and avoiding under- and over-vaccination.

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What is already known on this topic?

Hepatitis B can cause acute or chronic disease and is a significant public health concern both globally and in the United States. CDC guidelines recommend hepatitis B screening in U.S.-bound refugees from countries with a prevalence of chronic hepatitis B infection ≥2%. However, many U.S. refugee health programs screen refugees universally for hepatitis B.

What is added by this report?

Evidence of active or past hepatitis B infection was found in refugee groups from Bhutan, Burma, Iraq, and other countries and varied significantly by ethnic group. Both active and past infection rates were higher among men than women.

What are the implications for public health practice?

Public health officials and health care providers can use these results to further support overseas immunization programs and to target outreach efforts to populations found to be at increased risk for HBV infection.

[1]Thomas Jefferson University, Philadelphia, Pennsylvania; [2]Division of Global Migration and Quarantine, National Center for Emerging and Zoonotic Infectious Diseases, CDC; [3]Minnesota Department of Health, St. Paul, Minnesota; [4]University of Minnesota, Minneapolis, Minnesota; [5]SUNY-Upstate Medical University, Syracuse, New York; [6]The Children's Hospital of Philadelphia, Pennsylvania.

Corresponding author: Kevin C. Scott, Kevin.Scott@jefferson.edu, 617-233-4269.

References

1. Te HS, Jensen DM. Epidemiology of hepatitis B and C viruses: a global overview. Clin Liver Dis 2010;14:1–21.
2. Rossi C, Shrier I, Marshall L, et al. Seroprevalence of chronic hepatitis B virus infection and prior immunity in immigrants and refugees: a systematic review and meta-analysis. PLoS One 2012;7:e44611.
3. World Health Organization. Global alert and response: hepatitis B. Geneva, Switzerland: World Health Organization, Department of Communicable Diseases Surveillance and Response; 2014 Available at http://www.who.int/csr/disease/hepatitis/HepatitisB_whocdscsrlyo2002_2.pdf?ua=1.
4. CDC. Screening for hepatitis during the domestic medical examination for newly arrived refugees. Atlanta, GA: US Department of Health and Human Services, CDC; 2014. Available at http://www.cdc.gov/immigrantrefugeehealth/pdf/domestic-hepatitis-screening-guidelines.pdf.
5. Zhou YH, Liu FL, Yao ZH, et al. Comparison of HIV-, HBV-, HCV- and co-infection prevalence between Chinese and Burmese intravenous drug users of the China-Myanmar border region. PLoS One 2011;6:e16349.
6. CDC. Health of resettled Iraqi refugees—San Diego County, California, October 2007–September 2009. MMWR Morb Mortal Wkly Rep 2010;59:1614–8.
7. CDC. Vitamin B12 deficiency in resettled Bhutanese refugees—United States, 2008–2011. MMWR Morb Mortal Wkly Rep 2011;60:343–6.
8. Benson J, Phillips C, Kay M, et al. Low vitamin B12 levels among newly-arrived refugees from Bhutan, Iran and Afghanistan: a multicentre Australian study. PLoS One 2013;8:e57998.
9. Kumar GS, Varma S, Saenger MS, Burleson M, Kohrt BA, Cantey P. Noninfectious disease among the Bhutanese refugee population at a United States urban clinic. J Immigr Minor Health 2014;16:922–5.
10. Yanni EA, Naoum M, Odeh N, Han P, Coleman M, Burke H. The health profile and chronic diseases comorbidities of US-bound Iraqi refugees screened by the International Organization for Migration in Jordan: 2007-2009. J Immigr Minor Health 2013;15:1–9.

Rapid Large-Scale Deployment of Tuberculosis Testing in a High School — Riverside County, California, 2013–2014

Cameron Kaiser, MD[1]; Barbara Cole, MSN[1]; Kimberly Saruwatari, MPH[1]; Ramon Leon, MPH[1] (Author affiliations at end of text)

Mycobacterium tuberculosis, the causative agent of tuberculosis (TB), can spread from person to person through the air, which can make contact investigations particularly complex in heavily populated settings such as schools. In November 2013, a student (the index patient) at a southern California high school with approximately 2,000 students and staff members was diagnosed with active pulmonary TB. Because of an unexpectedly high number of positive tuberculin skin test results in the initial contact investigation, testing was extended to the entire school population, which had to be completed before the end of the school term. A total of 1,806 persons were tested in 24 hours. The rapid testing of the entire population of a high school is unusual and led to widespread media attention and community concern, requiring close coordination among branches of the County of Riverside Department of Public Health, local governments, and the school district. The testing resulted in identification of two additional cases of TB; in addition, 72 persons underwent treatment for latent TB infection (LTBI). This incident demonstrates the importance of a coordinated emergency response in a large-scale deployment of rapid testing, including efficiently focused resources, organized testing operations, and effective media relations.

In November 2013, a student aged 14 years in Riverside County was hospitalized with active TB after a multiple-week history of cough, fever, night sweats, and 6-pound (2.7 kg) weight loss. The patient had no notable medical history, was born in the United States, and had a previously nonreactive tuberculin skin test. Upon admission, a radiograph demonstrated cavitary lung disease, and sputum was smear-positive for acid-fast bacilli. The standard four-drug TB treatment with isoniazid, rifampin, ethambutol, and pyrazinamide was promptly initiated and respiratory isolation was maintained from December 18, 2013, to January 8, 2014, when the patient was smear-negative and had received sufficient doses of antimicrobials. *M. tuberculosis* was subsequently identified by culture and was sensitive to all four first-line TB medications; genotyping was not performed. The case was reported to the county public health department, which initiated a contact investigation. The patient was subsequently discharged to continue treatment with the health department's TB clinic. Further investigation determined that a previously known TB patient had been the index patient's babysitter, but that potential exposure had not been reported to the health department.

Initial Contact Investigation

In addition to contact investigation within the index patient's family, investigation of potential contacts at the school required substantial effort because of the index patient's multiple classes. After comparison of class records, the health department's disease control branch identified and performed tuberculin skin testing on 198 persons at an on-campus clinic on December 16, 2013. Of this initial cohort, 59 (29.8%) were positive with an induration >5mm, and all were referred for a chest radiograph. Several preliminary results became available that evening, some with granulomatous disease and one with a large, potentially cavitary mass.

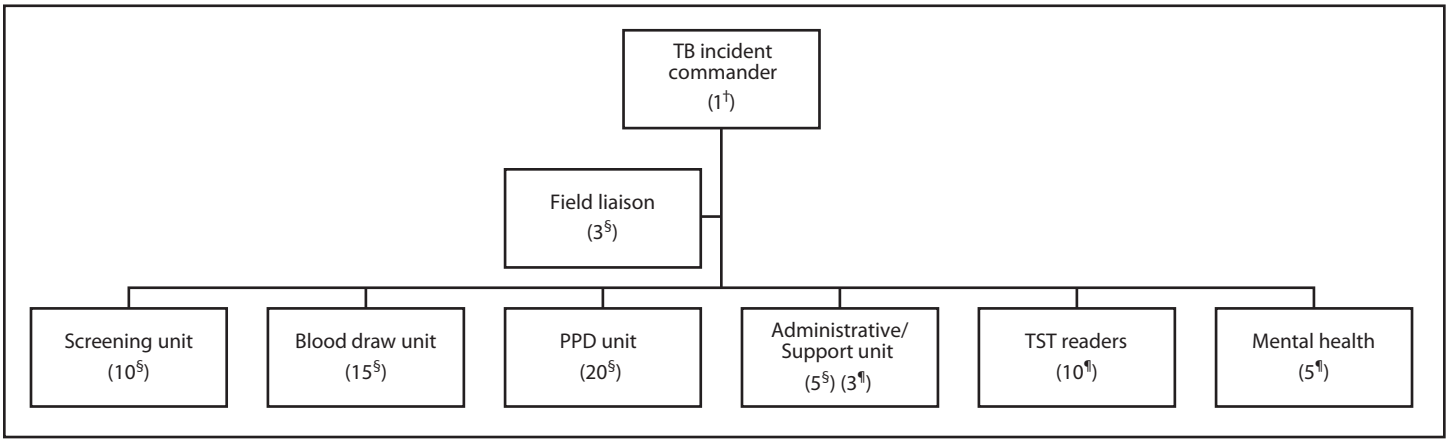
The findings were reviewed the same day by the county public health officer, who determined that sustained transmission could not be ruled out. This necessitated rapid decision-making because the school's winter break was imminent. Only 2 days remained until the end of the school term, and there was concern that students and staff would not be accessible for testing.

Incident Command System

Because of the severe time limitation, the health officer activated the health department's internal protocol for rapid response and instructed the department duty officer to activate the Department Operations Center (DOC). The Incident Command System (ICS) was initiated by the health department's public health emergency preparedness and response branch, headed by the DOC director, and finance, operations, logistics, and planning branches were staffed. DOC members were assigned to coordinate onsite TB testing of school staff members and students on December 20; additional DOC members were assigned to coordinate onsite reading of test results on December 23 (Figure).

The DOC identified the following four objectives: 1) complete the testing of all students and staff members on December 20; 2) ensure a safe and secure environment for response staff, school staff, and students; 3) ensure safety precautions were maintained; and 4) establish and maintain situational awareness of clinic operations. Operational priorities identified by the DOC included sufficient staffing

FIGURE. Organization chart showing Incident Command System staffing* for onsite testing (December 20) and results reading (December 23) in response to a tuberculosis (TB) outbreak in a high school — County of Riverside Department of Public Health, California, 2013



Abbreviations: PPD = purified protein derivative; TST = tuberculin skin test.
* No. of staff members in parentheses.
† December 20 and 23.
§ December 20.
¶ December 23.

for the on-campus health clinic and obtaining sufficient materials for testing. Staffing was secured by pulling a wide cross-section of trained personnel from across the county, facilitated by health department administration, with high school staff members serving under the operations section in the field. Coordination with city and county emergency staff members was facilitated by conference call and onsite liaisons to keep local officials informed.

The public health information officer coordinated press briefings with the school district, county, and city to ensure uniform messaging, and acted as the single point of contact for inquiries. The school pledged full cooperation and mandated all students and staff members to be cleared before returning to school. Written notifications in English and Spanish were sent the same day by the school to advise parents and the school staff of the on-campus clinic.

Through ICS logistics, the DOC worked with the county health care system to acquire sufficient purified protein derivative stocks from internal and external sources to provide tuberculin skin tests for at least 2,000 persons. For students and staff members who were traveling and could not return to have their tests read within the 48-hour timeframe, the department's public health laboratory coordinated staffing and sufficient reagents to perform 400 interferon-gamma release assays (IGRAs), which do not require a return for reading; limited quantities of reagents precluded its use for all tests.

On Friday, December 20, approximately 55 staff members operated the on-campus clinic from 8 a.m. to 3 p.m. In this 7-hour period, 1,494 persons had tuberculin skin tests performed, and 213 had blood drawn for IGRAs. Ninety-nine persons had a history of a previously positive tuberculin skin test and were instead evaluated by nursing staff for symptoms, with referral for a chest radiograph if history suggested disease.

Over the weekend, the public health laboratory processed the 213 IGRAs as an early indicator. Thirteen (6.1%) were positive for TB, and eight (3.8%) were indeterminate.

On Monday, December 23, tuberculin skin tests results for 1,464 of the 1,494 persons tested were read. A total of 133 (9.1%) had >10mm of induration and were referred for radiographs along with the 13 persons with positive IGRA results.

Treatment and Follow-up

The disease control branch of the health department continued to coordinate follow-up of pending test results, including among family members and those who visited outside health care providers. The school continued to require that testing and clearance be completed before readmission. A second testing of the 198 original contacts after the window period had elapsed indicated 10 new converters.

Two of the abnormal radiographs were judged severe enough to consider active disease, one with new-onset pleural effusion, and another with a large, potentially cavitary mass. The first person was hospitalized for workup; no other potential etiology was found, and the patient was started on a standard four-drug antituberculosis regimen. The second patient also was started on TB treatment by the public health officer as an outpatient. Neither demonstrated positive smears or culture results for TB, but both demonstrated marked radiographic improvement at the 2-month mark and completed 4 months of TB treatment for presumptive disease. No other cases were

found. The remaining abnormal radiographs were judged most consistent with healed TB.

Of the remaining positive tests, the 69 persons with positive results in the initial cohort of 198 were offered 12 weekly doses of isoniazid and rifapentine under directly observed therapy for LTBI because of their perceived greater risk for active TB; 35 accepted treatment, and the remainder were lost to follow-up, refused, or visited their personal medical provider. All treatment regimens were successfully completed. The 146 persons with positive results from the second cohort of 1,806 were offered 6 months of isoniazid for LTBI, of whom 37 accepted treatment. Twenty-two persons from the initial cohort were lost to follow-up; 2,004 persons were evaluated in total.

Discussion

Testing an entire high school for TB is uncommon, although a similar event occurred at a Colorado school in 2011, where 1,249 persons were screened (*1*). In that event, the percentage triggering the all-school testing was approximately 35% positive tests from a cohort of 140. In Riverside County, positive TB test rates were expected to range between 10% and 15% in a typical cohort; the 30% rate was considered extraordinary and suggestive of sustained transmission.

The Colorado incident was managed using ICS and 12 separate clinics over 1 month, whereas the Riverside County event demonstrates that the use of ICS can mobilize resources among health departments and their branches in a substantially shorter timeframe. The clearly defined command structure of ICS has been proven to aid resource and information flow and to provide for public communication and coordination with other local agencies (*2*). The rapid deployment and large-scale operation of the clinic required more resources than the public health department had immediately available; ICS logistics was able to obtain additional resources from other departments countywide, with strong support from county government and department administration. Large-scale testing operations might generate large numbers of positive test results, requiring greater resources and prioritization of labor-intensive LTBI regimens. In Riverside County, the number of nurses available for directly observed therapy was limited; therefore, the 12-dose isoniazid-rifapentine option was reserved for those determined at greater risk because of exposure history.

The presence of mental health staff members onsite was particularly important in providing immediate support to students and school staff members. They provided general support to address fears and anxiety brought on by the event and response activities, as well as to those who received positive test results. Prompt counseling and reassurance helped to allay the health fears of those who tested positive and facilitated their quicker evaluation.

What is already known on this topic?

Tuberculosis (TB) can pose a substantial risk in congregate settings, such as schools, care facilities, and prisons. Little evidence base exists regarding when contact investigations should be rapidly expanded.

What is added by this report?

This report describes use of an Incident Command System (ICS) to rapidly deploy a large-scale TB testing operation (1,806 persons tested in a single clinic within 24 hours) after 59 (29.8%) persons in the initial contact investigation cohort of 198 tested positive. A total of 1,494 persons were screened by tuberculin skin testing, with 133 testing positive (9.1%); 213 persons were screened by interferon-gamma release assay testing, with 13 testing positive (6.1%). A total of 37 persons accepted treatment for latent TB infection, and two secondary active TB cases were presumptively identified and treated.

What are the implications for public health practice?

An ICS should be considered as a management and response tool for large-scale TB screenings that might be warranted by abnormally high TB test conversion rates during an initial contact investigation.

Cooperation with the school and city officials was critical for success. The city provided security, and the school provided space for the testing operations; school nursing staff assisted with reading skin tests and performing symptom screening, and the school administration's enforcement of clearance before readmission greatly enhanced testing rates. However, the large open area in which testing was performed might have enabled other persons to infer test results based on the next station persons were sent to. Partitioning or standardized stations with uniform patient flow might be required to improve confidentiality in large testing venues.

Effective media relations also were recognized as an opportunity for improvement. During skin testing and reading, the media were kept off-premises. However, the large number of media inquiries to multiple departments might have been better facilitated with the establishment of a joint information center administered through the DOC.

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Susan Harrington, MS, James Saunders, Sarah Mack, MPH, Michael Osur, MBA, Jose Arballo, Jr., County of Riverside Department of Public Health, Riverside, California.

[1]County of Riverside Department of Public Health, Riverside, California.

Corresponding author: Cameron Kaiser, ckaiser@rivcocha.org, 951-358-7036.

References

1. CDC. Transmission of *Mycobacterium tuberculosis* in a high school and school-based supervision of an isoniazid-rifapentine regimen for preventing tuberculosis—Colorado, 2011–2012. MMWR Morb Mortal Wkly Rep 2013;62:805–9.

2. Adams EH, Scanlon E, Callahan JJ 3rd, Carney MT. Utilization of an incident command system for a public health threat: West Nile virus in Nassau County, New York, 2008. J Public Health Manag Pract 2010;16:309–15.

Impact of Arthritis and Multiple Chronic Conditions on Selected Life Domains — United States, 2013

Jin Qin, ScD[1,2]; Kristina A. Theis, PhD[1]; Kamil E. Barbour, PhD[1]; Charles G. Helmick, MD[1]; Nancy A. Baker, ScD[1]; Teresa J. Brady, PhD[1]
(Author affiliations at end of text)

About half of U.S. adults have at least one chronic health condition, and the prevalence of multiple (two or more) chronic conditions increased from 21.8% in 2001 to 25.5% in 2012 (*1,2*). Chronic conditions profoundly affect quality of life, are leading causes of death and disability, and account for 86% of total health care spending (*3*). Arthritis is a common cause of disability (*4*), one of the most common chronic conditions (*5*), and is included in prevalent combinations of multiple chronic conditions (*1*). To determine the impact of having arthritis alone or as one of multiple chronic conditions on selected important life domains, CDC analyzed data from the 2013 National Health Interview Survey (NHIS). Having one or more chronic conditions was associated with significant and progressively higher prevalences of social participation restriction, serious psychological distress, and work limitations. Adults with arthritis as one of their multiple chronic conditions had higher prevalences of adverse outcomes on all three life domains compared with those with multiple chronic conditions but without arthritis. The high prevalence of arthritis, its common co-occurrence with other chronic conditions, and its significant adverse effect on life domains suggest the importance of considering arthritis in discussions addressing the effect of multiple chronic conditions and interventions needed to reduce that impact among researchers, health care providers, and policy makers.

NHIS uses a complex sampling design to select a representative sample of the U.S. civilian, noninstitutionalized population and collects data continuously throughout the year through the use of in-home interviews. CDC analyzed data from the sample adult component, which includes self-reported data from randomly selected adults (aged ≥18 years) from sampled families. The conditional and final response rates in the sample adult component were 81.7% and 61.2%, respectively.* Doctor-diagnosed arthritis was defined as a "yes" response to the question, "Have you ever been told by a doctor or other health professional that you have some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?" Nine other doctor-diagnosed chronic conditions were defined similarly through self-report: hypertension, heart diseases (coronary heart disease, angina pectoris, heart attack, and any other heart condition or heart disease), stroke, diabetes, asthma, cancer, weak or failing kidneys, hepatitis, and chronic obstructive pulmonary disease.† These chronic conditions were selected because 1) they are common comorbidities of arthritis; 2) they are among the leading causes of death and disability; 3) the risks for many conditions can be reduced through modifiable lifestyle factors and public health interventions; and 4) information about them is available in NHIS 2013.

Adults in the 2013 NHIS study population (n = 34,506) were classified into five mutually exclusive categories of chronic condition status: no condition, arthritis only, one nonarthritis condition, ≥2 chronic conditions with one being arthritis, and ≥2 nonarthritis chronic conditions. Six covariates included age group, sex, race/ethnicity, educational attainment level, body mass index (BMI) categories, and smoking status.§ The three life domains selected as outcomes were 1) social participation restriction, defined by answers of "very difficult" or "can't do at all" to questions¶ about ability to participate in social activities outside the home (specifically, to go shopping, go to movies, go to sporting events; attend clubs, parties, or meetings; or visit friends) and coded as yes/no; 2) serious psychological distress, defined by Kessler 6 scale (*6*)** and coded as yes/no; and 3) work limitations, defined in two ways as either work

* Survey description documents are available at http://www.cdc.gov/nchs/nhis/quest_data_related_1997_forward.htm.

† Hypertension, coronary heart disease, angina pectoris, heart attack, and any other heart condition or heart disease, stroke, asthma, cancer, diabetes, hepatitis, chronic obstructive pulmonary disease, and emphysema were ascertained by a "yes" response the question, "Have you ever been told by a doctor or other health professional that you had [condition]?" Weak or failing kidneys and chronic bronchitis were ascertained by a "yes" response to the question, "During the past 12 months, have you been told by a doctor or other health professional that you had [condition]?" Hepatitis was ascertained by a "yes" response to the question, "Have you ever had hepatitis?" For hypertension and asthma, a "yes" response to the following additional questions was used to identify participants with hypertension or asthma: "Were you told on two or more different visits that you had hypertension, also called high blood pressure?" and "Do you still have asthma?" Chronic obstructive pulmonary disease for the analysis was ascertained by a "yes" response to any of the three questions of emphysema, chronic bronchitis, and chronic obstructive pulmonary disease.

§ Smoking status was classified as current, former, or never.

¶ Respondents who answered "very difficult" or "can't do at all" to either of the following questions were classified as having social participation restriction: "By yourself, and without using any special equipment, how difficult is it for you to…" and ending with "…go out to things like shopping, movies, or sporting events," and "…participate in social activities such as visiting friends, attending clubs and meetings, or going to parties?"

** Cutoff point of ≥13 in Kessler scale identified respondents with serious psychological distress.

disability[††] (coded as yes/no) or missing work days during the past 12 months because of illness or injury[§§] (coded as 0, 1–5, and 6–365 days).

Prevalence estimates (percentage with 95% confidence intervals [CIs]) were age-standardized using the year 2000 projected U.S. population for the age-groups 18–44, 45–64, and ≥65 years.[¶¶] Multivariate binary and multinomial logistic regressions were performed, and predicted marginal proportions (*7*) were used to estimate prevalences of outcomes adjusting for the six covariates. To examine the role of arthritis, pairwise comparisons of model-adjusted proportions between adults with and without arthritis among those with one or more chronic conditions were performed, using two-sided alpha-level adjusting for multiple comparisons (Bonferroni correction $p<0.001$). Taylor series linearization method was used to estimate standard errors and account for intracluster correlation because of the complex sampling design.

The overall unadjusted prevalences of chronic conditions were the highest for hypertension (25.6%), arthritis (22.7%), heart diseases (11.4%), diabetes (9.3%), cancer (8.5%), and asthma (7.0%). Among adults with a single nonarthritis chronic condition, the most common conditions were hypertension, asthma, cancer, and heart diseases. Among adults with two or more nonarthritis chronic conditions, the most common multiple chronic condition combinations all included hypertension with diabetes, heart diseases, cancer, or asthma. The most common multiple chronic condition combinations with arthritis included hypertension, heart diseases, diabetes, and cancer (Table 1).

Overall, 51.0% of adults had no selected chronic conditions, 16.8% had one nonarthritis condition, 6.1% had arthritis only, 9.5% had two or more nonarthritis chronic conditions, and 16.6% of adults had arthritis plus other chronic conditions. Among those with arthritis, 73.1% reported additional chronic conditions. Older adults (≥65 years), women, whites or blacks, overweight or obese adults, and current or former smokers were more likely to report having arthritis plus one or more other conditions, compared with younger adults, men, Hispanics, under/healthy weight adults, and never smokers, respectively (Table 2).

The overall unadjusted prevalences of social participation restriction, serious psychological distress, and work disability in the U.S. adult population were 4.2%, 3.8%, and 12.8%, respectively; among those who had jobs in the past 12 months, 33.6% missed 1–5 work days, and 9.9% missed 6–365 work days. Model-adjusted prevalences of all three life domain outcomes increased stepwise among adults with no chronic conditions, one chronic condition (with or without arthritis), two or more nonarthritis conditions, and arthritis plus one or more other chronic conditions, in that order (Table 3). Among adults with one chronic condition, those with arthritis had significantly higher prevalences of social participation restriction and work disability than those with other chronic conditions. Among adults with multiple chronic conditions, those with arthritis had significantly higher prevalences of all the selected life domain outcomes than those without arthritis (Table 3).

Discussion

Living with multiple chronic health conditions was significantly associated with social participation restriction, serious psychological distress, and work limitations among adults aged ≥18 years, even after adjusting for six important covariates. Arthritis alone had a greater impact on social participation restriction and work disability than having one of the other chronic conditions, and arthritis as one of multiple chronic conditions was associated with higher prevalences of adverse impact on all three life domains. These consequences have profound public health implications because social activity participation, mental health, and the ability to work can be important contributors to quality of life. Missed work days and lost productivity related to chronic diseases are associated with enormous direct and indirect costs, both for those remaining in the workforce and for those who prematurely leave because of disability.[***]

The findings in this report are subject to at least three limitations. First, because of the cross-sectional nature of NHIS, temporal relationships cannot be established between chronic conditions and outcomes, although causality is plausible for all the associations. Second, NHIS captured only doctor-diagnosed conditions through self-report, which could have led to underreporting of undiagnosed conditions. Finally, the 10 conditions included represent only a subset of chronic conditions.

This study also has several strengths. First, NHIS is a nationally representative data source. Second, because NHIS captures various important chronic conditions, it permits analysis of multiple chronic conditions, an issue of growing importance in the United States. Third, NHIS captures important life

[††] Work disability was defined by identifying a person as "unable to work" or "limited in work" when asked if a person was limited in the kind or amount of work.

[§§] Missing work days were ascertained by the question, "During the past 12 months, about how many days did you miss work at a job or business because of illness or injury (do not include maternity leave)?" Missing work days were analyzed among adults who worked or had a job or business with or without pay in the last week or who had a job or business in the past 12 months.

[¶¶] Additional information available at http://www.cdc.gov/nchs/data/statnt/statnt20.pdf.

[***] Additional information available at http://assets1c.milkeninstitute.org/assets/Publication/ResearchReport/PDF/chronic_disease_report.pdf.

TABLE 1. Percentages of conditions among adults aged ≥18 years with one nonarthritis chronic condition and top six most common chronic condition combinations among those with multiple chronic conditions — National Health Interview Survey, United States, 2013

Rank	1 Nonarthritis chronic condition	%	(95% CI)
1	Hypertension	42.2	(40.6–43.9)
2	Asthma	14.4	(13.3–15.6)
3	Cancer	11.0	(10.0–12.1)
4	Heart diseases	10.9	(9.9–12.0)
5	Diabetes	8.7	(7.8–9.7)
6	Hepatitis	5.4	(4.7–6.1)
7	Chronic obstructive pulmonary disease	5.2	(4.5–6.1)
8	Stroke	1.4	(1.1–1.9)
9	Weak/Failing kidneys	0.8	(0.6–1.2)
Rank	**≥2 Nonarthritis chronic conditions***	**%**	**(95% CI)**
1	Hypertension/Diabetes	15.0	(13.5–16.5)
2	Hypertension/Heart diseases	10.8	(9.4–12.2)
3	Hypertension/Cancer	8.1	(7.0–9.4)
4	Hypertension/Asthma	5.1	(4.2–6.1)
5	Hypertension/Heart diseases/Diabetes	4.2	(3.4–5.2)
6	Hypertension/Heart diseases/Cancer	2.9	(2.3–3.8)
Rank	**Arthritis plus ≥1 chronic condition***	**%**	**(95% CI)**
1	Arthritis/Hypertension	22.0	(20.8–23.3)
2	Arthritis/Hypertension/Heart diseases	7.0	(6.2–7.9)
3	Arthritis/Hypertension/Diabetes	5.7	(5.1–6.4)
4	Arthritis/Cancer	5.2	(4.6–6.0)
5	Arthritis/Heart diseases	5.1	(4.5–5.8)
6	Arthritis/Hypertension/Cancer	4.0	(3.4–4.7)

Abbreviation: CI = confidence interval.
* The top six combinations of multiple chronic conditions are presented as a sample of what each category comprised.

What is already known on this topic?

Arthritis is a common cause of disability and often co-occurs with a number of other chronic conditions. Having multiple chronic conditions is a growing problem in the United States, and chronic diseases are leading causes of death, morbidity, disability, and health care costs in the United States.

What is added by this report?

Having an increased number of chronic conditions was linked to adverse outcomes in terms of social participation restriction, serious psychological distress, and work limitations. If arthritis was one of those conditions, the outcomes were even worse.

What are the implications for public health practice?

It is important to include arthritis in discussions addressing the negative effects of multiple chronic conditions and the interventions needed to counter those effects. Inexpensive, proven, but underused strategies can help adults with arthritis and/or other chronic conditions have better quality-of-life outcomes. These strategies include physical activity, maintaining healthy weight, and participating in self-management programs that have been shown to reduce pain and disability, improve function, and address arthritis barriers to physical activity, such as joint pain.

domain outcomes. Finally, the large sample size allowed for adequate statistical power when performing multivariate analyses with multiple pairwise comparisons.

Many chronic conditions not only co-occur, but also share several main risk factors. Modifiable lifestyle behavior factors, such as poor diet, physical inactivity, high BMI, and tobacco use, are some of the root causes of many chronic diseases. Public health interventions and programs that promote healthy diet, physical activity, weight control, and smoking cessation can address these risk factors effectively for individuals and populations (*8*).

The high prevalence of arthritis, its common co-occurrence with other chronic conditions, and its impact on meaningful life domains suggest the importance of including arthritis in discussions addressing the adverse effects of multiple chronic conditions and the interventions needed to counter those effects among researchers, health care providers, and policy makers. These findings reinforce the need to include public health messages and all-inclusive self-management intervention programs to reduce arthritis-specific barriers to healthy behaviors, such as pain and fear of pain, which can limit physical activity among persons with arthritis.

To address the growing public health burden of multiple chronic conditions, the U.S. Department of Health and Human Services developed a strategic framework to address this problem.††† Effective evidence-based public health interventions, including physical activity, self-management education, and weight loss for overweight/obese adults, help persons with chronic conditions, including arthritis (*9,10*), manage the negative physical and psychological effects of these diseases, reduce long-term impairment and disability, reduce the need for medical care, improve quality of life, and are cost effective (*8*). For example, the Chronic Disease Self-Management Program is an intervention that helps persons with a range of chronic conditions. Walk with Ease is an evidence-based program that helps persons with arthritis overcome arthritis-specific barriers to increasing physical activity by learning to walk without increasing joint pain. Improving the availability of these and other evidence-based programs through partnerships with health care systems, worksites, and community

††† Additional information available at http://www.hhs.gov/ash/initiatives/mcc/mcc_framework.pdf.

TABLE 2. Age-standardized distributions among adults aged ≥18 years of five chronic condition categories, by selected characteristics — National Health Interview Survey, United States, 2013

Characteristic	Sample size*	No chronic condition		1 Nonarthritis chronic condition		Arthritis only		≥2 Nonarthritis chronic conditions		Arthritis plus ≥1 other chronic condition	
		%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Overall†	**34,505**	**51.0**	**(50.2–51.8)**	**16.8**	**(16.3–17.3)**	**6.1**	**(5.8–6.4)**	**9.5**	**(9.1–9.9)**	**16.6**	**(16.1–17.2)**
Age group (yrs)†											
18–44	15,256	74.4	(73.5–75.4)	14.7	(13.9–15.4)	3.7	(3.3–4.1)	3.6	(3.3–4.0)	3.6	(3.2–4.0)
45–64	11,544	38.5	(37.3–39.7)	19.7	(18.8–20.6)	9.2	(8.6–9.9)	12.1	(11.3–12.9)	20.5	(19.6–21.5)
≥65	7,705	14.3	(13.3–15.3)	16.7	(15.7–17.8)	6.4	(5.7–7.2)	19.7	(18.6–20.9)	42.9	(41.4–44.4)
Sex											
Men	15,416	55.2	(54.2–56.1)	17.0	(16.2–17.8)	4.5	(4.1–4.9)	9.9	(9.4–10.5)	13.4	(12.8–14.1)
Women	19,089	51.8	(50.9–52.7)	16.1	(15.5–16.8)	7.0	(6.5–7.5)	8.1	(7.6–8.5)	17.0	(16.4–17.7)
Race/Ethnicity											
Hispanic	5,938	59.9	(58.5–61.4)	15.9	(14.8–17.1)	4.2	(3.5–4.9)	8.9	(8.0–9.8)	11.1	(10.2–12.1)
White, non-Hispanic	20,769	51.6	(50.8–52.5)	16.7	(16.0–17.4)	6.5	(6.1–6.9)	8.9	(8.4–9.3)	16.3	(15.7–16.8)
Black, non-Hispanic	5,306	49.8	(48.4–51.4)	17.5	(16.3–18.8)	4.9	(4.1–5.7)	10.5	(9.6–11.5)	17.3	(16.2–18.3)
Other	2,492	61.6	(59.4–63.8)	16.5	(14.7–18.4)	4.3	(3.3–5.3)	7.2	(6.0–8.7)	10.4	(8.9–12.1)
Education level											
Less than high school	5,351	51.4	(49.7–53.2)	16.4	(15.1–17.9)	4.8	(4.0–5.6)	10.6	(9.6–11.8)	16.8	(15.7–17.9)
High school	8,872	51.8	(50.4–53.1)	16.6	(15.5–17.7)	5.5	(4.9–6.2)	9.5	(8.9–10.3)	16.6	(15.7–17.5)
Some college	10,454	52.0	(50.8–53.2)	15.9	(15.1–16.8)	6.5	(5.9–7.1)	9.0	(8.3–9.7)	16.6	(15.8–17.4)
Completed college or greater	9,669	57.2	(56.1–58.4)	17.1	(16.2–18.1)	6.1	(5.4–6.7)	7.3	(6.8–8.0)	12.3	(11.6–13.1)
Body mass index category											
Under/Healthy weight	12,162	62.0	(61.0–63.0)	14.7	(14.0–15.5)	5.9	(5.4–6.5)	6.9	(6.4–7.5)	10.5	(9.8–11.0)
Overweight	11,317	54.9	(54.0–55.9)	16.9	(16.0–17.8)	6.0	(5.5–6.6)	8.4	(7.8–9.0)	13.8	(13.0–14.4)
Obese	9,555	40.5	(39.3–41.7)	18.6	(17.7–19.7)	5.6	(5.0–6.3)	11.7	(11.0–12.5)	23.6	(22.6–24.4)
Smoking status											
Current	6,229	47.2	(45.5–48.8)	18.4	(17.0–19.9)	6.2	(5.5–7.1)	10.8	(9.8–12.0)	17.4	(16.1–18.6)
Former	7,642	46.1	(44.5–47.6)	17.9	(16.7–19.2)	7.1	(6.2–8.1)	10.6	(9.8–11.5)	18.3	(17.2–19.4)
Never	20,565	57.6	(56.8–58.4)	15.9	(15.3–16.5)	5.5	(5.1–5.9)	7.6	(7.2–8.1)	13.4	(12.9–14.0)

Abbreviation: CI = confidence interval.
* Unweighted number of some variables do not add up to 34,505 because of missing values.
† Not age-standardized.

TABLE 3. Model-adjusted* prevalence of adults aged ≥18 years with social participation restriction, serious psychological distress, and work limitations, by chronic condition categories — National Health Interview Survey, United States, 2013

Life domain	No chronic condition		1 Nonarthritis chronic condition		Arthritis only		≥2 Nonarthritis chronic conditions		Arthritis plus ≥1 other chronic condition	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Social participation restriction	1.0	(0.8–1.3)	2.1†	(1.7–2.6)	3.7†	(2.8–4.8)	6.3†	(5.3–7.4)	10.4†	(9.4–11.6)
Serious psychological distress	1.8	(1.6–2.2)	3.5	(2.9–4.2)	3.9	(2.9–5.2)	6.8†	(5.7–8.1)	9.9†	(8.7–11.2)
Work limitations										
Work disability	4.3	(3.8–4.8)	8.6†	(7.8–9.5)	15.6†	(13.7–17.6)	22.5†	(20.6–24.4)	30.7†	(29.0–32.4)
Missing work (days)§										
None	62.0	(60.9–63.0)	52.9	(50.7–55.1)	48.5	(45.1–52.0)	45.5†	(41.8–49.3)	39.0†	(36.3–41.8)
1–5	30.2	(29.4–31.1)	36.1	(34.6–37.5)	38.6	(36.5–40.6)	40.1†	(38.1–42.1)	42.9†	(41.6–44.2)
6–365	7.8	(7.4–8.3)	11.0	(10.1–12.0)	12.9	(11.4–14.6)	14.4†	(12.6–16.4)	18.1†	(16.3–20.0)

Abbreviation: CI = confidence interval.
* Adjusted for age group, sex, race/ethnicity, education attainment level, body mass index category, and smoking status.
† A statistically significant difference of adjusted prevalences is observed between those with and without arthritis among adults with 1 or ≥2 chronic conditions.
§ Among adults who worked or had a job or business with or without pay in the last week or who had a job or business in the past 12 months.

organizations can help ensure that tens of millions of persons with chronic conditions can contribute to achieving the *Healthy People 2020* overarching goal to increase quality and years of healthy life.

[1]Division of Population Health, National Center for Chronic Disease Prevention and Health Promotion, CDC; [2]Epidemic Intelligence Service, CDC.

Corresponding author: Jin Qin, jqin@cdc.gov, 770-488-4236.

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Donna J. Brogan, PhD, Rollins School of Public Health, Emory University, Atlanta, Georgia.

References

1. Ward BW, Schiller JS. Prevalence of multiple chronic conditions among US adults: estimates from the National Health Interview Survey, 2010. Prev Chronic Dis 2013;10:E65.
2. Ward BW, Schiller JS, Goodman RA. Multiple chronic conditions among US adults: a 2012 update. Prev Chronic Dis 2014;11:E62.
3. Agency for Healthcare Research and Quality. Multiple chronic conditions chartbook: 2010 medical expenditure panel survey data. Washington, DC: US Department of Health and Human Services; 2014. Available at http://www.ahrq.gov/professionals/prevention-chronic-care/decision/mcc/mccchartbook.pdf.
4. CDC. Prevalence and most common causes of disability among adults—United States, 2005. MMWR Morb Mortal Wkly Rep 2009;58:421–6.
5. CDC. Prevalence of doctor-diagnosed arthritis and arthritis-attributable activity limitation—United States, 2010–2012. MMWR Morb Mortal Wkly Rep 2013;62:869–73.
6. Kessler RC, Andrews G, Colpe LJ, et al. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. Psychol Med 2002;32:959–76.
7. Bieler GS, Brown GG, Williams RL, Brogan DJ. Estimating model-adjusted risks, risk differences, and risk ratios from complex survey data. Am J Epidemiol 2010;171:618–23.
8. Bauer UE, Briss PA, Goodman RA, Bowman BA. Prevention of chronic disease in the 21st century: elimination of the leading preventable causes of premature death and disability in the USA. Lancet 2014;384:45–52.
9. Brady TJ, Murphy L, O'Colmain BJ, et al. A meta-analysis of health status, health behaviors, and healthcare utilization outcomes of the Chronic Disease Self-Management Program. Prev Chronic Dis 2013;10:120112.
10. Hootman JM, Helmick CG, Brady TJ. A public health approach to addressing arthritis in older adults: the most common cause of disability. Am J Public Health 2012;102:426–33.

Influenza Activity — United States, 2014–15 Season and Composition of the 2015–16 Influenza Vaccine

Grace D. Appiah, MD[1]; Lenee Blanton, MPH[1]; Tiffany D'Mello, MPH[1]; Krista Kniss, MPH[1]; Sophie Smith, MPH[1]; Desiree Mustaquim, MPH[1]; Craig Steffens, MPH[1]; Rosaline Dhara, MPH[1]; Jessica Cohen, MPH[1]; Sandra S. Chaves, MD[1]; Joseph Bresee, MD[1]; Teresa Wallis, MS[1]; Xiyan Xu, MD[1]; Anwar Isa Abd Elal[1]; Larisa Gubareva, PhD[1]; David E. Wentworth, PhD[1]; Jacqueline Katz, PhD[1]; Daniel Jernigan, MD[1]; Lynnette Brammer, MPH[1]
(Author affiliations at end of text)

During the 2014–15 influenza season in the United States, influenza activity* increased through late November and December before peaking in late December. Influenza A (H3N2) viruses predominated, and the prevalence of influenza B viruses increased late in the season. This influenza season, similar to previous influenza A (H3N2)–predominant seasons, was moderately severe with overall high levels of outpatient illness and influenza-associated hospitalization, especially for adults aged ≥65 years. The majority of circulating influenza A (H3N2) viruses were different from the influenza A (H3N2) component of the 2014–15 Northern Hemisphere seasonal vaccines, and the predominance of these drifted viruses resulted in reduced vaccine effectiveness (*1*). This report summarizes influenza activity in the United States during the 2014–15 influenza season (September 28, 2014–May 23, 2015)† and reports the recommendations for the components of the 2015–16 Northern Hemisphere influenza vaccine.

Viral Surveillance

During September 28, 2014–May 23, 2015, World Health Organization (WHO) and National Respiratory and Enteric Virus Surveillance System collaborating laboratories in the United States tested 691,952 specimens for influenza viruses; 125,462 (18.1%) were positive (Figure 1). Of the positive specimens, 104,822 (83.5%) were influenza A viruses, and 20,640 (16.5%) were influenza B viruses. Among the seasonal influenza A viruses, 52,518 (50.1%) were subtyped; 52,299 (99.6%) were influenza A (H3N2) viruses, and 219 (0.2%) were A (H1N1)pdm09 viruses. In addition, three variant influenza A viruses§ (one H3N2v and two H1N1v) were identified.

Through the peak of the 2014–15 season, H3N2 viruses predominated nationally, with lesser numbers of influenza B viruses and influenza A (H1N1)pdm09 viruses also identified. Based on the percentage of specimens testing positive for influenza to determine the peak of influenza activity, the peak occurred during week 52 (the week ending December 27, 2014) nationally; however, differences among U.S. Department of Health and Human Services regions¶ were observed in the timing of influenza activity and relative proportions of circulating viruses. Activity in region 7 peaked earliest, during the week ending December 13, 2014 (week 50), and activity in region 1 peaked latest, during the week ending January 24, 2015 (week 3).

Although H3N2 activity peaked between late December and early January, substantial influenza B activity occurred late in the season. Influenza A viruses predominated until late February, with influenza B viruses predominating from the week ending February 28, 2015 (week 8) through the week ending May 23, 2015 (week 20). The highest proportion of influenza B viruses was observed in Region 4 (19.8%), and the lowest proportion of influenza B viruses was detected in Region 10 (11.1%).

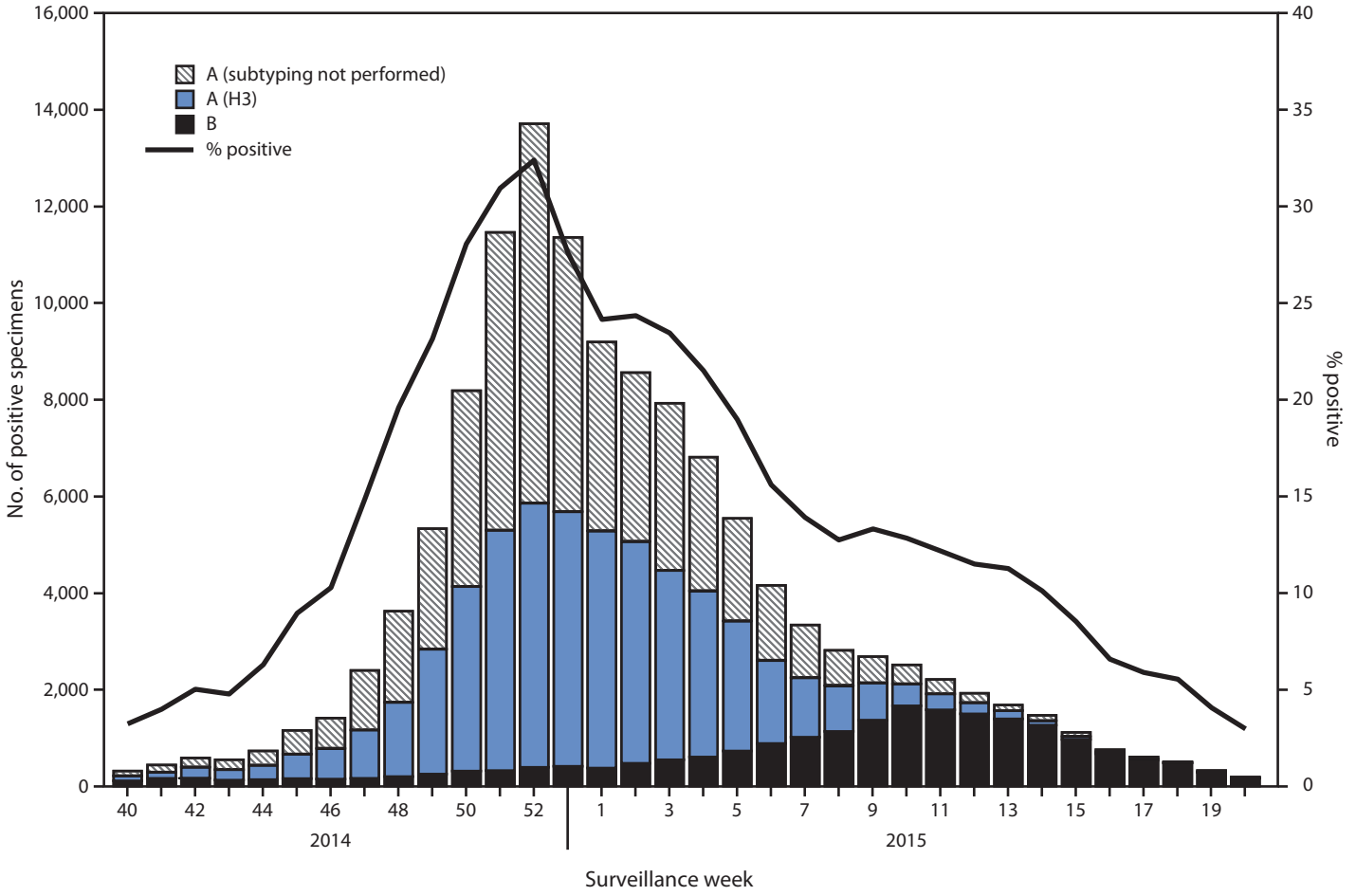
* The CDC influenza surveillance system collects information in five categories from eight data sources: 1) viral surveillance (World Health Organization collaborating laboratories, the National Respiratory and Enteric Virus Surveillance System, and novel influenza A virus case reporting); 2) outpatient illness surveillance (U.S. Outpatient Influenza-Like Illness Surveillance Network); 3) mortality (122 Cities Mortality Reporting System and influenza-associated pediatric mortality reports); 4) hospitalizations (Influenza Hospitalization Surveillance Network [FluSurv-NET], which includes the Emerging Infections Program and surveillance in three additional states); and 5) summary of the geographic spread of influenza (state and territorial epidemiologist reports).

† Data as of May 23, 2015.

§ Influenza viruses that normally circulate in pigs are called "variant" viruses when they are found in humans. Influenza A (H3N2) variant viruses ("H3N2v" viruses) with the matrix (M) gene from the 2009 H1N1 pandemic virus were first detected in humans in July 2011. Since then, 352 cases of H3N2v infection have been confirmed in humans, mostly associated with prolonged exposure to pigs at agricultural fairs. Of the other variant viruses, to date, 19 cases of H1N1v and five cases of H1N2v have been detected in humans.

¶ *Region 1:* Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. *Region 2:* New Jersey, New York, Puerto Rico, and the U.S. Virgin Islands. *Region 3:* Delaware, the District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia. *Region 4:* Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee. *Region 5:* Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin. *Region 6:* Arkansas, Louisiana, New Mexico, Oklahoma, and Texas. *Region 7:* Iowa, Kansas, Missouri, and Nebraska. *Region 8:* Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming. *Region 9:* Arizona, California, Hawaii, Nevada, American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Marshall Islands, and Republic of Palau. *Region 10:* Alaska, Idaho, Oregon, and Washington.

FIGURE 1. Number* and percentage of respiratory specimens testing positive for influenza reported by World Health Organization and National Respiratory and Enteric Virus Surveillance System collaborating laboratories, by type, subtype, and surveillance week — United States, 2014–15 influenza season†



* N = 125,462.
† Data as of May 23, 2015.

Novel Influenza A Viruses

During the 2014–15 influenza season, three cases of human infection with novel influenza A viruses have been reported. One infection with an influenza A (H3N2) variant virus occurred during the week ending October 18, 2014 (week 42) in Wisconsin, and one infection with an influenza A (H1N1) variant (H1N1v) virus was reported to CDC during the week ending January 24, 2015 (week 3) from Minnesota. Both patients had illness onset in October 2014 and reported contact with swine in the week preceding illness. Both patients fully recovered, and no further cases were identified in contacts of either patient. The third case, a fatal infection with an H1N1v virus was reported from Ohio during the week ending April 2, 2015 (week 17). The patient worked at a livestock facility that housed swine, but no direct contact with swine in the week before illness onset was reported. The patient died from complications of the infection, and no ongoing human-to-human transmission was identified.

Antigenic and Genetic Characterization of Influenza Viruses

WHO collaborating laboratories in the United States are requested to submit a subset of their influenza-positive respiratory specimens to CDC for further virus characterization. CDC has antigenically and/or genetically characterized**

** CDC routinely uses hemagglutination inhibition (HI) assays to antigenically characterize influenza viruses year-round to compare how similar currently circulating influenza viruses are to those included in the influenza vaccine, and to monitor for changes in circulating influenza viruses. However, a portion of recent influenza A (H3N2) viruses did not yield sufficient hemagglutination titers for antigenic characterization by HI. For many of these viruses, CDC performed genetic characterization to infer antigenic properties and is also using alternative methods (e.g., focus forming unit reduction) for antigenic characterization.

2,193 influenza viruses collected and submitted by U.S. laboratories since October 1, 2014, including 59 influenza A (H1N1)pdm09 viruses, 1,324 influenza A (H3N2) viruses, and 810 influenza B viruses. Of the 59 influenza A (H1N1)pdm09 viruses tested, all were antigenically similar to A/California/7/2009, the influenza A (H1N1) component of the 2014–15 Northern Hemisphere influenza vaccine.

A total of 246 (18.6%) of the 1,324 H3N2 viruses tested have been characterized as A/Texas/50/2012-like, the influenza A (H3N2) component of the 2014–15 Northern Hemisphere influenza vaccine. A total of 1,078 (81.4%) of the 1,324 viruses tested showed either reduced titers with antiserum produced against A/Texas/50/2012 or belonged to a genetic group that typically shows reduced titers to A/Texas/50/2012. The viruses that showed reduced titers to A/Texas/50/2012 belonged to multiple genetic groups; most but not all were antigenically similar to the influenza A (H3N2) virus selected in September 2014 for the 2015 Southern Hemisphere and in February 2015 for the 2015–16 Northern Hemisphere influenza vaccines, A/Switzerland/9715293/2013. A total of 948 of the 1,324 A (H3N2) viruses were further characterized; 889 (93.7%) were antigenically similar to A/Switzerland/9715293/2013, and fifty-nine (6.2%) showed reduced titers with antiserum produced against A/Switzerland/9715293/2013 virus.

Of the 810 influenza B viruses tested, 582 (71.9%) belonged to the B/Yamagata lineage, and the remaining 228 (28.1%) influenza B viruses tested belonged to the B/Victoria/02/87 lineage. A total of 571 (98.1%) of the 582 B/Yamagata-lineage viruses were characterized as B/Massachusetts/2/2012-like, which was included as an influenza B component of the 2014–15 Northern Hemisphere trivalent and quadrivalent influenza vaccines. Eleven (1.9%) of the B/Yamagata-lineage viruses tested showed reduced titers to B/Massachusetts/2/2012. Among the 582 B/Yamagata lineage viruses characterized, 576 (98.9%) viruses were antigenically similar to B/Phuket/3073/2013 virus, the B/Yamagata lineage virus selected for the 2015 Southern Hemisphere influenza vaccine and 2015–16 Northern Hemisphere influenza vaccine. Six (1.0%) showed reduced titers with antiserum produced against B/Phuket/3073/2013 virus. A total of 223 (97.8%) of the 228 B/Victoria-lineage viruses were characterized as B/Brisbane/60/2008-like, the virus that is included as an influenza B component of the 2014–15 Northern Hemisphere quadrivalent influenza vaccine. Five (2.2%) of the B/Victoria-lineage viruses tested showed reduced titers to B/Brisbane/60/2008.

Antiviral Resistance to Influenza Viruses

Since October 1, 2014, a total of 4,192 influenza virus specimens have been tested for resistance to influenza antiviral medications. All 896 influenza B viruses and 3,232 influenza A (H3N2) viruses tested were sensitive to oseltamivir and zanamivir. All 896 influenza B viruses and 1,723 influenza A (H3N2) viruses tested were sensitive to peramivir. Among 64 pH1N1 viruses tested for resistance, one (1.6%) was found to be resistant to oseltamivir and one (1.6%) to peramivir. All 58 influenza A (H1N1)pdm09 viruses tested for resistance to zanamivir were sensitive. High levels of resistance to the adamantanes (amantadine and rimantadine) persist among influenza A viruses currently circulating globally (the adamantanes are not effective against influenza B viruses).

Composition of the 2015–16 Influenza Vaccine

The Food and Drug Administration's Vaccines and Related Biological Products Advisory Committee has recommended that the 2015–16 influenza trivalent vaccines used in the United States contain an A/California/7/2009 (H1N1)pdm09-like virus, an A/Switzerland/9715293/2013 (H3N2)-like virus, and a B/Phuket/3073/2013-like (B/Yamagata lineage) virus. It is recommended that quadrivalent vaccines, which have two influenza B viruses, contain the viruses recommended for the trivalent vaccines, as well as a B/Brisbane/60/2008-like (B/Victoria lineage) virus (*2*). This represents a change in the influenza A (H3) and influenza B (Yamagata lineage) components compared with the composition of the 2014–15 influenza vaccine. These vaccine recommendations were based on several factors, including global influenza virologic and epidemiologic surveillance, genetic characterization, antigenic characterization, antiviral resistance, and the candidate vaccine viruses that are available for production.

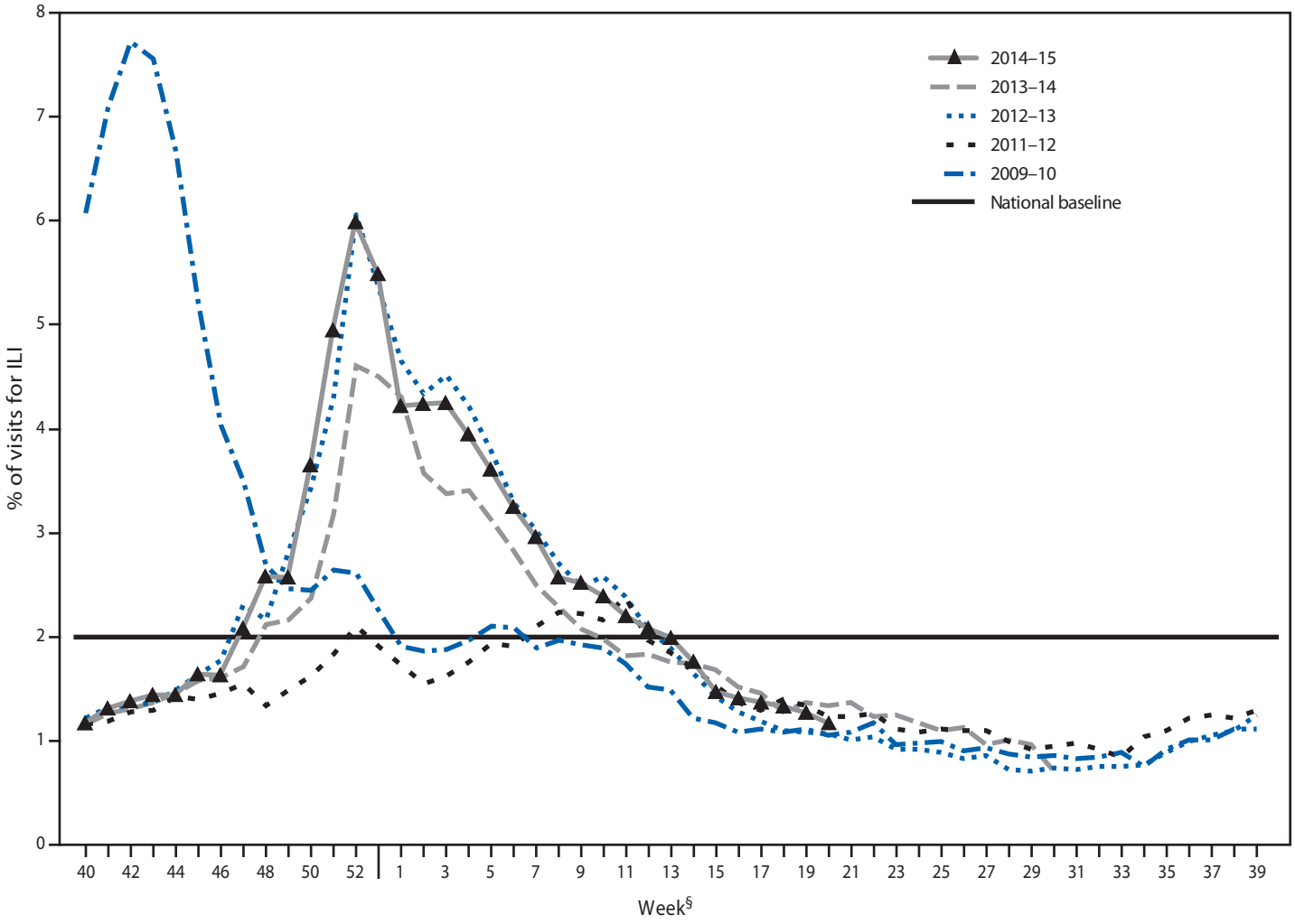
Outpatient Illness Surveillance

Nationally, the weekly percentage of outpatient visits for influenza-like illness (ILI)[††] to health care providers participating in the U.S. Outpatient Influenza-Like Illness Surveillance Network (ILINet) was at or above the national baseline level[§§] of 2.0% for 20 consecutive weeks during the 2014–15 influenza season (Figure 2). The peak percentage of outpatient visits for ILI was 6.0% and occurred in the week ending December 27, 2014 (week 52). During the 2001–02 through 2013–14 seasons, peak weekly percentages of outpatient visits

[††] Defined as a temperature of ≥100.0°F (≥37.8°C), oral or equivalent, and cough or sore throat, in the absence of a known cause other than influenza.

[§§] The national and regional baselines are the mean percentage of visits for ILI during weeks with little or no influenza virus circulation (non-influenza weeks) for the previous three seasons plus two standard deviations. A non-influenza week is defined as periods of ≥2 consecutive weeks in which each week accounted for <2% of the season's total number of specimens that tested positive for influenza. National and regional percentages of patient visits for ILI are weighted on the basis of state population. Use of the national baseline for regional data is not appropriate.

FIGURE 2. Percentage of visits for influenza-like illness (ILI)* reported to CDC, by surveillance week — Outpatient Influenza-Like Illness Surveillance Network, United States, 2014–15 influenza season and selected previous influenza seasons†



* Defined as a fever (≥100.0°F [≥37.8°C]), oral or equivalent, and cough and/or sore throat, without a known cause other than influenza.
† Data as of May 23, 2015.
§ Because there was no week 53 in the previous influenza seasons displayed, the week 53 data point for those seasons is an average of percentages from weeks 52 and 1.

for ILI ranged from 2.4% to 7.7% and remained at or above baseline levels for an average of 13 weeks (range = 1–19 weeks).

ILINet data are used to produce a weekly jurisdiction-level measure of ILI activity[¶¶] ranging from minimal to high. The number of jurisdictions experiencing elevated ILI activity peaked during the weeks ending December 27, 2014 (week 52) and January 24, 2015 (week 3), when a total of 31 states and Puerto Rico experienced high ILI activity. A total of 45 jurisdictions experienced high ILI activity during at least 1 week this season. The peak number of jurisdictions experiencing high ILI activity in a single week during the last five influenza seasons has ranged from four during the 2011–12 season to 44 during the 2009–10 season.

[¶¶] Activity levels are based on the percentage of outpatient visits in a jurisdiction attributed to ILI and are compared with the average percentage of ILI visits that occur during weeks with little or no influenza virus circulation. Activity levels range from minimal, which would correspond to ILI activity from outpatient clinics being at or below the average, to high, which would correspond to ILI activity from outpatient clinics being much higher than the average. Because the clinical definition of ILI is very nonspecific, not all ILI is caused by influenza; however, when combined with laboratory data, the information on ILI activity provides a clearer picture of influenza activity in the United States.

Geographic Spread of Influenza Activity

State and territorial epidemiologists report the geographic distribution of influenza in their jurisdictions through a weekly

influenza activity code.*** The geographic distribution of influenza activity was most extensive during the weeks ending January 3, 2015 (week 53) and January 10, 2015 (week 1), when a total of 47 jurisdictions reported influenza activity as widespread. During the previous five seasons, the peak number of jurisdictions reporting widespread activity has ranged from 20 in the 2011–12 season to 49 in the 2010–11 season.

Influenza-Associated Hospitalizations

CDC monitors hospitalizations associated with laboratory-confirmed influenza virus infections using the FluSurv-NET††† surveillance system. Cumulative hospitalization rates (cases per 100,000 population) were calculated by age group based on 17,911 total hospitalizations resulting from influenza during October 1, 2014–April 30, 2015. Among 17,856 cases with influenza type specified, 15,271 (85.5%) were associated with influenza A and 2,473 (13.8%) with influenza B virus and 112 (0.6%) were associated with influenza A and influenza B coinfections; 55 had no virus type information available. Adults aged ≥65 years accounted for approximately 61.0% of reported cases. The cumulative incidence§§§ for all age groups since October 1, 2014, was 65.5 per 100,000 (Figure 3). The cumulative incidence rate (cases per 100,000 population) by age group for this period was 57.2 (0–4 years), 16.5 (5–17 years), 18.9 (18–49 years), 54.8 (50–64 years), and 322.8 (≥65 years). During the past four influenza seasons, age-specific hospitalization rates ranged from 16.0 to 67.0 (0–4 years), 4.0 to 14.6 (5–17 years), 4.2 to 21.5 (18–49 years), 8.1 to 53.7 (50–64 years), and 30.2 to 183.2 (≥65 years).

As of April 30, 2015, among the FluSurv-NET adult patients for whom medical chart data were available, the most frequent underlying conditions were cardiovascular disease (51.0%), metabolic disorders (45.8%) and obesity (33.1%). Among children hospitalized with laboratory-confirmed influenza and for whom medical chart data were available, 43.3% did not have any recorded underlying conditions, and 26.4% had underlying asthma or reactive airway disease. Among the 626 hospitalized women of childbearing age (15–44 years), 200 (31.9%) were pregnant.

Pneumonia and Influenza-Associated Mortality

During the 2014–15 influenza season, the percentage of deaths attributed to pneumonia and influenza (P&I) exceeded the epidemic threshold¶¶¶ for 8 consecutive weeks from January 3 to February 21, 2015 (weeks 53–7). The weekly percentage of deaths attributed to P&I ranged from 5.0% to 9.3% (Figure 4). The peak weekly percentages of deaths attributed to P&I for the previous five seasons ranged from 7.9% during the 2011–12 season to 9.9% during the 2012–13 season.

Influenza-Associated Pediatric Mortality

For the 2014–15 influenza season, as of May 23, 2015, a total of 141 laboratory-confirmed, influenza-associated pediatric deaths had been reported from 40 states and New York City. The deaths occurred in 14 children aged <6 months, 23 aged 6–23 months, 22 aged 2–4 years, 45 aged 5–11 years, and 37 aged 12–17 years; mean and median ages were 7.2 years and 5.9 years, respectively. Among the 141 deaths, 109 were associated with an influenza A virus, 29 were associated with an influenza B virus, two were associated with an influenza virus for which the type was not determined, and one was associated with an influenza A and influenza B virus coinfection.

Since influenza-associated pediatric mortality became a nationally notifiable condition in 2004, the total number of influenza-associated pediatric deaths had previously ranged from 34 to 171 per season; this excludes the 2009 pandemic, when 358 pediatric deaths were reported to CDC during April 15, 2009–October 2, 2010.

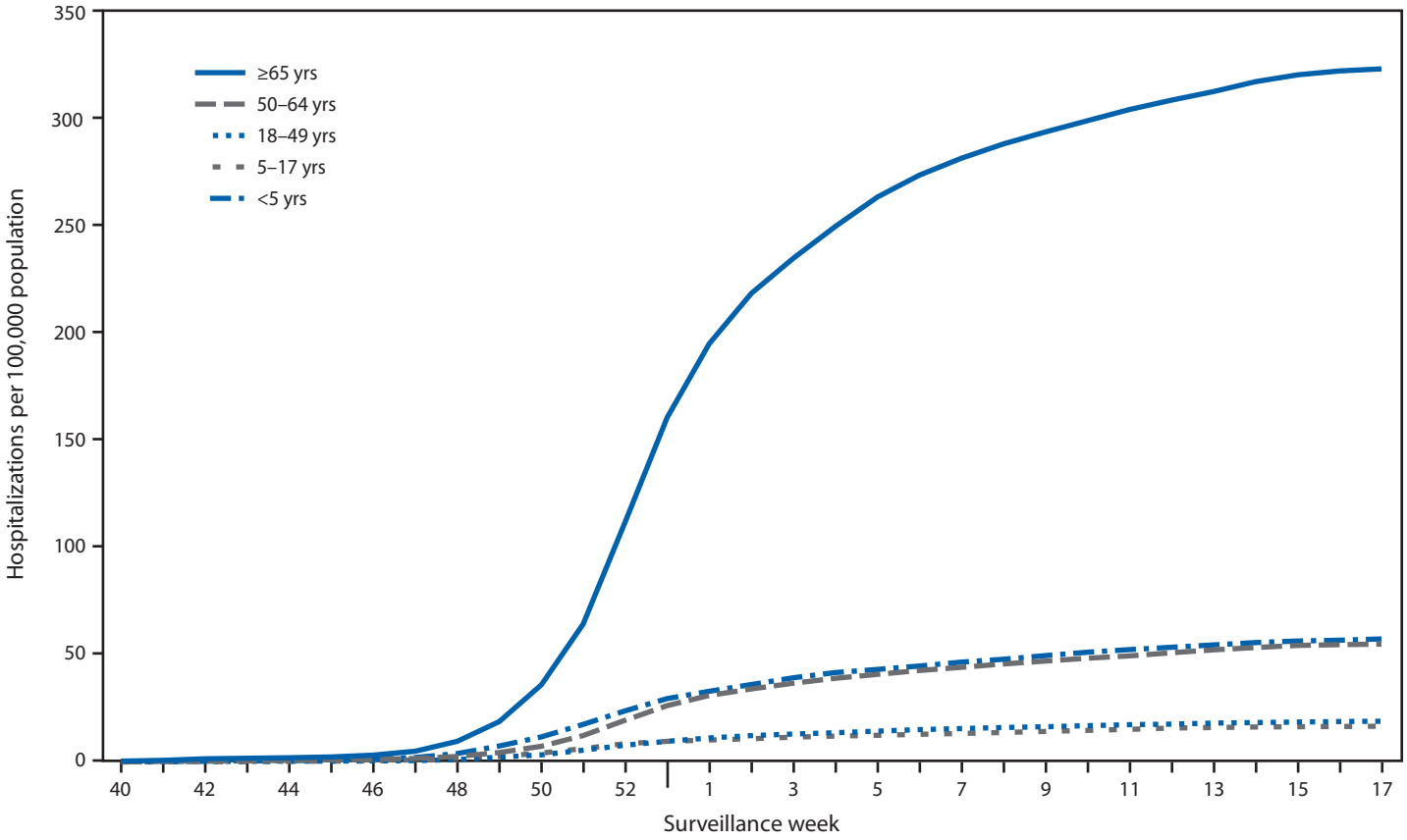
*** Levels of activity are 1) no activity; 2) sporadic: isolated laboratory-confirmed influenza case(s) or a laboratory-confirmed outbreak in one institution, with no increase in activity; 3) local: increased ILI, or at least two institutional outbreaks (ILI or laboratory-confirmed influenza) in one region of the state, with recent laboratory evidence of influenza in that region and virus activity no greater than sporadic in other regions; 4) regional: increased ILI activity or institutional outbreaks (ILI or laboratory-confirmed influenza) in at least two but less than half of the regions in the state with recent laboratory evidence of influenza in those regions; and 5) widespread: increased ILI activity or institutional outbreaks (ILI or laboratory-confirmed influenza) in at least half the regions in the state, with recent laboratory evidence of influenza in the state.

††† FluSurv-NET conducts population-based surveillance for laboratory-confirmed influenza-associated hospitalizations among children aged <18 years (since the 2003–04 influenza season) and adults aged ≥18 years (since the 2005–06 influenza season). FluSurv-NET covers approximately 70 counties in the 10 Emerging Infections Program states (California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New Mexico, New York, Oregon, and Tennessee) and additional Influenza Hospitalization Surveillance Project (IHSP) states. IHSP began during the 2009–10 season to enhance surveillance during the 2009 H1N1 pandemic. IHSP sites included Iowa, Idaho, Michigan, Oklahoma, and South Dakota during the 2009–10 season; Idaho, Michigan, Ohio, Oklahoma, Rhode Island, and Utah during the 2010–11 season; Michigan, Ohio, Rhode Island, and Utah during the 2011–12 season; Iowa, Michigan, Ohio, Rhode Island, and Utah during the 2012–13 season; and Michigan, Ohio, and Utah during the 2013–14 and 2014–15 seasons.

§§§ Incidence rates are calculated using CDC's National Center for Health Statistics population estimates for the counties included in the surveillance catchment area. Laboratory confirmation is dependent on clinician-ordered influenza testing, and testing for influenza often is underutilized because of the poor reliability of rapid influenza diagnostic test results and greater reliance on clinical diagnosis for influenza. As a consequence, the number of cases identified as part of influenza hospitalization surveillance likely is an underestimation of the actual number of persons hospitalized with influenza.

¶¶¶ The seasonal baseline proportion of P&I deaths is projected using a robust regression procedure, in which a periodic regression model is applied to the observed percentage of deaths from P&I that were reported by the 122 Cities Mortality Reporting System during the preceding 5 years. The epidemic threshold is set at 1.645 standard deviations above the seasonal baseline.

FIGURE 3. Cumulative rates of hospitalization for laboratory-confirmed influenza, by age group and surveillance week — FluSurv-NET,* United States, 2014–15 influenza season†



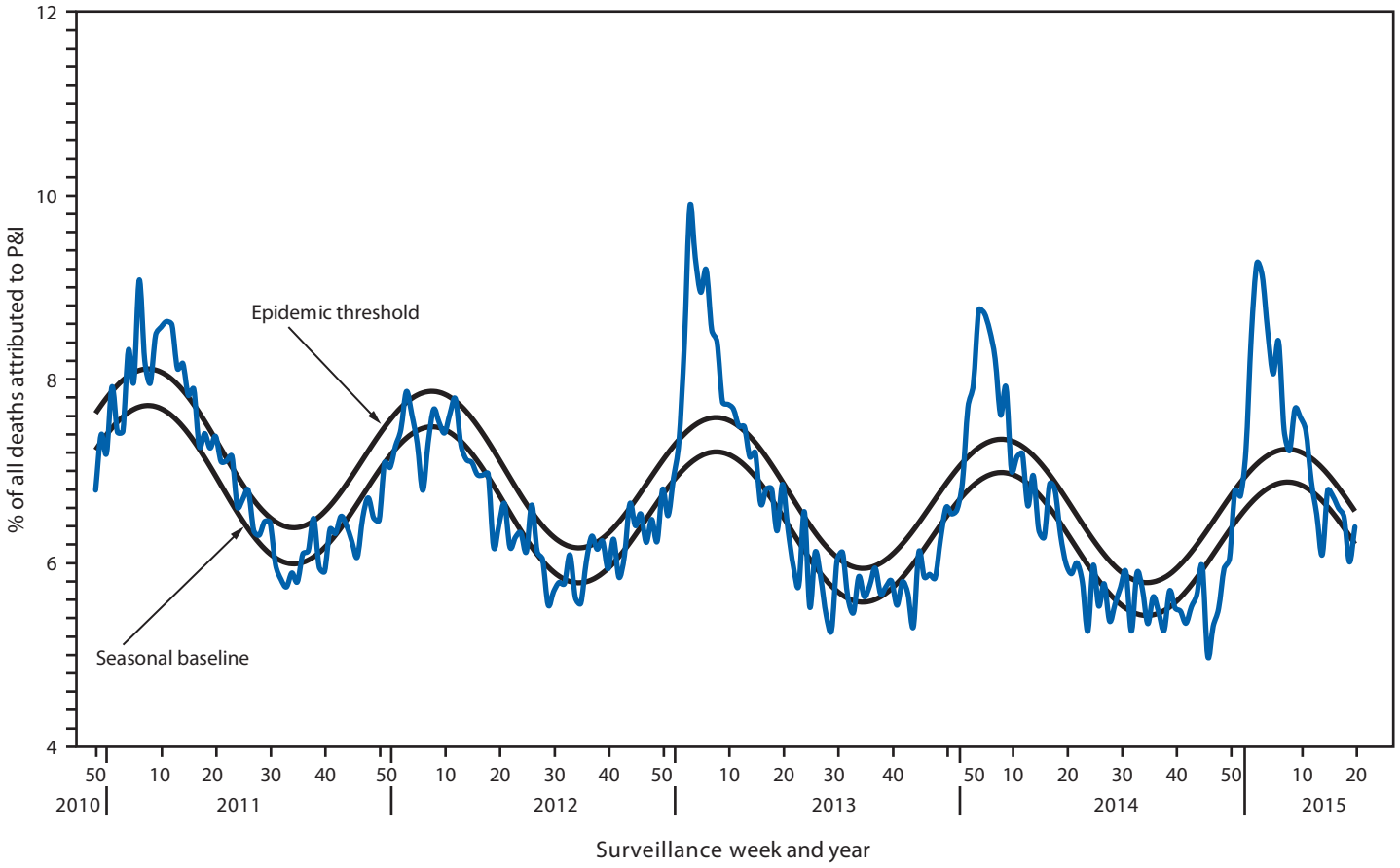
* FluSurv-NET conducts population-based surveillance for laboratory-confirmed influenza-associated hospitalizations in children aged <18 years (since the 2003–04 influenza season) and adults aged ≥18 years (since the 2005–06 influenza season). FluSurv-NET covers approximately 80 counties in the 10 Emerging Infections Program states (California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New Mexico, New York, Oregon, and Tennessee) and three additional Influenza Hospitalization Surveillance Project states (Michigan, Ohio, and Utah).
† Data as of May 23, 2015.

Discussion

The 2014–15 influenza season was moderately severe overall and especially severe in adults aged ≥65 years, with predominant circulation of antigenically and genetically drifted influenza A (H3N2) viruses. Influenza activity peaked during late December, with influenza A (H3N2) viruses predominant early in the season through the week ending February 21, 2015 (week 7). Influenza B became the predominant virus starting week 8 (the week ending February 28, 2015). The majority of influenza A (H3N2) viruses sent to CDC for antigenic and/or genetic characterization were different from the influenza A (H3N2) component of the 2014–15 Northern Hemisphere seasonal vaccines (A/Texas/50/2012).

Previous influenza A (H3N2)–predominant seasons have been associated with increased hospitalizations and deaths compared to seasons that were not influenza A (H3N2)–predominant, especially among children aged <5 years and adults aged ≥65 years (*3*–*6*). Influenza activity this season was similar to the 2012–13 season, which was the most recent influenza A (H3N2)–predominant season, but with higher rates of influenza-associated hospitalizations among adults aged ≥65 years. The cumulative rate of influenza-associated hospitalizations among this age group was 319.2 per 100,000 population, exceeding the cumulative total of 183.2 per 100,000 population for the 2012–13 season, which had previously been the highest recorded rate of laboratory-confirmed, influenza-associated hospitalizations since this type of surveillance began in 2005. Among children aged <5 years, the cumulative hospitalization rate (57.1 per 100,000 population) was slightly less than that observed during the 2012–13 season (66.2 per 100,000 population). Older adults also accounted for the majority of deaths attributed to P&I this season. Approximately 79.0% of the P&I deaths this season have occurred in adults aged ≥65 years, which is similar to what was observed during the 2012–13 influenza season (79.5%).

FIGURE 4. Percentage of all deaths attributable to pneumonia and influenza (P&I), by surveillance week and year* — 122 Cities Mortality Reporting System, United States, 2010–2015



* Data as of May 23, 2015.

However, the peak weekly percentage of deaths attributed to P&I for the current influenza season (9.3%) was lower than the peak observed during the 2012–13 influenza season (9.9%).

Influenza vaccination this season offered reduced protection against the predominant circulating viruses, drifted influenza A (H3N2), compared with previous seasons when most circulating and vaccine strain viruses were well-matched. Data collected during November 10, 2014–January 30, 2015, indicated that the influenza vaccine was 19% (95% confidence interval [CI] = 7%–29%) effective in preventing medical visits against all influenza across all age groups, and was 18% (CI = 6%–29%) and 45% (CI = 14%–65%) effective in preventing medical visits associated with influenza A (H3N2) and influenza B (Yamagata lineage), respectively (*7*). Despite reduced vaccine effectiveness, influenza vaccination was still recommended for all unvaccinated persons aged ≥6 months (*8*,*9*). Influenza vaccination provided protection against vaccine-like influenza A (H3N2) viruses that had not undergone significant antigenic drift and against influenza B viruses, which predominated later in the season (*1*,*3*,*6*). Of note, among the influenza A (H3N2) viruses, most, but not all, were antigenically similar to the influenza A (H3N2) virus selected for the 2015 Southern Hemisphere influenza vaccine (A/Switzerland/9715293/2013) (*1*).

Testing for seasonal influenza viruses and monitoring for novel influenza A virus infections should continue throughout the summer. Although summer influenza activity in the United States is typically low, influenza cases have occurred during the summer months and clinicians should remain vigilant in considering influenza in the differential diagnosis of summer respiratory illnesses. Health care providers also are reminded to consider novel influenza virus infections in persons with ILI, swine or poultry exposure, or with severe acute respiratory infection after travel to areas where avian influenza viruses have been detected. Providers should alert the local public health department if novel influenza virus infection is suspected. Early treatment with influenza antiviral medications is recommended for persons at high risk for influenza-associated complications,

What is already known on this topic?

CDC collects, compiles, and analyzes data on influenza activity year-round in the United States. Substantial influenza activity generally begins in the fall and continues through the winter and spring months; however, the timing and severity of influenza activity varies by geographic location and season.

What is added by this report?

The 2014–15 influenza season was an influenza A (H3N2)–predominant and moderately severe season overall, but was especially severe for adults aged ≥65 years. This age group had the highest laboratory-confirmed influenza hospitalization rates and also accounted for the majority of pneumonia and influenza deaths. Antigenic and genetic characterization showed that most of the circulating influenza A (H3N2) viruses were different from the influenza A (H3N2) component of the 2014–15 Northern Hemisphere vaccines, resulting in reduced vaccine effectiveness.

What are the implications for public health practice?

Influenza vaccination remains the most effective way to prevent influenza illness and its associated complications. Although vaccine effectiveness was reduced this season because of antigenic drift in H3N2 viruses, vaccination was still protective against vaccine-like influenza A (H3N2) viruses and influenza B viruses. Timely influenza surveillance informs vaccine strain selection; the influenza A (H3) and influenza B components of the subsequent 2015–16 season vaccine have been changed to more optimally match circulating viruses. As an adjunct to vaccination, timely empiric antiviral treatment is also recommended for all patients with severe, complicated, or progressive influenza illness and those at higher risk for influenza-associated complications, including adults aged ≥65 years.

as defined by the Advisory Committee on Immunization Practices, or with severe influenza illness. In randomized, controlled trials, antivirals have been shown to shorten the duration of influenza symptoms (*10*). In observational studies, influenza antiviral medications have reduced the risk for severe complications (*10*). Antiviral treatment decisions should not be delayed while awaiting laboratory confirmation of influenza; rather, treatment should be administered as soon as possible for any patient with confirmed or suspected influenza at high risk for influenza-associated complications (*10*).

Influenza surveillance reports for the United States are posted online weekly and are available at http://www.cdc.gov/flu/weekly. Additional information regarding influenza viruses, influenza surveillance, influenza vaccine, influenza antiviral medications, and novel influenza A infections in humans is available at http://www.cdc.gov/flu.

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State, county, city, and territorial health departments and public health laboratories. U.S. World Health Organization collaborating laboratories. National Respiratory and Enteric Virus Surveillance System collaborating laboratories. U.S. Outpatient Influenza-Like Illness Surveillance Network sites. Influenza Hospitalization Surveillance Network. 122 Cities Mortality Reporting System.

[1]Influenza Division, National Center for Immunization and Respiratory Diseases, CDC.

Corresponding author: Grace D. Appiah, ydg3@cdc.gov, 404-639-3747.

References

1. Flannery B, Clippard J, Zimmerman RK, et al. Early estimates of seasonal influenza vaccine effectiveness—United States, January 2015. MMWR Morb Mortal Wkly Rep 2015;64:10–5.
2. Food and Drug Administration. March 4, 2015: Vaccines and Related Biological Products Advisory Committee meeting summary minutes. Silver Spring, MD: Food and Drug Administration; 2015. Available at http://www.fda.gov/downloads/AdvisoryCommittees/CommitteesMeetingMaterials/BloodVaccinesandOtherBiologics/VaccinesandRelatedBiologicalProductsAdvisoryCommittee/UCM438843.pdf.
3. CDC. FluView interactive. Available at http://www.cdc.gov/flu/weekly/fluviewinteractive.htm.
4. Thompson WW, Shay DK, Weintraub E, et al. Influenza-associated hospitalizations in the United States. JAMA 2004;292:1333–40.
5. CDC. Estimates of deaths associated with seasonal influenza—United States, 1976–2007. MMWR Morb Mortal Wkly Rep 2010;59:1057–62.
6. CDC. Health advisory regarding the potential for circulation of drifted influenza A (H3N2) viruses. Available at http://emergency.cdc.gov/HAN/han00374.asp.
7. CDC. CDC presents updated estimates of flu vaccine effectiveness for the 2014–2015 season. Available at http://www.cdc.gov/flu/news/updated-vaccine-effectiveness-2014-15.htm.
8. Rolfes M, Blanton L, Brammer L, et al. Update: influenza activity—United States, September 28–December 6, 2014. MMWR Morb Mortal Wkly Rep 2014;63:1189–94.
9. D'Mello T, Brammer L, Blanton L, et al. Update: influenza activity—United States, September 28, 2014–February 21, 2015. MMWR Morb Mortal Wkly Rep 2015;64:206–12.
10. Fiore AE, Fry A, Shay D, Gubareva L, Bresee JS, Uyeki TM. Antiviral agents for the treatment and chemoprophylaxis of influenza—recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recomm Rep 2011;60(No. RR-1).

Vital Signs: Melanoma Incidence and Mortality Trends and Projections — United States, 1982–2030

Gery P. Guy Jr., PhD[1]; Cheryll C. Thomas, MSPH[1]; Trevor Thompson[1]; Meg Watson, MPH[1]; Greta M. Massetti, PhD[1]; Lisa C. Richardson, MD[1]
(Author affiliations at end of text)

On June 2, 2015, this report was posted as an MMWR *Early Release on the* MMWR *website (http://www.cdc.gov/mmwr).*

Abstract

Background: Melanoma incidence rates have continued to increase in the United States, and risk behaviors remain high. Melanoma is responsible for the most skin cancer deaths, with about 9,000 persons dying from it each year.

Methods: CDC analyzed current (2011) melanoma incidence and mortality data, and projected melanoma incidence, mortality, and the cost of treating newly diagnosed melanomas through 2030. Finally, CDC estimated the potential melanoma cases and costs averted through 2030 if a comprehensive skin cancer prevention program was implemented in the United States.

Results: In 2011, the melanoma incidence rate was 19.7 per 100,000, and the death rate was 2.7 per 100,000. Incidence rates are projected to increase for white males and females through 2019. Death rates are projected to remain stable. The annual cost of treating newly diagnosed melanomas was estimated to increase from $457 million in 2011 to $1.6 billion in 2030. Implementation of a comprehensive skin cancer prevention program was estimated to avert 230,000 melanoma cases and $2.7 billion in initial year treatment costs from 2020 through 2030.

Conclusions: If additional prevention efforts are not undertaken, the number of melanoma cases is projected to increase over the next 15 years, with accompanying increases in health care costs. Much of this morbidity, mortality, and health care cost can be prevented.

Implications for Public Health Practice: Substantial reductions in melanoma incidence, mortality, and cost can be achieved if evidence-based comprehensive interventions that reduce ultraviolet (UV) radiation exposure and increase sun protection are fully implemented and sustained.

Introduction

Skin cancer is the most common form of cancer in the United States, and melanoma is responsible for the most skin cancer deaths with over 9,000 each year. An individual dying from melanoma loses an average of 20.4 years of potential life (*1*). Total melanoma treatment costs are about $3.3 billion annually in the United States (*2*). Melanoma is the fifth most common cancer for men, and is the seventh most common cancer for women. More than 90% of melanoma cases in the United States are attributed to skin cell damage from ultraviolet (UV) radiation exposure (*3,4*).

Sun-protective behaviors (e.g., using sunscreen, wearing sun-protective clothing, and seeking shade) can reduce harmful exposure to UV. Sunburns are a significant risk factor for melanoma (*5,6*). Nearly 40% of persons in the United States report sunburn each year (*7*), indicating that many are not adequately protecting their skin from damaging UV that can cause melanoma. *The Guide to Community Preventive Services* (Community Guide) (http://www.thecommunityguide.org/news/2014/skin-cancer.html) recommends multicomponent community-wide programs and educational, environmental, and policy interventions based on evidence that they increase UV protective behaviors, decrease skin damage that can develop into melanoma, and reduce health care spending (*8,9*). Community-level interventions to reduce sun exposure include providing sunscreen and shade, increasing the availability of protective clothing and hats, and scheduling activities before or after midday hours.

This report presents current melanoma incidence and death rates for 2011, projections of melanoma incidence rates and cases, mortality rates, and treatment costs through 2030, and describes the potential impact of a comprehensive skin cancer prevention program in the United States.

Key Points

- Melanoma incidence rates have doubled from 1982 to 2011.
- In 2011, in the United States, there were 65,647 cases of melanoma and 9,128 deaths.
- The annual cost of treating newly diagnosed melanomas is projected to triple by 2030.
- Melanoma can be prevented by reducing ultraviolet radiation exposure from sunbathing and indoor tanning and increasing the use of sun protection.
- A comprehensive national skin cancer prevention program could avert 230,000 melanoma cases and $2.7 billion in initial year treatment costs from 2020 to 2030.
- Additional information available at http://www.cdc.gov/vitalsigns.

Methods

United States Cancer Statistics (USCS) (http://www.cdc.gov/uscs) provide official federal cancer incidence statistics in each state, using data from the National Program of Cancer Registries and the Surveillance, Epidemiology, and End Results (SEER) program. Forty-nine states and the District of Columbia (DC) met USCS publication criteria for 2011, representing 99.1% of the U.S. population. Incident melanomas of the skin were coded according to the *International Classification of Disease for Oncology, Third Edition*.

Cancer mortality statistics are based on all death certificates filed in the 50 states and DC, representing 100% of the U.S. population and provided by CDC's National Center for Health Statistics. All reported deaths with melanoma of the skin identified as the underlying cause of death according to the *International Classification of Diseases, 10th Revision* were included.

Incidence and death rates for 2011 are presented per 100,000 persons and are age-standardized to the 2000 U.S. standard population. Population estimates produced by the U.S. Census Bureau were obtained from the SEER program (http://www.seer.cancer.gov/popdata). Corresponding 95% confidence intervals were calculated using the Tiwari method (*10*).

Incidence count and rate projections for whites are based on SEER data from 1982 to 2011, representing approximately 10% of the U.S. population (http://www.seer.cancer.gov). Death count and rate projections for blacks and whites are based on mortality data from 1982 to 2011. Population projections were obtained from the U.S. Census Bureau (http://www.census.gov/population/projections/data/national/2012.html). Age-period-cohort regression models were analyzed using statistical software, with assumptions that offset exponential increases or decreases in rates and that gradually reduced current trends over time (*11*). Projections were based on either long-term trend data or the most recent 10-year period data, depending on whether there was a statistically significant curvature in the trend over time. Predicted cancer incidence and death counts for the entire U.S. population were estimated by applying the age-specific rates to U.S. population projections.

To estimate the cost of melanoma treatment in the initial year of diagnosis, age- and sex-specific treatment costs were used (*12*). Cost estimates were adjusted using the per capita projected increase in national health expenditures through 2023 (http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/index.html). The annual rate of growth from 2024 through 2030 was calculated using the average increase in the 3 preceding years. Adjusted per capita treatment costs were multiplied by the projected number of new melanoma cases each year through 2030.

To determine the effectiveness of a comprehensive skin cancer prevention program in the United States, it is assumed that the observed reduction in melanoma incidence attributed to SunSmart (*8*), a multicomponent community-wide sun protection program in Australia, can be reproduced by a nationwide program in the United States. Similar to previous studies (*9*), the lag period between program implementation and reduced melanoma incidence was set at 5 years.

Results

In 2011, a total of 65,647 invasive melanomas of the skin were reported in the United States (Table). The overall age-adjusted melanoma incidence rate was 19.7 per 100,000. Melanoma incidence rates increased with age, and were highest among non-Hispanic whites (24.6). Among persons aged 15–49 years, higher rates were observed among women, whereas among those aged ≥50 years, higher rates were observed among men.

In 2011, a total of 9,128 melanoma deaths occurred in the United States. The overall age-adjusted melanoma death rate was 2.7 per 100,000, with a higher death rate among non-Hispanic whites (3.4). Melanoma death rates increased with age and were higher among men (4.0) than among women (1.7).

From 1982 to 2011, melanoma incidence rates increased while mortality rates remained constant (Figure 1). Melanoma incidence rates doubled from 1982 to 2011. In the absence of new interventions, 112,000 new melanoma cases are projected in 2030 (Figure 2). A comprehensive skin cancer prevention program is estimated to prevent 20% of melanoma cases from 2020 to 2030, corresponding to an average of 21,000

TABLE. Number and rate of new melanoma cases and deaths,* by sex, racial/ethnic group,† and age group — National Program of Cancer Registries, and Surveillance, Epidemiology, and End Results Program, United States, 2011

	Incidence§								
	Overall			Men			Women		
Characteristic	No.	Rate	95% CI	No.	Rate	95% CI	No.	Rate	95% CI
All races/ethnicities	**65,647**	**19.7**	**19.5–19.9**	**38,415**	**25.3**	**25.1–25.6**	**27,232**	**15.6**	**15.5–15.8**
White	61,337	22.1	21.9–22.2	36,145	28.0	27.7–28.3	25,192	17.8	17.5–18.0
White, Hispanic	1,266	4.2	3.9–4.4	551	4.4	4.0–4.8	715	4.2	3.9–4.6
White, non-Hispanic	60,071	24.6	24.4–24.8	35,594	30.8	30.5–31.1	24,477	20.0	19.8–20.3
Black	359	1.0	0.9–1.2	153	1.1	0.9–1.3	206	1.0	0.9–1.2
Asian/Pacific Islander	197	1.3	1.1–1.5	87	1.4	1.1–1.7	110	1.3	1.1–1.6
American Indian/ Alaska Native	128	4.3	3.6–5.2	72	6.2	4.6–8.0	56	3.2	2.4–4.2
Hispanic	1,371	4.1	3.9–4.4	590	4.3	3.9–4.7	781	4.2	3.9–4.5
Age group (yrs)									
<15	129	0.2	0.2–0.3	59	0.2	0.1–0.2	70	0.2	0.2–0.3
15–19	217	1.0	0.9–1.2	85	0.8	0.6–1.0	132	1.3	1.1–1.5
20–24	722	3.3	3.1–3.5	199	1.8	1.5–2.0	523	4.9	4.5–5.3
25–29	1,348	6.4	6.1–6.7	438	4.1	3.7–4.5	910	8.7	8.2–9.3
30–34	1,854	9.1	8.7–9.5	688	6.8	6.3–7.3	1,166	11.5	10.8–12.2
35–39	2,242	11.5	11.1–12.0	902	9.3	8.7–10.0	1,340	13.8	13.0–14.5
40–44	3,206	15.4	14.9–15.9	1,353	13.1	12.4–13.8	1,853	17.7	16.9–18.5
45–49	4,568	20.8	20.2–21.4	2,130	19.6	18.8–20.5	2,438	21.9	21.1–22.8
50–54	6,071	27.1	26.4–27.8	3,258	29.7	28.7–30.7	2,813	24.7	23.8–25.6
55–59	6,736	33.5	32.7–34.3	3,950	40.6	39.3–41.9	2,786	26.9	25.9–27.9
60–64	7,748	43.9	42.9–44.9	4,942	58.4	56.8–60.0	2,806	30.5	29.4–31.7
65–69	7,355	57.7	56.3–59.0	4,873	81.0	78.8–83.3	2,482	36.8	35.4–38.3
70–74	6,694	70.3	68.6–72.0	4,580	105.0	102.0–108.1	2,114	41.0	39.2–42.8
75–79	6,135	83.7	81.6–85.8	4,176	130.3	126.4–134.3	1,959	47.5	45.4–49.6
80–84	5,603	97.6	95.0–100.1	3,701	159.5	154.4–164.8	1,902	55.6	53.1–58.1
≥85	5,019	88.3	85.9–90.8	3,081	164.4	158.7–170.3	1,938	50.9	48.7–53.2
	Mortality								
	Overall			Men			Women		
Characteristic	No.	Rate	95% CI	No.	Rate	95% CI	No.	Rate	95% CI
All races/ethnicities	**9,128**	**2.7**	**2.6–2.7**	**6,001**	**4.0**	**3.9–4.1**	**3,127**	**1.7**	**1.6–1.7**
White	8,928	3.1	3.0–3.2	5,906	4.6	4.5–4.7	3,022	1.9	1.9–2.0
White, Hispanic	232	0.9	0.7–1.0	133	1.1	0.9–1.3	99	0.7	0.5–0.8
White, non-Hispanic	8,687	3.4	3.3–3.4	5,769	5.0	4.9–5.1	2,918	2.1	2.0–2.2
Black	133	0.4	0.3–0.5	56	0.4	0.3–0.5	77	0.4	0.3–0.5
Asian/Pacific Islander	46	0.3	0.2–0.4	23	0.4	0.2–0.6	23	0.3	0.2–0.4
American Indian/ Alaska Native	21	0.8	0.5–1.2	16	1.3	0.7–2.2	—¶	—¶	—¶
Hispanic	235	0.8	0.7–0.9	134	1.0	0.8–1.2	101	0.6	0.5–0.8
Age group (yrs)									
<15	—¶	—¶	—¶	—¶	—¶	—¶	—¶	—¶	—¶
15–19	—¶	—¶	—¶	—¶	—¶	—¶	—¶	—¶	—¶
20–24	22	0.1	0.1–0.2	—¶	—¶	—¶	—¶	—¶	—¶
25–29	56	0.3	0.2–0.3	35	0.3	0.2–0.5	21	0.2	0.1–0.3
30–34	103	0.5	0.4–0.6	63	0.6	0.5–0.8	40	0.4	0.3–0.5
35–39	151	0.8	0.7–0.9	78	0.8	0.6–1.0	73	0.7	0.6–0.9
40–44	282	1.3	1.2–1.5	169	1.6	1.4–1.9	113	1.1	0.9–1.3
45–49	435	2.0	1.8–2.2	262	2.4	2.1–2.7	173	1.5	1.3–1.8
50–54	629	2.8	2.6–3.0	395	3.6	3.2–3.9	234	2.0	1.8–2.3
55–59	828	4.1	3.8–4.4	557	5.7	5.2–6.2	271	2.6	2.3–2.9
60–64	1,024	5.7	5.4–6.1	698	8.2	7.6–8.8	326	3.5	3.1–3.9
65–69	997	7.7	7.3–8.2	704	11.6	10.8–12.5	293	4.3	3.8–4.8
70–74	1,035	10.8	10.1–11.4	731	16.6	15.4–17.8	304	5.8	5.2–6.5
75–79	1,139	15.4	14.5–16.3	784	24.3	22.6–26.0	355	8.5	7.7–9.5
80–84	1,095	18.9	17.8–20.1	743	31.8	29.5–34.2	352	10.2	9.2–11.3
≥85	1,327	23.2	22.0–24.5	768	40.7	37.9–43.7	559	14.6	13.4–15.9

* Per 100,000 persons, age-adjusted to the 2000 U.S. standard population.
† Racial categories are not mutually exclusive from Hispanic ethnicity unless noted. Rates are not presented for cases with unknown or other race.
§ Compiled from cancer registries that meet the data-quality criteria for all invasive cancer sites combined (covering approximately 99% of the U.S. population).
¶ Value not displayed because there are fewer than 16 deaths.

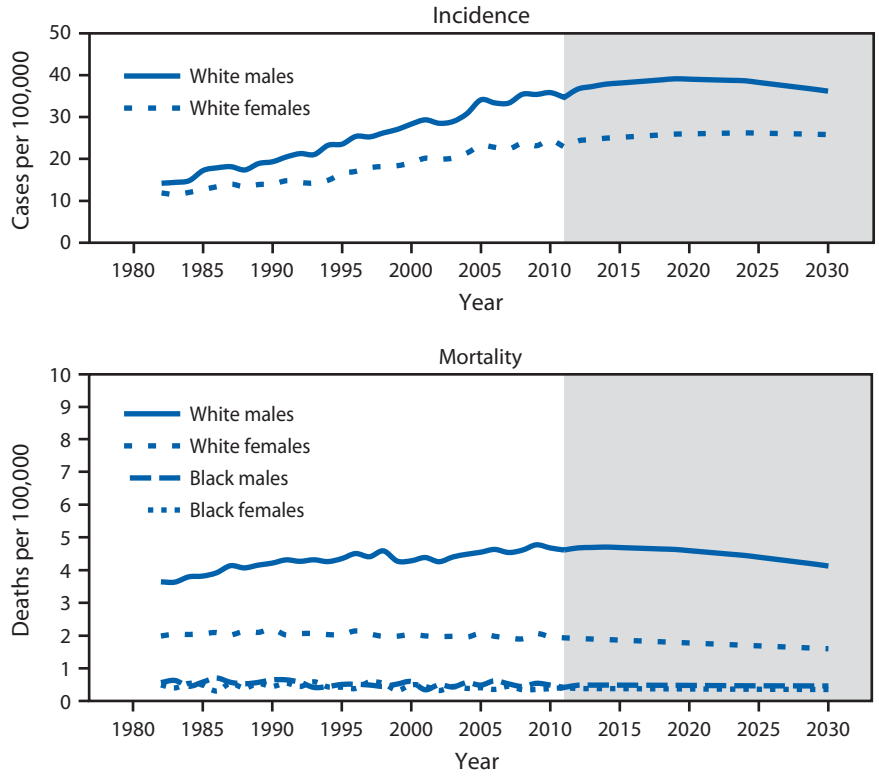
melanoma cases averted each year (a total of 230,000 cases from 2020 to 2030).

In the absence of new interventions, the annual cost of treating newly diagnosed melanoma cases is estimated to increase by 252.4% from 2011 to 2030 (from $457 million to $1.6 billion) (Figure 3). A comprehensive skin cancer prevention program is estimated to result in an average annual reduction in spending of $250 million on newly diagnosed melanoma cases, and a total of $2.7 billion during 2020–2030.

Conclusions and Comment

The health and economic burden of melanoma is substantial and without additional efforts is projected to increase through 2030. Without new interventions, the annual cost of treating newly diagnosed melanomas is projected to increase threefold from 2011 to 2030. Prevention strategies include reducing UV exposure from sunbathing and indoor tanning, and increasing the use of sun protection (*13*). A comprehensive skin cancer prevention program was estimated to avert 230,000 melanoma cases and $2.7 billion in initial year treatment costs from 2020 through 2030.

FIGURE 1. Observed and projected age-adjusted melanoma incidence and mortality rates, by sex and race — United States, 1982–2030*



Sources: Melanoma incidence data are from the Surveillance, Epidemiology, and End Results program for the period 1982–2011. Mortality data are provided by CDC's National Center for Health Statistics for the period 1982–2011.

* Age-period-cohort regression models were used to project melanoma incidence and mortality rates through 2030.

The estimated impact of a comprehensive skin cancer prevention program on the number of melanoma cases and treatment costs averted was based on findings from SunSmart, an Australian skin cancer prevention program (*8*). SunSmart is a multicomponent, community-wide intervention designed to raise awareness, change personal behaviors, and influence institutional policy and practices. SunSmart activities include mass media campaigns; programs with schools, workplaces, and sports programs; health care provider education; resource development and dissemination; and building capacity for skin cancer prevention at the community level. SunSmart was estimated to prevent more than 9,000 melanomas, avert over 1,000 deaths, and save 22,000 life-years in the state of Victoria during 1988–2003. SunSmart has also been shown to save $2.30 for every $1 invested.

The Affordable Care Act is reducing financial barriers to preventive services by requiring many plans to cover clinical preventive services rated A or B by the U.S. Preventive Services Task Force (USPSTF) without patient cost sharing. Behavioral counseling is now provided with no cost-sharing to counsel individuals aged 10–24 years with fair skin about minimizing their exposure to UV radiation to reduce risk for skin cancer (*14*). USPSTF has stated that current evidence is insufficient to recommend skin cancer screening; an updated recommendation is in progress (http://www.uspreventiveservicestaskforce.org/Page/Topic/recommendation-summary/skin-cancer-screening?ds=1&s=).

Although rates of melanoma are highest among whites, persons who identify as nonwhite are also at risk for melanoma. Lack of awareness might result in underestimating risk. Blacks are more likely to report experiencing frequent sunburns (*7*) and less likely to engage in certain protective behaviors, particularly sunscreen use, compared to other racial/ethnic groups (*15*). Melanoma survival is poorest among black populations who develop it in non–sun-exposed skin, possibly because of later diagnosis, lower perceived risk among patients and physicians, and a higher proportion of certain types of melanoma with poorer survival (*16–18*).

Previous research suggests that melanoma trends reflect increases in cumulative exposure to UV and increases in skin cancer awareness and early detection. Despite increases in melanoma incidence, decreases in melanoma mortality among persons aged <65 years have been

observed, likely reflecting earlier detection and improved treatment. Meanwhile, increasing melanoma mortality rates among persons aged ≥65 years and increasing incidence for both thin and thick lesions, along with the substantial contribution of thin lesions at diagnosis to melanoma mortality (about 30%), suggest that cumulative overexposure to UV radiation plays a substantial role (*19*).

This report found that among persons aged 15–49 years higher melanoma incidence rates were observed among women, whereas among those aged ≥50 years, higher rates were observed among men. Higher rates among young females compared with young males might be attributable, in part, to the widespread use of indoor tanning among females, which is associated with an increased risk for melanoma (*20*). Nearly one-third of non-Hispanic white women aged 16–25 years engage in indoor tanning each year (*21*). Meanwhile, higher melanoma rates among older non-Hispanic white men may be attributable, in part, to lower rates of sun protection and more time spent outdoors throughout life compared with women (*15,22*). Additionally, men are less likely to use sunscreen compared to women (*15*); thus, clothing and wide-brimmed hats might be particularly effective sun protection options for males, as well as increasing the use of sunscreen.

FIGURE 2. Annual observed and projected number of new melanoma cases among whites — United States, 2011–2030

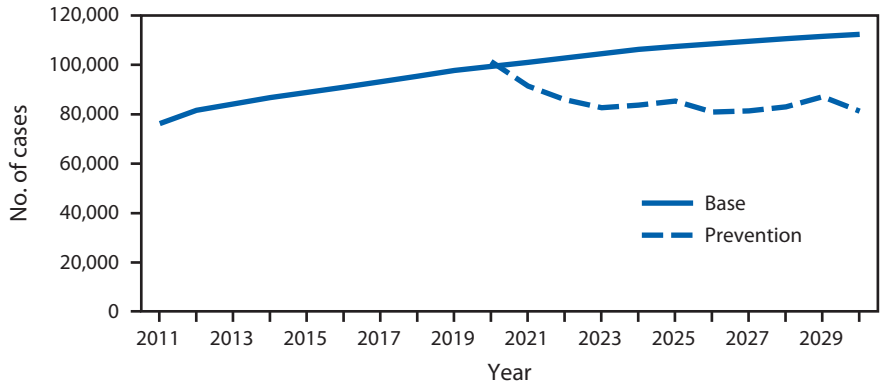
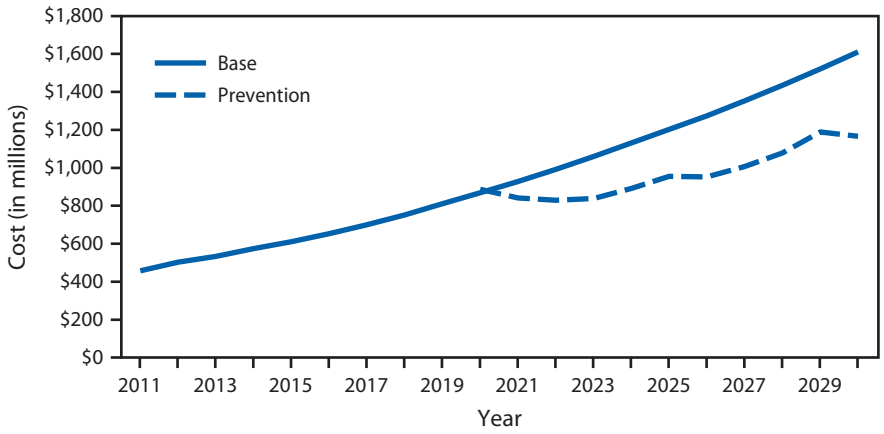


FIGURE 3. Annual observed and projected cost of treating new melanoma cases among whites — United States, 2011–2030



The findings in this report are subject to at least six limitations. First, delays in melanoma reporting might result in an underestimate of cases; reporting delays are more common for cancers such as melanoma that are often diagnosed and treated in nonhospital settings such as physicians' offices. Second, incidence projections are based on data that represent approximately 10% of the US population and have a lower percentage of whites. Third, accurate confidence intervals are not available for the incidence and death projections. Fourth, the impact of a skin cancer prevention program is based on the assumption that a reduction in incidence could be achieved in 5 years. Fifth, the impact of a prevention program is extrapolated from a state in Australia to all of the United States, which has a different underlying population and health care system. Finally, cost estimates only include health care costs incurred in the initial year after diagnosis.

Although the burden of melanoma is increasing, it is estimated that a substantial number of new melanoma cases could be prevented by following effective prevention strategies to reduce sun exposure, facilitate sun protection, prevent sunburn, and reduce indoor tanning. A comprehensive skin cancer prevention program addressing these skin cancer risk factors can help slow the growth in melanoma incidence and reduce melanoma treatment costs.

[1]Division of Cancer Prevention and Control, CDC.

Corresponding author: Gery P. Guy Jr., gguy@cdc.gov, 770-488-3279.

References

1. Ekwueme DU, Guy GP, Li C, Rim SH, Parelkar P, Chen SC. The health burden and economic costs of cutaneous melanoma mortality by race/ethnicity—United States, 2000 to 2006. J Am Acad Dermatol 2011;65:S133–S143.
2. Guy GP, Machlin SR, Ekwueme DU, Yabroff KR. Prevalence and costs of skin cancer treatment in the US, 2002-2006 and 2007-2011. Am J Prev Med 2015;48:183–7.
3. Gilchrest BA, Eller MS, Geller AC, Yaar M. Mechanisms of disease: the pathogenesis of melanoma induced by ultraviolet radiation. N Engl J Med 1999;340:1341–8.
4. Armstrong BK, Kricker A. How much melanoma is caused by sun exposure? Melanoma Res 1993;3:395–401.

5. CDC Preventing skin cancer: findings of the Task Force on Community Preventive Services on reducing exposure to ultraviolet light. MMWR Recomm Rep 2003;52(No. RR-15).
6. Dennis LK, Vanbeek MJ, Beane Freeman LE, Smith BJ, Dawson DV, Coughlin JA. Sunburns and risk of cutaneous melanoma: does age matter? A comprehensive meta-analysis. Ann Epidemiol 2008;18:614–27.
7. Holman DM, Berkowitz Z, Guy GP, Jr., Hartman AM, Perna FM. The association between demographic and behavioral characteristics and sunburn among U.S. adults—National Health Interview Survey, 2010. Prev Med 2014;63:6–12.
8. Shih ST, Carter R, Sinclair C, Mihalopoulos C, Vos T. Economic evaluation of skin cancer prevention in Australia. Prev Med 2009; 49:449–53.
9. Carter R, Marks R, Hill D. Could a national skin cancer primary prevention campaign in Australia be worthwhile?: an economic perspective. Health Promot Int 1999;14:73–82.
10. Tiwari RC, Clegg LX, Zou Z. Efficient interval estimation for age-adjusted cancer rates. Stat Methods Med Res 2006;15:547–69.
11. Moller B, Fekjaer H, Hakulinen T, et al. Prediction of cancer incidence in the Nordic countries: empirical comparison of different approaches. Stat Med 2003;22:2751–66.
12. Mariotto AB, Robin Yabroff K, 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.
13. US Department of Health and Human Services. The Surgeon General's call to action to prevent skin cancer. Washington, DC: US Department of Health and Human Services, Office of the Surgeon General; 2014. Available at http://www.surgeongeneral.gov/library/calls/prevent-skin-cancer.
14. Moyer VA. Behavioral counseling to prevent skin cancer: US Preventive Services Task Force recommendation statement. Ann Intern Med 2012;157:1–8.
15. CDC. Sunburn and sun protective behaviors among adults aged 18–29 years—United States, 2000–2010. MMWR Morb Mortal Wkly Rep 2012;61:317–22.
16. Wu XC, Eide MJ, King J, et al. Racial and ethnic variations in incidence and survival of cutaneous melanoma in the United States, 1999–2006. J Am Acad Dermatol 2011;65:S26–S37.
17. Battie C, Gohara M, Verschoore M, Roberts W. Skin cancer in skin of color: an update on current facts, trends, and misconceptions. J Drugs Dermatol 2013;12:194–8.
18. Myles ZM, Buchanan N, King JB, et al. Anatomic distribution of malignant melanoma on the non-Hispanic black patient, 1998–2007. Arch Dermatol 2012;148:797–801.
19. Jemal A, Saraiya M, Patel P, et al. Recent trends in cutaneous melanoma incidence and death rates in the United States, 1992–2006. J Am Acad Dermatol 2011;65:S17.
20. Colantonio S, Bracken MB, Beecker J. The association of indoor tanning and melanoma in adults: systematic review and meta-analysis. J Am Acad Dermatol 2014;70:847–57.
21. Guy GP, Berkowitz Z, Watson M, Holman DM, Richardson LC. Indoor tanning among young non-Hispanic white females. JAMA Intern Med 2013;173:1920–2.
22. Gandini S, Stanganelli I, Magi S, et al. Melanoma attributable to sunbed use and tan seeking behaviours: an Italian survey. Eur J Dermatol 2014;24:35–40.

Notes from the Field

Outbreaks of *Shigella sonnei* Infection with Decreased Susceptibility to Azithromycin Among Men Who Have Sex with Men — Chicago and Metropolitan Minneapolis-St. Paul, 2014

Anna Bowen, MD[1]; Dana Eikmeier, MPH[2]; Pamela Talley, MD[2,3]; Alicia Siston, PhD[4]; Shamika Smith, MPH[4]; Jacqueline Hurd, MPH[1]; Kirk Smith, PhD[2]; Fe Leano, MS[2]; Amelia Bicknese[1]; J. Corbin Norton[1]; Davina Campbell, MS[1] (Author affiliations at end of text)

Increasing rates of shigellosis among adult males, particularly men who have sex with men (MSM), have been documented in the United States, Canada, and Europe (*1*–*4*), and MSM appear to be at greater risk for infection with shigellae that are not susceptible to ciprofloxacin or azithromycin (*5*–*8*). Azithromycin is the first-line empiric antimicrobial treatment for shigellosis among children and is a second-line treatment among adults. Isolates collected in 2014 in two U.S. cities from outbreaks of shigellosis displayed highly similar pulsed-field gel electrophoresis (PFGE) patterns and decreased susceptibility to azithromycin (DSA). This report summarizes and compares the findings from investigations of the two outbreaks, which occurred among MSM in metropolitan Minneapolis-St. Paul, Minnesota, and Chicago, Illinois.

Minneapolis-St. Paul

In February 2015, the Minnesota Department of Health Public Health Laboratory determined that 14 *Shigella sonnei* isolates obtained during May 13–December 8, 2014, displayed DSA (minimum inhibitory concentration >16 μg/ml). CDC's National Antimicrobial Resistance Monitoring System laboratory performed antimicrobial susceptibility testing and polymerase chain reaction testing to identify resistance genes on 13 of these isolates. All 13 isolates 1) were susceptible to nalidixic acid and ciprofloxacin, 2) were resistant to ampicillin and trimethoprim/sulfamethoxazole, 3) displayed DSA, and 4) harbored macrolide resistance genes *mph*A and *erm*B. The 14 isolates yielded five similar PFGE patterns (Figure).

Patients were male, had a median age of 39 years (range = 24–64 years) and lived in or near metropolitan Minneapolis-St. Paul. Patients were ill for a median of 12 days (range = 8–21 days), and one patient (7%) was hospitalized. Five were treated with ciprofloxacin, three with metronidazole, one with azithromycin, and one with an unknown antimicrobial agent. Of the four remaining patients, two were not treated with antimicrobial agents, and two had no available treatment information. Eight of nine with such information self-identified as MSM. Thirteen (93%) had received a diagnosis of sexually transmitted infection at least once during 2012–2015 (chlamydia [16 infections], gonorrhea [10], and syphilis [2]). Six (43%) were infected with human immunodeficiency virus (HIV); three had CD4 counts of 467, 516, and 899, respectively, in late 2014.

Chicago

During July 31–October 31, 2014, the Chicago Department of Public Health detected 23 cases of *S. sonnei* infection among male Chicago residents aged >17 years. Among 17 (74%) isolates that underwent PFGE analysis, 10 displayed patterns highly similar to or indistinguishable from patterns in the Minneapolis-St. Paul outbreak (Figure) and are included in this analysis. The CDC laboratory performed antimicrobial susceptibility testing on eight Chicago isolates; all eight displayed the same antimicrobial susceptibility profile as the Minneapolis-St. Paul isolates and harbored *mph*A and *erm*B. The median age of the Chicago patients was 35 years (range = 24–53 years). Seven (88%) patients self-identified as MSM among eight who provided this information, and six (60%) were infected with HIV. Five (50%) patients were hospitalized; HIV infection was not associated with hospitalization (Fisher's exact test, p = 0.5).

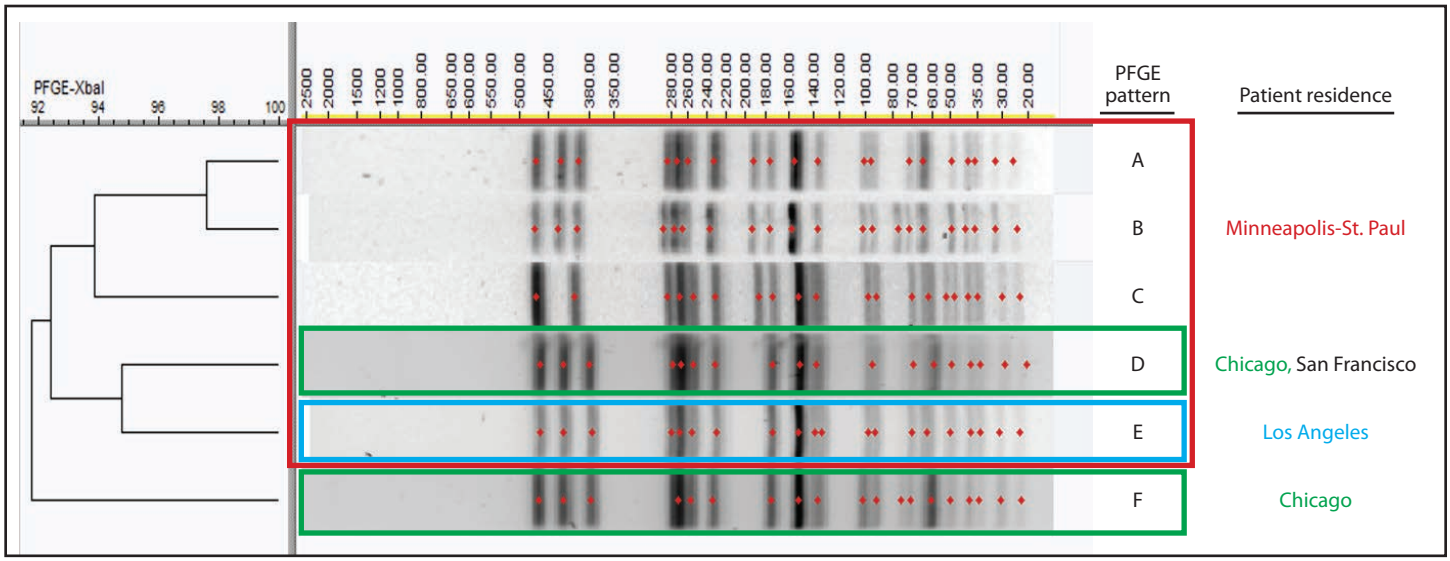
San Francisco and Los Angeles

Using CDC's PulseNet, investigators detected additional isolates with PFGE patterns indistinguishable from the outbreak clusters. A man aged 32 years from San Francisco who self-identified as MSM and reported no travel developed illness in January 2015 (Figure). In addition, one PFGE pattern was associated with a previously reported 2012 outbreak of 43 cases of shigellosis with DSA in Los Angeles (Figure) (*9*).

Further Laboratory Findings

To better understand the prevalence of DSA among *Shigella* in Minnesota, the public health laboratory tested the 80 (86%) available isolates from the 93 shigellosis cases reported in Minnesota in 2014. In addition to the 14 outbreak-associated *S. sonnei* isolates with DSA, the public health laboratory found DSA in two nonoutbreak *S. sonnei* isolates and four *Shigella flexneri* isolates, for a total of 20 (25%) shigellae with DSA in Minnesota in 2014. Patients infected with *Shigella* with DSA had a median age of 38 years (range = 19–64 years), 18 (90%) were male, and nine (45%) were known to be infected with HIV. Among 16 male patients who provided travel

FIGURE. Pulsed-field gel electrophoresis (PFGE) patterns created using enzyme *Xba*I and associated with outbreaks during 2014–2015 of *Shigella sonnei* infection with decreased susceptibility to azithromycin among men who have sex with men in 1) metropolitan Minneapolis-St. Paul, Minnesota (patterns A–E); 2) Chicago, Illinois (D and F); and 3) San Francisco, California (D); as well as with a 2012 outbreak in 4) Los Angeles, California (E)



information, none reported recent international travel; two female patients reported travel to Asia.

MSM in the United States and abroad appear to be at greater risk for shigellosis with DSA (*10*). MSM can protect themselves and others from shigellosis by washing hands before preparing food or eating and after using the toilet; refraining from swimming for 1 week after recovering from shigellosis; avoiding sex while they or their partners have diarrhea and for a few weeks after recovering from shigellosis; washing hands, genitals, and anus before and after sex; and using barriers such as dental dams and gloves during anal rimming and fisting. Clinicians should obtain stool cultures from patients with symptoms of shigellosis and choose treatments, when needed, based on isolate antimicrobial susceptibility profiles. Clinical guidance for the testing and interpretation of azithromycin susceptibility among shigellae is needed to guide patient management. Increasing rates of routine or outbreak-driven PFGE testing of shigellae can help track *Shigella* strains with DSA.

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[1]Division of Foodborne, Waterborne, and Environmental Diseases, National Center for Emerging, Zoonotic, and Infectious Diseases, CDC; [2]Minnesota Department of Health; [3]Epidemic Intelligence Service, CDC; [4]Chicago Department of Public Health, Illinois.

Corresponding author: Anna Bowen, abowen@cdc.gov, 404-639-4636.

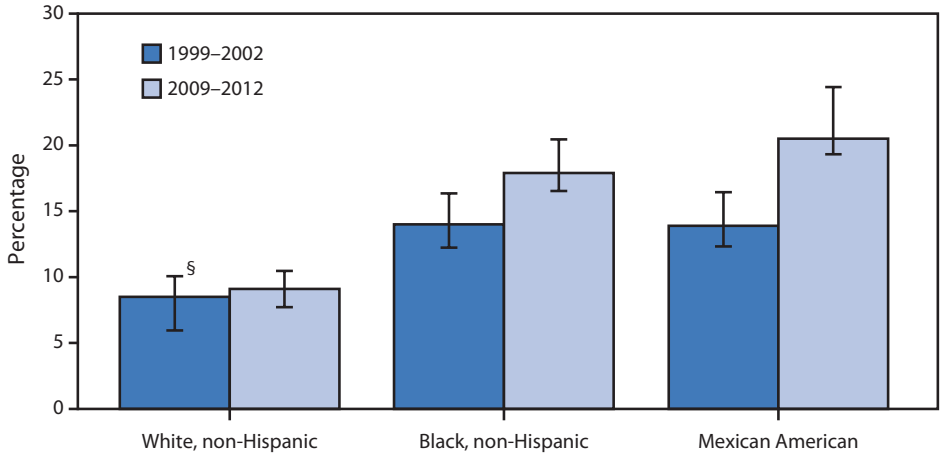
References

1. Aragón TJ, Vugia DJ, Shallow S, et al. Case-control study of shigellosis in San Francisco: the role of sexual transmission and HIV infection. Clin Infect Dis 2007;44:327–34.
2. Borg ML, Modi A, Tostmann A, et al. Ongoing outbreak of *Shigella flexneri* serotype 3a in men who have sex with men in England and Wales, data from 2009-2011. Euro Surveill 2012;17:20137.
3. Wilmer A, Romney MG, Gustafson R, et al. *Shigella flexneri* serotype 1 infections in men who have sex with men in Vancouver, Canada. HIV Med 2015;16:168–75.
4. Gupta A, Polyak CS, Bishop RD, Sobel J, Mintz ED. Laboratory-confirmed shigellosis in the United States, 1989–2002: epidemiologic trends and patterns. Clin Infect Dis 2004;38:1372–7.
5. Gaudreau C, Barkati S, Leduc JM, Pilon PA, Favreau J, Bekal S. *Shigella* spp. with reduced azithromycin susceptibility, Quebec, Canada, 2012–2013. Emerg Infect Dis 2014;20:854–6.
6. Gaudreau C, Ratnayake R, Pilon PA, Gagnon S, Roger M, Lévesque S. Ciprofloxacin-resistant *Shigella sonnei* among men who have sex with men, Canada, 2010. Emerg Infect Dis 2011;17:1747–50.
7. Heiman KE, Karlsson M, Grass J, et al. Notes from the field: *Shigella* with decreased susceptibility to azithromycin among men who have sex with men—United States, 2002–2013. MMWR Morb Mortal Wkly Rep 2014;63:132–3.
8. Hoffmann C, Sahly H, Jessen A, et al. High rates of quinolone-resistant strains of *Shigella sonnei* in HIV-infected MSM. Infection 2013;41:999–1003.
9. CDC. Notes from the field: Outbreak of infections caused by *Shigella sonnei* with decreased susceptibility to azithromycin—Los Angeles, California, 2012. MMWR Morb Mortal Wkly Rep 2013;62:171.
10. Baker K, Dallman T, Ashton P, et al. Intercontinental dissemination of azithromycin-resistant shigellosis through sexual transmission: a cross-sectional study. Lancet Infect Dis 2015. Epub April 27, 2015. Available at http://www.sciencedirect.com/science/article/pii/S147330991500002X.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Age-Adjusted* Percentage of Adults Aged ≥20 Years with Diabetes,† by Race and Hispanic Ethnicity — National Health and Nutrition Examination Survey, United States, 1999–2002 and 2009–2012



* Estimates are age-adjusted; pregnant women are excluded.
† Diabetes is defined as measured fasting plasma glucose of at least 126 mg/dL, measured hemoglobin A1c of at least 6.5, or having been diagnosed by a physician.
§ 95% confidence interval.

From 1999–2002 to 2009–2012, the prevalence of diabetes increased for non-Hispanic black and Mexican American adults, but remained stable for non-Hispanic white adults, increasing the disparity with the two minority populations. In 1999–2002, the prevalence of diabetes among non-Hispanic black (14.0%) and Mexican American (13.9%) adults aged ≥20 years was 1.6 times the prevalence among non-Hispanic white adults (8.5%). By 2009–2012, diabetes prevalence among Mexican American adults (20.5%) had increased to more than twice the prevalence among non-Hispanic white adults (9.1%); among non-Hispanic black adults (17.9%), the prevalence had increased to nearly twice that among non-Hispanic white adults.

Source: Health, United States, 2014: with special feature on adults aged 55–64. Table 44. Available at http://www.cdc.gov/nchs/hus.htm.

Reported by: Sheila J. Franco, sfranco@cdc.gov, 301-458-4331; Shilpa Bengeri.

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