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Homicide Rates Among Persons Aged 10–24 Years — United States, 1981–2010

Homicide disproportionately affects persons aged 10–24 years in the United States and consistently ranks in the top three leading causes of death in this age group, resulting in approximately 4,800 deaths and an estimated $9 billion in lost productivity and medical costs in 2010 (*1*). To investigate trends in homicide among persons aged 10–24 years for the period 1981–2010, CDC analyzed National Vital Statistics System data on deaths caused by homicide of persons in this age group and examined trends by sex, age, race/ethnicity, and mechanism of injury. This report describes the results of that analysis, which indicated that homicide rates varied substantially during the study period, with a sharp rise from 1985 to 1993 followed by a decline that has slowed since 1999. During the period 2000–2010, rates declined for all groups, although the decline was significantly slower for males compared with females and for blacks compared with Hispanics and persons of other racial/ethnic groups. By mechanism of injury, the decline for firearm homicides from 2000 to 2010 was significantly slower than for nonfirearm homicides. The homicide rate among persons aged 10–24 years in 2010 was 7.5 per 100,000, the lowest in the 30-year study period. Primary prevention strategies remain critical, particularly among groups at increased risk for homicide.

National homicide counts and population estimates for U.S. residents were obtained from the National Vital Statistics System using CDC's Web-based Injury Statistics Query and Reporting System (WISQARS) for persons aged 10–24 years for the period 1981–2010 (*1,2*). Data were stratified by year, sex, 5-year age group (i.e., 10–14, 15–19, and 20–24 years), and mechanism of injury (i.e., firearm or nonfirearm). Homicide counts and population estimates were further stratified by race/ethnicity for 1990–2010 (i.e., non-Hispanic white, non-Hispanic black, non-Hispanic other, and Hispanic).* Annual homicide rates (per 100,000 population) were determined overall and for the indicated strata. The most recent period (2000–2010) is of particular interest because it best reflects the populations currently at highest risk for whom the continued implementation of prevention strategies remains crucial. Trends for this later period were analyzed using a negative binomial rate regression modeling approach, allowing formal statistical evaluation of trends and comparisons across strata.

The overall homicide rate among persons aged 10–24 years varied substantially during the 30-year study period (Figure 1). Rates rose sharply from 1985 to 1993, increasing 83%, from 8.7 per 100,000 in 1985 to 15.9 in 1993. From 1994 to 1999, the overall rate declined 41%, from 15.2 per 100,000 in 1994 to 8.9 in 1999. Modeled rates indicate a slow but statistically significant downward trend in homicide in this age group for the period 2000–2010 (p=0.04), with a model-estimated decline of approximately 1% per year. The overall homicide rate in 2010 (7.5 per 100,000) was the lowest rate during the 30-year period. Nearly 80% of all homicides during the 30-year study period were firearm homicides (79% overall; range of annual percentages: 64%–85%). The annual rate of firearm homicide was on average 3.7 times the annual rate of

* Unless indicated otherwise, all racial/ethnic groups are non-Hispanic; Hispanics can be of any race. For this report, other races include Asian/Pacific Islander and American Indian/Alaska Native.

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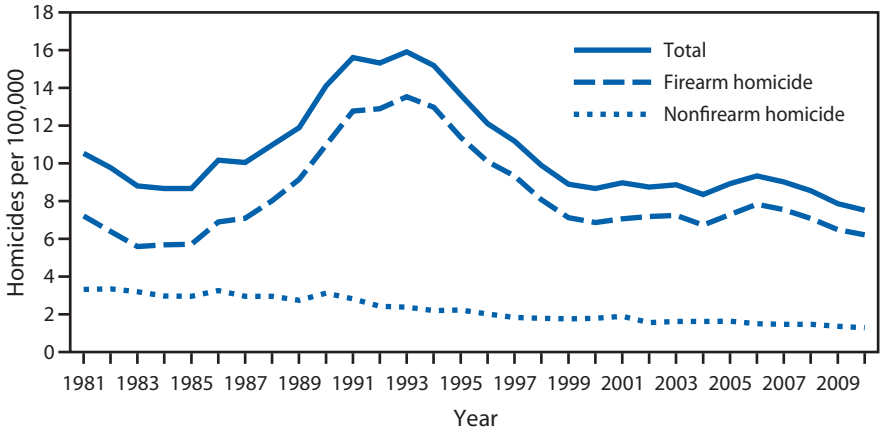
FIGURE 1. Firearm and nonfirearm homicide rates among persons aged 10–24 years — United States, 1981–2010



nonfirearm homicide during this period. Among persons aged 10–24 years, males, those aged 20–24 years, and blacks had the highest rates of homicide over the 30 years examined (Figures 2 and 3). In 2010, the homicide rates for these groups were 12.7 per 100,000 for males, 13.2 for persons aged 20–24 years, and 28.8 for blacks.

Patterns in homicide rates among persons aged 10–24 years for the period 2000–2010 were further examined by sex, age group, race/ethnicity, and mechanism of injury. Homicide rates for males remained substantially higher than rates for females (Figure 2). Although model-estimated rates for males and females indicate declines, in relative terms, the decline for males was significantly slower than the decline for females (p=0.03). When homicide rates were examined by age group, rates for persons aged 20–24 years remained highest, and rates for persons aged 10–14 years remained lowest (Figure 2). Model-estimated rates indicate declines for all three age groups. Age-specific declines in homicide rates were not found to be significantly different.

The examination of homicide rates by race/ethnicity for the period 2000–2010 shows that rates for blacks aged 10–24 years remained the highest and rates for whites in this age group remained the lowest (Figure 3). Model-estimated rates indicate a decline for all four racial/ethnic groups. The decline in homicide rates for blacks was significantly slower than the declines for Hispanics and persons of other racial/ethnic groups (p<0.01). The decline for blacks also was slower than the decline for whites, but the difference was not significant. Model-estimated rates indicate a decline during 2000–2010 for both firearm and nonfirearm homicides, with the decline for the firearm homicide rate significantly slower than the decline for the nonfirearm homicide rate (p<0.01) (Figure 1).

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FIGURE 2. Homicide rates among persons aged 10–24 years, by sex and age group — United States, 1981–2010

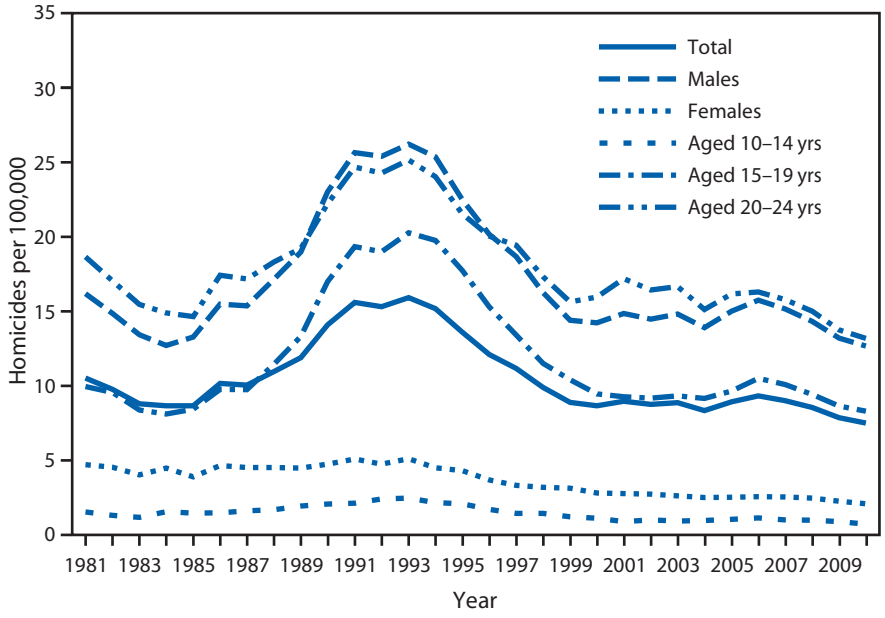
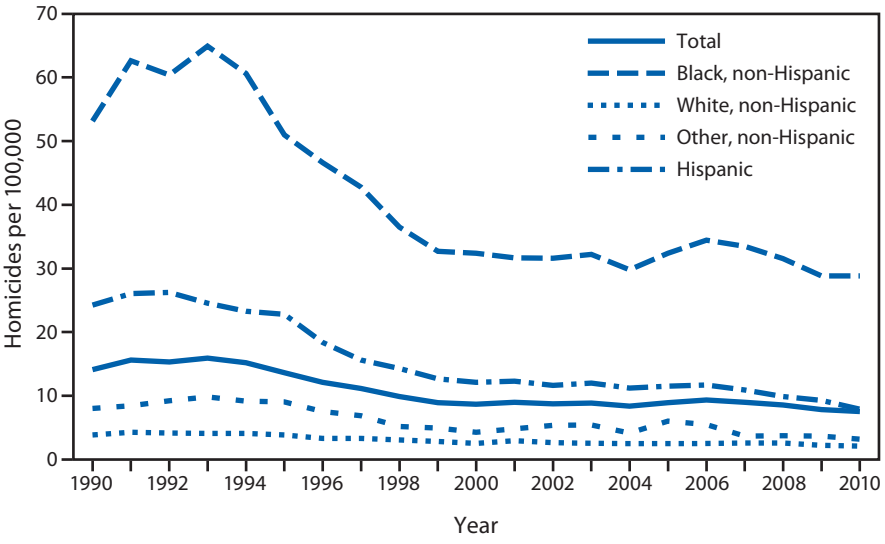


FIGURE 3. Homicide rates among persons aged 10–24 years, by race/ethnicity — United States, 1990–2010



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Editorial Note

For the past three decades, homicide has been a leading cause of death among adolescents and young adults in the United States. The findings in this report demonstrate that homicide rates among persons aged 10–24 years varied substantially over time but showed a decline from 1994 through 2010. Changes in the overall homicide rate for this age group during the 30-year study period primarily reflect variations in homicide rates for the groups at highest risk (i.e., males, persons aged 20–24, and blacks). These findings highlight the fact that despite an overall decline in homicide to a 30-year low in 2010, some adolescents and young adults remain disproportionately affected, and more recent declines in rates have been slower for those at increased risk for homicide. Overall, the findings of this report demonstrate that progress has been made in reducing homicide in these populations, but progress is slowing, and primary prevention of violence in these populations needs continued emphasis.

The variability of homicide rates among persons aged 10–24 years over time is similar to trends for other violent crime rates (*3*). Previous research has linked the rise and subsequent decline in homicide and violent crime in this population to changes in drug use and drug-related crime, shifting community demographics, community-based and problem-oriented policing (i.e., identification and analysis of a specific type of crime to develop customized, coordinated, and improved community response strategies), and varying economic conditions (*4*). Focused deterrence strategies specifically address serious violence and crime, and when implemented well, these strategies show promise in reducing crime though more rigorous evaluations are needed (*5*). Focused deterrence approaches vary in design and generally include an interagency coalition (e.g., law enforcement and social service providers), identification of crime perpetrator groups (e.g., gang members), communication of incentives (e.g., avoidance of incarceration and availability of education and employment services) to these groups to stop them from continuing to engage in violence, and law enforcement and social service organizations implementing activities (e.g., vocational training, mentoring, housing assistance, and substance use treatment) directed toward these groups.

Although law enforcement responses to violence and focused attention on high crime areas and perpetrators help to reduce the continuation of violence, they do not stop violence from happening in the first place. Research on youth violence demonstrates the importance of implementing primary prevention approaches that begin in childhood to disrupt the

developmental pathways to serious violence in adolescence and adulthood and can be diffused across large populations (*6,7*). A number of primary prevention strategies are scientifically proven to reduce the risk for and occurrence of youth violence and provide critical complements to law enforcement approaches (*6,7*). Examples of primary prevention strategies include 1) school-based programs that build the communication skills of youths to nonviolently solve problems; 2) family approaches that help caregivers set age-appropriate rules and effectively monitor children's activities and relationships; and 3) policy, environmental, and structural approaches that enhance safety and increase opportunities for positive social interaction. For example, innovative community-level strategies, such as business improvement districts, address socioeconomic and other factors that influence rates of violence, and initial results show that these approaches contribute to significant reductions in rates of crime and violence and cost savings attributed to such reductions, fewer arrests, and lower prosecution-related expenditures (*8*). Many other prevention strategies have been shown to reduce the risk for youth violence and result in a significant return on investment (*7*).

The findings of this report are subject to at least two limitations. First, race and ethnicity were not coded separately until 1990, restricting examination of racial/ethnic group statistics and differences to the period 1990–2010. Second, comparisons of census self-report and death certificate reports of race and ethnicity show misclassification for Hispanics, Asian/Pacific Islanders, and American Indian/Alaska Natives, which might result in underestimation of rates for these groups (*9*).

Community-wide and long-lasting reductions in youth violence come from comprehensive approaches that include multiple evidence-based strategies and collaboration of diverse groups, such as public health, justice, education, businesses, and community groups (*7*). The public health sector brings to this collaboration a science-driven approach that focuses on primary prevention and promotion of population-wide health and safety. CDC's Academic Centers of Excellence in Youth Violence Prevention and the Striving To Prevent Youth Violence Everywhere national initiative are examples of collaborative approaches to strategically plan and implement comprehensive, evidence-based strategies that include the public health sector (*10*).

Acknowledgment

J. Lee Annest, PhD, Div of Analysis, Research, and Practice Integration, National Center for Injury Prevention and Control, CDC.

What is already known on this topic?

Homicide consistently ranks in the top three leading causes of death among persons aged 10–24 years in the United States.

What is added by this report?

Youth homicide rates during 1981–2010 fluctuated widely over time but had a downward trend beginning in 1994. The 2010 youth homicide rate of 7.5 per 100,000 is the lowest rate in the 30 years examined. However, the decline in overall youth homicide rates has slowed in the last decade. Declines have been slower for the highest-risk groups (e.g., males and non-Hispanic blacks) and for firearm homicide.

What are the implications for public health practice?

The continued use of evidence-based, primary prevention strategies to stop youth violence is needed. The public health sector reaching the highest-risk youths with effective prevention strategies is particularly critical.

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CDC Grand Rounds: Reducing Severe Traumatic Brain Injury in the United States

A traumatic brain injury (TBI) is caused by a bump, blow, jolt, or penetrating wound to the head that disrupts the normal functioning of the brain (*1*). In 2009, CDC estimated that at least 2.4 million emergency department visits, hospitalizations, or deaths were related to a TBI, either alone or in combination with other injuries (*2*). Approximately 75% of TBIs are mild, often called concussions (*3*). Children, adolescents, and older adults are most likely to sustain a TBI (*4*). Nearly one third (30.5%) of all injury deaths included a diagnosis of TBI (*5*). In addition, an estimated 5.3 million U.S. residents are living with TBI-related disabilities, including long-term cognitive and psychologic impairments (*6*). A severe TBI not only affects a person's life and family, but also has a large societal and economic toll. The economic costs of TBIs in 2010 were estimated at $76.5 billion, including $11.5 billion in direct medical costs and $64.8 billion in indirect costs (e.g., lost wages, lost productivity, and nonmedical expenditures) (*7,8*). These data underestimate the national burden because they include neither TBIs managed in nonhospital settings nor >31,000 military personnel diagnosed with TBI and treated in the U.S. Department of Defense or Veterans Administration medical systems in 2010 (*9*).

The leading causes of TBI in the general population are falls (35.2%), motor vehicle crashes (17.3%), blunt impact (e.g., being struck by or against a moving or stationary object) (16.5%), and assaults (10%) (*4*). Different age groups are affected to varying degrees (Table). Falls account for a large proportion of TBIs among children aged 0–14 years and among adults aged ≥65 years (*4*). Motor vehicle crashes and assaults are the predominant causes of TBIs in teens and young adults aged 15–34 years (*4*). Military personnel, both in and out of combat, and rescue workers and victims exposed to blasts also are at risk for TBI (*10*).

TBIs can be categorized as mild (often called concussions), moderate, or severe based on the Glasgow Coma Scale (*11*). This and other categorization systems, although crucial for clinical management, generally do not reflect the underlying pathologic processes of the injury or nonfatal outcomes. The lack of a system for severity classification is one of the major gaps in the clinical assessment and treatment of TBIs (*12,13*).

Much of the brain injury occurs after the primary injury, not at the moment of initial impact. A complex biologic cascade begins immediately after the trauma and can continue for hours to weeks after the initial injury. It is this secondary injury that can significantly increase the overall morbidity and mortality that follows a TBI. Although research is ongoing, no drugs have yet been proven to reduce secondary injury and improve functional outcome of TBIs (*14*). The long-term or lifelong physical, cognitive, behavioral, and emotional consequences of a severe TBI can affect all aspects of a person's life, including the ability to return to work or school and sustain relationships with family, friends, and community (*2*).

This is another in a series of occasional MMWR *reports titled CDC Grand Rounds. These reports are based on grand rounds presentations at CDC on high-profile issues in public health science, practice, and policy. Information about CDC Grand Rounds is available at http://www.cdc.gov/about/grand-rounds.*

Public Health Role in Addressing Severe TBIs — Challenges and Opportunities

Public health efforts coordinated across organizations and communities could help to reduce the incidence of TBIs and mitigate their short- and long-term consequences. Those efforts can include primary prevention, early management, and comprehensive approaches to rehabilitation and reintegration.

Primary Prevention

Public health plays a key role in primary prevention of TBI by conducting surveillance, identifying and disseminating evidence-based strategies, and promoting implementation of effective policies. Several systems collect and report national and state-based TBI data used for surveillance, including multiple cause of death mortality data and vital statistics submitted to the National Vital Statistics System from all 50 states and the District of Columbia, basic TBI surveillance from the 20 states funded through the Core Violence and Injury Prevention Program, reports and data from the National Trauma Data Bank, and national estimates of injury-related emergency department visits from the National Electronic Injury Surveillance System.* These data collection tools are critical for monitoring TBI incidence and informing decision making on prevention initiatives, research needs, and education priorities. However, current data sources do not provide the level of detail needed to fully understand the epidemiology and long-term outcomes of TBI. A more

* Additional information available at http://www.cdc.gov/nchs/deaths.htm; http://www.cdc.gov/nchs/nvss.htm; http://www.cdc.gov/injury/stateprograms; http://www.facs.org/trauma/ntdb/index.html; and http://www.cpsc.gov/library/neiss.html.

TABLE. Estimated average annual numbers and rates* of emergency department visits, hospitalizations, and deaths related to traumatic brain injury, by age group and external cause — United States, 2002–2006

	Motor vehicle crash		Falls		Assault		Blunt impact		Other/Unknown	
Age group (yrs)	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
0–4	15,429	77.1	167,950	838.7	1,619	8.1	54,811	273.7	27,974	139.7
5–9	10,180	51.7	44,114	223.9	1,091	5.5	36,139	183.4	22,740	115.4
10–14	9,076	43.3	44,750	213.4	11,991	57.2	35,826	170.8	27,568	131.5
15–19	52,408	252.4	34,911	168.1	24,528	118.1	37,595	181.0	36,646	176.5
20–24	54,224	261.3	21,191	102.1	36,337	175.1	19,464	93.8	30,594	147.4
25–34	54,161	135.8	35,368	88.7	41,197	103.3	31,399	78.7	48,467	121.5
35–44	29,888	67.8	39,662	89.9	25,285	57.3	22,744	51.6	45,162	102.4
45–54	29,031	69.8	39,871	95.8	17,058	41.0	17,743	42.6	32,205	77.4
55–64	18,951	65.2	22,940	78.9	8,031	27.6	10,579	36.4	24,740	85.1
65–74	8,653	46.7	37,466	202.2	1,567	8.5	7,627	41.2	16,294	87.9
≥75	10,193	57.1	106,872	599.2	909	5.1	5,957	33.4	42,306	237.2

* Per 100,000 population.

comprehensive national injury surveillance system that enables population-based longitudinal or follow-up studies would better guide prevention efforts and aid in the evaluation of the effectiveness of interventions (*2*).

Public policies can advance prevention of TBIs and other injuries through education, enforcement of safety laws and regulations, engineering, and economic incentives. This is demonstrated by recent progress in reducing deaths and serious injuries from motor vehicle crashes. Since 1980, the rate of TBI-associated deaths caused by motor vehicle crashes decreased approximately 40%, in part because of a multitude of public policies and law enforcement. Those initiatives have included state laws and sustained, high-visibility enforcement that increased nationwide seatbelt use to 85% (*15*), universal motorcycle helmet laws in states that sustained helmet usage of 90% or higher (*16*), and enforcement of state laws lowering the legal limit for blood alcohol concentration to 0.08 g/dL and raising the minimum drinking age from 18 to 21 years (*17*). Despite these policy successes, ongoing challenges to injury and TBI prevention remain. In 2011, for example, alcohol-impaired driving still accounted for 31% of the total motor vehicle traffic fatalities in the United States (*18*).

Because the causes of TBIs vary among population groups, multiple educational and awareness efforts are needed to improve the primary prevention of severe TBI. For example, in the last decade, the number of children and adolescents who sought care in emergency departments for sports- and recreation-related TBIs, including concussions, increased 60% (*19*). In response, CDC, in collaboration with the National Collegiate Athletic Association, National Football League, and many associations governing sport activities, created concussion educational resources for coaches, athletes, and medical professionals.† To prevent fall-related TBIs among older adults, CDC partnered with stakeholder organizations to develop educational materials that describe evidence-based interventions to help public health practitioners, clinicians, community-based organizations, and older adults to prevent, recognize, and respond to the signs and symptoms of TBI.§ A leading cause of child maltreatment deaths in the United States, is "shaken baby syndrome" (abusive head trauma). The steps to implement evidence-based intervention strategies and integrate specific education messages into existing programs for new parents, caregivers, professionals, and the general public are outlined in the CDC publication, *Preventing Shaken Baby Syndrome: Guide for Health Departments and Community-Based Organizations*.¶

Early Management

An effective public health response to TBI requires concerted programs to minimize adverse outcomes among injured persons, including efforts to improve acute care and early management, and strategies to ensure patient access to appropriate care and services. The CDC publication, *Guidelines for Field Triage of Injured Patients, Recommendations of the National Expert Panel on Field Triage, 2011*, was developed to help prehospital-care providers recognize injured patients who are most likely to benefit from specialized trauma center resources (*20*). The risk for death for a severely injured adult patient is 25% lower when the patient receives care at a Level I trauma center than at a nontrauma center (*21*). Unfortunately, nearly 45 million U.S. residents live more than an hour away from Level I or II trauma centers (i.e., hospitals that have the resources to treat patients with life-threatening injuries).

The Brain Trauma Foundation (BTF) guidelines for prehospital and in-hospital management of severe TBIs provide

† Available at http://www.cdc.gov/concussion.

§ Available at http://www.cdc.gov/homeandrecreationalsafety/falls/index.html.
¶ Available at http://www.cdc.gov/concussion/headsup/sbs.html.

health-care professionals with evidence-based patient care and treatment recommendations.** A study assessing the effectiveness of adopting the BTF guidelines estimated that full implementation would result in a 50% decrease in deaths, a savings of approximately $288 million in medical and rehabilitation costs, and savings of approximately $3.8 billion in annual societal costs for severely injured persons who survived TBI (*22*). However, adherence to BTF guidelines in 2006 was approximately 65% in Level I and Level II trauma centers (*23*). Moreover, TBI mortality and morbidity vary widely, even in centers that report adoption of the guidelines.

The structure, organization, and use of emergency medical services and trauma systems can have a profound impact on improved acute care and early management of injured patients, the costs associated with trauma care, and on the lives of the millions of persons injured every year in the United States. Continued efforts are needed to promote widespread treatment guideline adoption, ensure early access to trauma care, and support the development of trauma systems that are integrated with public health systems across the United States. Ongoing collaboration among local, regional, and state emergency medical services agencies with governmental, nongovernmental, academic, and public health agencies and institutions will allow the continued analysis and evaluation of the effect of the guidelines on the care of acutely injured patients, including those with TBIs.

Comprehensive Approaches to Rehabilitation and Reintegration

Because of the variability in how disabilities associated with TBI might permanently alter a person's vocational aspirations and social and family relationships, each patient needs an individualized approach to rehabilitation and community reintegration. This ensures that each person reaches their maximum functional potential, learns to adapt to their disability, and maximizes the possibility that they will be able to return to their employment or former role in households and communities.

Current evidence shows that a comprehensive program of rehabilitation is the most effective way of helping patients regain function and minimize negative consequences of TBIs (*24*). Public health plays a critical role in supporting the rehabilitation and reintegration of patients into their communities and in identifying mechanisms for reimbursement that allow access to comprehensive care. Public health and the clinical community also need to collaborate to build the evidence base for effective strategies of comprehensive rehabilitation programs, disseminate best practices, and link rehabilitation care to public health interventions that support life-long health.

** Guidelines for management of severe traumatic brain injuries are available from BTF at https://www.braintrauma.org/professional-homepage.

Conclusions

TBI is an important public health problem that requires more attention, societal engagement, and research. The major aspects of public health interventions for TBI include primary prevention, early management, and comprehensive approaches to rehabilitation and community reintegration. TBIs can be prevented through available interventions, but those interventions must be implemented in coordination with commitment of multiple sectors of society, including efforts at federal, state, local and community levels. More research also is needed to understand the basic mechanisms and pathophysiology of TBI, and to identify treatments and therapies that can mitigate its long-term consequences.

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Outbreak of *Salmonella* Heidelberg Infections Linked to a Single Poultry Producer — 13 States, 2012–2013

In June 2012, the Oregon Health Authority and the Washington State Department of Health noted an increase in the number of *Salmonella enterica* serotype Heidelberg clinical isolates sharing an identical pulsed-field gel electrophoresis (PFGE) pattern. In 2004, this pattern had been linked to chicken from Foster Farms by the Washington State Department of Health; preliminary 2012 interviews with infected persons also indicated exposure to Foster Farms chicken. On August 2, 2012, CDC's PulseNet* detected a cluster of 19 *Salmonella* Heidelberg clinical isolates matching the outbreak pattern. This report summarizes the investigation by CDC, state and local health departments, the U.S. Department of Agriculture's Food Safety and Inspection Service (USDA-FSIS), and the Food and Drug Administration (FDA) and reinforces the importance of safe food handling to prevent illness. A total of 134 cases from 13 states were identified, including 33 patients who were hospitalized. This multifaceted investigation used standard epidemiologic and laboratory data along with patient shopper card purchase information, and PFGE data from the retail meat component of the National Antimicrobial Resistance Monitoring System (NARMS)†, a relatively novel tool in outbreak investigation, to link the outbreak strain to chicken from Foster Farms.

Epidemiologic Investigation

A total of 134 persons infected with the *Salmonella* Heidelberg outbreak strain§ with illness onset on or after June 1, 2012, were identified in 13 states (Figure 1). Median patient age was 22 years (range: <1 to 94 years); 73 (55%) of 132 patients with data available were female. Illness onset ranged from June 4, 2012, to April 16, 2013. Thirty-three (31%) of 105 patients with known outcomes were hospitalized; no deaths were reported. The majority of cases were reported from four states in the Pacific Northwest: Washington, 57 cases; Oregon, 40; Alaska, 13; and California, 11 (Figure 1). This outbreak appears to have ended, based on the calculated 5-year baseline of the expected number of cases reported per week.

Initial state-based interviews found that chicken was commonly consumed by the persons with infections. A structured questionnaire was developed to collect detailed information on chicken and other exposures noted during initial interviews, and exposures commonly linked to *Salmonella* Heidelberg, such as eggs. Of 70 patients who responded, 55 (79%) reported consuming chicken in the week before illness onset, a percentage significantly higher (p=0.01) than the 64.9% reported in the 2006–2007 Foodborne Diseases Active Surveillance Network (FoodNet) Population Survey of healthy persons.¶ In addition, eight patients reported that chicken had been prepared in the home, but either had not been consumed or consumption was not specified. In total, 36 (71%) of 51 patients who had brand information available reported exposure either to Foster Farms chicken (27 patients) or to another brand likely produced by Foster Farms (although packaging information was unavailable) (nine patients). Other exposures of interest (e.g., eggs) were reported in significantly lower proportions by patients than by respondents to the FoodNet survey.

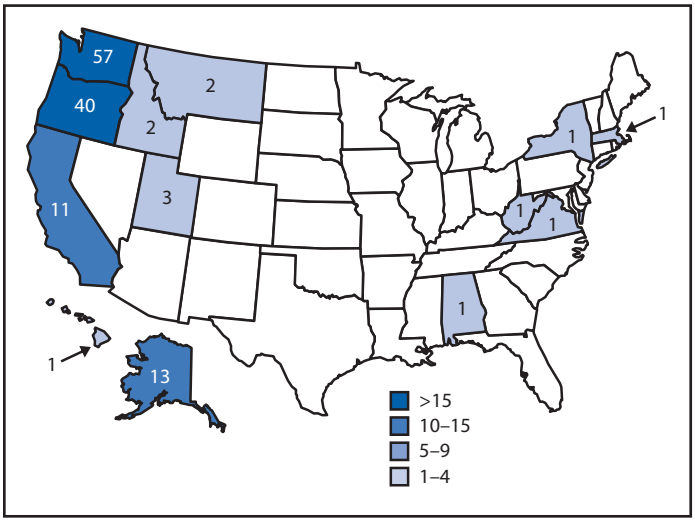
NARMS, a collaboration of CDC, FDA's Center for Veterinary Medicine, USDA, and participating state public health laboratories, monitors the prevalence and trends of antimicrobial resistance among enteric bacteria from humans, raw unprocessed retail meats, and food animals. Of 14 clinical isolates from this outbreak tested for antimicrobial susceptibility by NARMS, 12 were susceptible to all antimicrobials tested, and two were resistant to amoxicillin/clavulanic acid, ampicillin, cefoxitin, ceftiofur, and ceftriaxone. The two patients with resistant isolates both were aged <12 months and required hospitalization; for both patients, exposure to Foster Farms chicken was reported. Resistance was mediated by the presence of an IncI1 plasmid carrying a $bla_{\text{CMY-2}}$ gene. Plasmids are mobile genetic elements that can be gained or lost relatively easily, which might explain the variable resistance profiles. Resistance to third-generation cephalosporins (e.g., ceftriaxone) is clinically important because extended-spectrum cephalosporins are commonly used for treatment of severe salmonellosis in children (*1*).

Product Testing and Traceback Investigation

Oregon and Washington worked with USDA-FSIS to conduct a traceback investigation using shopper card records from nine patients. Records indicated all nine patients purchased Foster Farms chicken before illness onset. Four intact (i.e., unopened) chicken samples from three Washington patients' homes were tested for *Salmonella*; all yielded the outbreak strain and were traced back to two Foster Farms slaughter

* Additional information available at http://www.cdc.gov/pulsenet.
† Additional information available at http://www.fda.gov/animalveterinary/safetyhealth/antimicrobialresistance/nationalantimicrobialresistancemonitoringsystem/default.htm.
§ *Xba*I pattern JF6X01.0122.
¶ Additional information available at http://www.cdc.gov/foodnet/studies/population-surveys.html.

FIGURE 1. Number of persons (N = 134) infected with the outbreak strain of *Salmonella* Heidelberg, by state — United States 2012–2013



establishments. Three were susceptible to all antimicrobials tested; one was resistant to gentamicin, streptomycin, and sulfisoxazole. As part of this investigation, USDA-FSIS sent an incident investigation team to one Foster Farms slaughter establishment; the results of that investigation have not yet been finalized.

NARMS Retail Samples

The NARMS retail meat surveillance program isolated the outbreak strain from Foster Farms retail chicken samples purchased in Washington and Oregon in October 2012. Using PFGE data provided by the Center for Veterinary Medicine, the association between Foster Farms chicken and the outbreak strain was evaluated. From 2002 to 2011, *Salmonella* was isolated from 1,503 (13%) of 11,417 retail chicken samples tested by NARMS, of which 233 (16%) were serotype Heidelberg. Among these, 48 (21%) matched the outbreak strain, of which 47 (98%) were Foster Farms retail chicken isolates. Stratification by brand showed that 47 (52%) of 90 NARMS Foster Farms chicken isolates matched the outbreak strain, compared with one (0.7%) of 143 isolates not from Foster Farms ($p<0.001$).

Public Health Response

The two state health departments and CDC issued Internet announcements and news releases regarding the outbreak investigation, indicating that Foster Farms chicken was the most likely source of the outbreak, that antimicrobial testing revealed most of the isolates were susceptible to all antimicrobial agents tested, and reminding the public of the importance of safe handling of raw poultry.

What is already known on this topic?

Poultry is the commodity most frequently associated with *Salmonella* outbreaks. *Salmonella* is the most common bacterial cause of foodborne illness in the United States, and is estimated to cause approximately 1 million illnesses annually.

What is added by this report?

An outbreak of 134 *Salmonella* Heidelberg cases in the Pacific Northwest was linked to chicken consumption. Information from National Antimicrobial Resistance Monitoring System (NARMS) retail meat surveillance and shopper card records helped link the outbreak strain with Foster Farms.

What are the implications for public health practice?

The historical significance of this pattern in the Pacific Northwest suggests the need for ongoing surveillance and intervention to prevent additional illnesses. Shopper card records and NARMS retail meats surveillance can provide brand information crucial to investigations of outbreaks linked to commonly consumed foods. Because it is not unusual that raw poultry from any producer has *Salmonella,* it is important to continue to remind consumers of the need for safe raw poultry handling practices to help the public protect themselves and others from foodborne illness.

Reported by

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Editorial Note

Epidemiologic data, traceback investigations, and product testing support the conclusion that Foster Farms chicken was the likely source of this outbreak. Shopper card records collected from patients provided specific brand information for chicken, a commonly consumed food product, and were critical to linking this outbreak to a single chicken producer. The NARMS retail meat surveillance program not only isolated the outbreak strain from Foster Farms retail chicken samples purchased in Oregon and Washington during the current outbreak, but also demonstrated that 98% of historic isolates matching the outbreak strain were from Foster Farms retail chicken samples. One limitation to these findings is

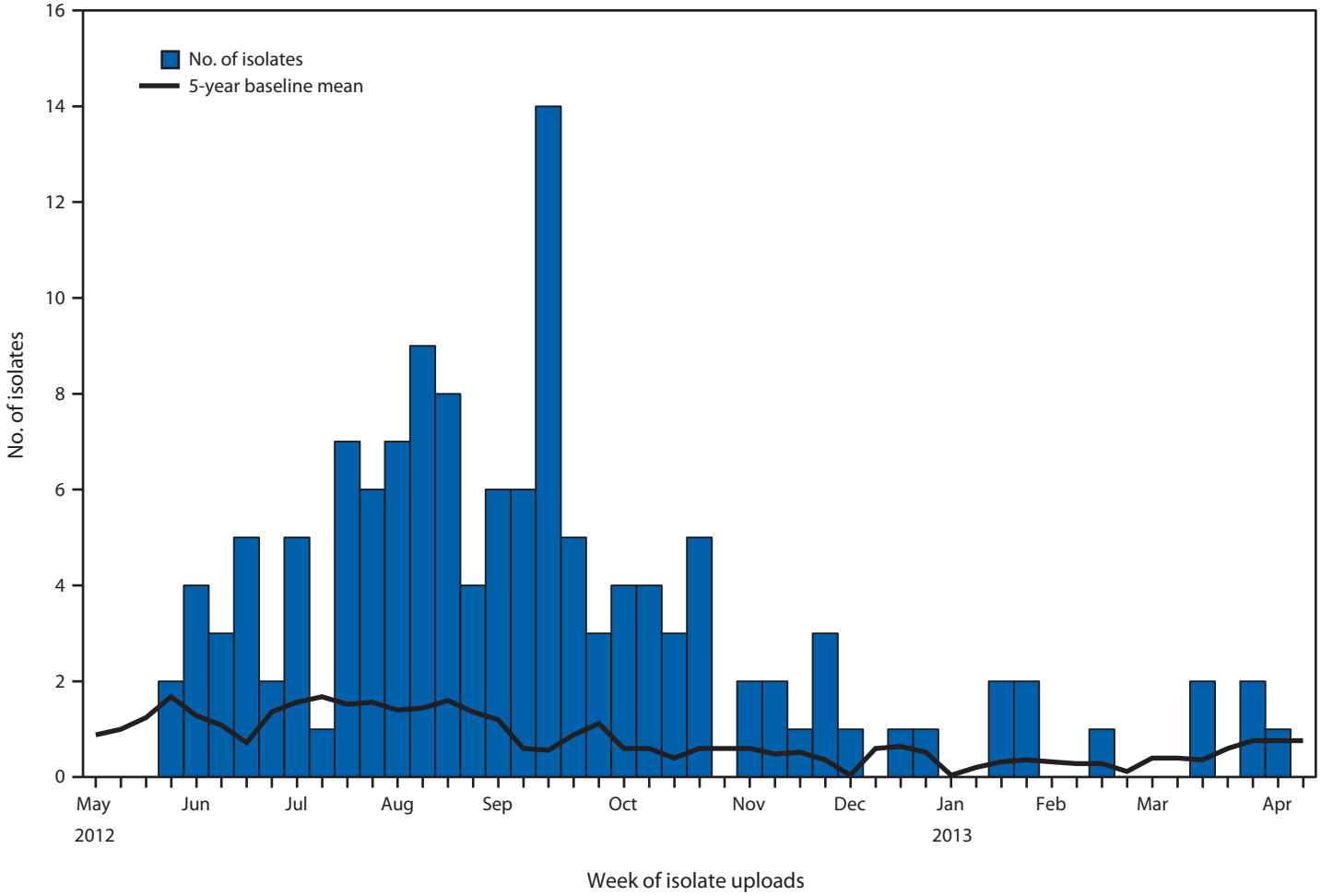
that they might not reflect all establishments that produce Foster Farms chicken or all brands of chicken produced by each establishment.

PulseNet data collected before this outbreak indicate that four to eight human isolates of this Heidelberg pattern typically are uploaded each month from June to November (Figure 2). During this outbreak, an average of 12 human isolates matching the outbreak strain was uploaded each month. The proportion of *Salmonella* Heidelberg human isolates uploaded to PulseNet with this PFGE pattern also has been increasing: from 3.5% to 5.7% of all *Salmonella* Heidelberg uploads per year during 2004–2008, to 3.7% to 13.7% during 2009–2012.

Historically, reports of this pattern to PulseNet come from the Pacific Northwest region of the United States. Foster Farms chicken was previously linked to illness in a 2004 investigation by Washington and USDA-FSIS (Kathryn MacDonald, Washington State Department of Health, personal communication, 2012). USDA-FSIS conducted comprehensive food safety assessments in 2004 and 2009. Following the 2004 assessment, USDA-FSIS issued a Notice of Intended Enforcement to Foster Farms, after which uploads to PulseNet of the outbreak strain decreased, followed by an increase in 2009 (Figure 3). From 2001 to 2012, *Salmonella* was isolated from 3,094 (4%) of 83,743 raw meat and poultry samples collected for testing by USDA-FSIS from establishments in the western United States. Among these, 264 (9%) were serotype Heidelberg, 45 (17%) of which matched the outbreak strain. The historical significance of this pattern in the Pacific Northwest suggests the need for ongoing surveillance and intervention to prevent additional illnesses.

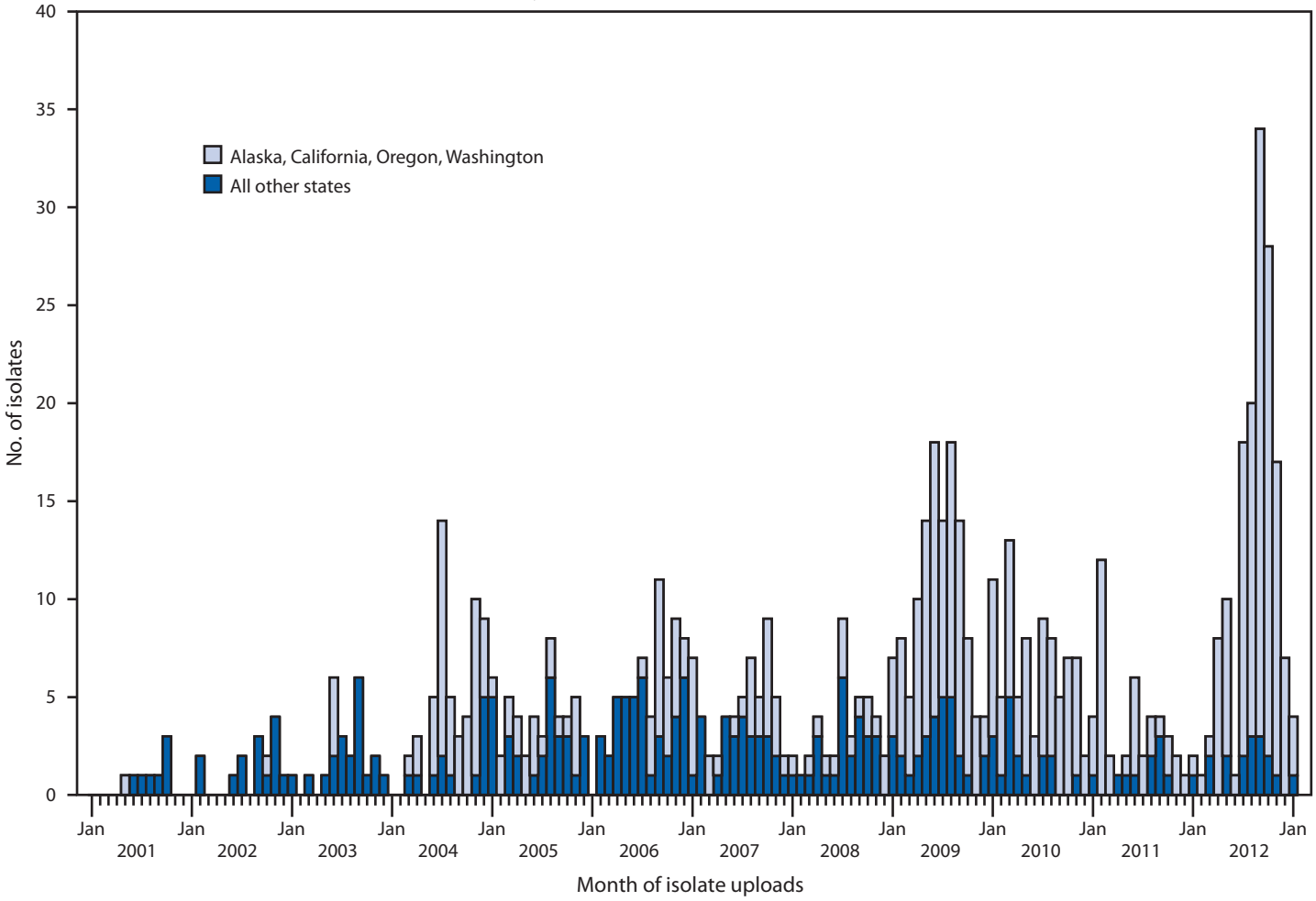
Salmonella Heidelberg is frequently isolated from retail meats and predominantly from poultry products; in 2010, 38% of *Salmonella* Heidelberg strains isolated from retail chicken breasts were resistant to at least one antimicrobial class (*2*). Raw poultry in general can have *Salmonella*, and *Salmonella* is not considered a bacterial contaminant in raw poultry

FIGURE 2. Number of clinical isolates matching the *Salmonella* Heidelberg outbreak strain and 5-year baseline mean number of cases with the same strain, by week of uploads — PulseNet,* United States, 2012–2013



* Additional information available at http://www.cdc.gov/pulsenet.

FIGURE 3. Comparison of the number of clinical isolates matching the *Salmonella* Heidelberg outbreak strain from Alaska, California, Oregon, and Washington with the number from all other states, by month of uploads — PulseNet,* United States, 2001–2012



* Additional information available at http://www.cdc.gov/pulsenet.

from a regulatory perspective. However, poultry is the commodity most often associated with *Salmonella* outbreaks (*3*). Therefore, consumers should follow safe handling instructions to help protect themselves and others from foodborne illness. USDA-FSIS set stricter pathogen-reduction performance standards for *Salmonella* contamination in young chicken and turkey carcasses at slaughter facilities, effective July 2011. In December 2012, USDA-FSIS announced that all establishments producing not-ready-to-eat ground or comminuted poultry products, including Foster Farms, will be required to reassess their Hazard Analysis and Critical Control Points plans, in response to recent turkey-associated outbreaks of salmonellosis (*4,5*).

This outbreak illustrates the importance of a multifaceted outbreak investigation, and particularly the value of incorporating historical PulseNet and NARMS data with information from patient interviews, shopper card records, and product samples from patients' homes. NARMS retail meat surveillance data is a relatively novel and useful tool to help link an outbreak strain with a particular brand and should be considered in future foodborne disease outbreak investigations.

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Update: Recommendations for Middle East Respiratory Syndrome Coronavirus (MERS-CoV)

On June 11, 2013, CDC issued interim infection prevention and control recommendations for hospitalized patients with known or suspected Middle East respiratory syndrome coronavirus (MERS-CoV) infection in U.S. hospitals (*1*). To date, no MERS-CoV cases have been reported in the United States; however, cases have been reported in eight other countries (*2*). Recent published reports (*3,4*) have described limited health-care transmission of MERS-CoV, including cases among health-care personnel in international settings. These published reports highlight the need for rapid detection of infectious patients and adherence to correct infection prevention measures to prevent transmission of the virus among patients, health-care personnel, and visitors.

In coming months, the U.S. health-care system might be called upon to provide care to patients infected with MERS-CoV. Front-line providers and health-care organizations should be prepared to care for MERS-CoV patients as part of routine operations. To aid providers and facilities, CDC has developed checklists that identify key actions that can be taken now to enhance preparedness for treating persons with MERS-CoV infection and compiled a list of preparedness resources (available at http://www.cdc.gov/coronavirus/mers/preparedness).

Additional information, including guidance on case definitions, infection control, case investigation, and specimen collection and testing, is available at the CDC MERS website (*2*). The MERS website contains the most current information and guidance, which is subject to change. State and local health departments with questions should contact the CDC Emergency Operations Center at telephone, 770-488-7100.

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Announcement

Community Preventive Services Task Force Issues 2013 Annual Report to Congress

The Community Preventive Services Task Force recently posted its *2013 Annual Report to Congress and to Agencies Related to the Work of the Task Force* on its website. The report, which focuses on cardiovascular disease, is available at http://www.thecommunityguide.org/annualreport/index.html.

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

Errata

Vol. 62, No. 23

In the report, "Nationwide Rubella Epidemic — Japan, 2013" an error occurred in the first sentence of the first full paragraph on page 460. That sentence should read, "In the current outbreak, males aged 20–39 years, many of whom had not been vaccinated in the initial rubella vaccination program for male junior high students offered only in clinics and hospitals, have accounted for 46% of reported cases."

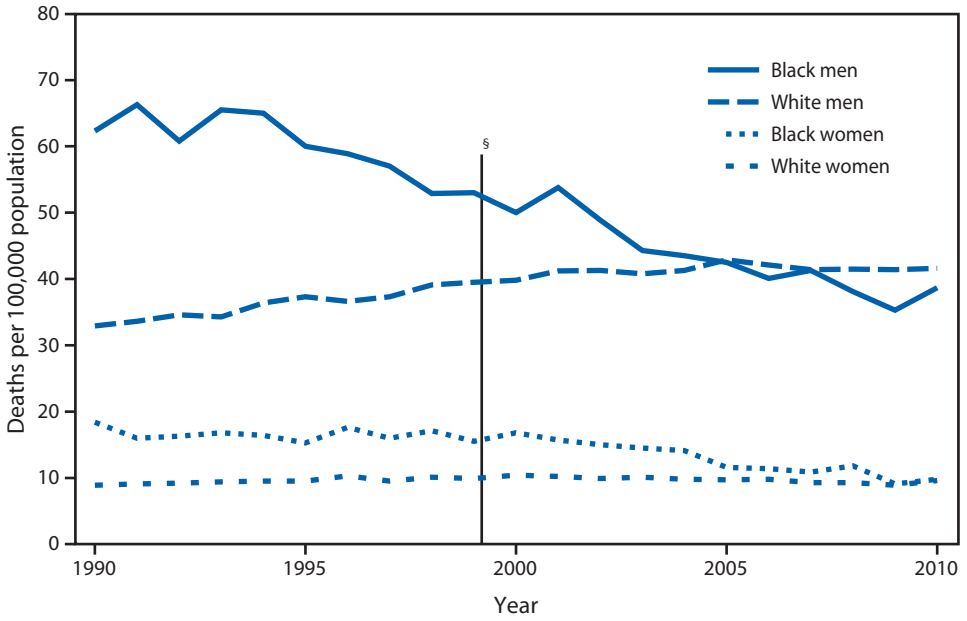
Vol. 62, No. 25

In the report, "HIV and Syphilis Infection Among Men Who Have Sex with Men — Bangkok, Thailand, 2005–2011," an error occurred in the table of on page 519. In the median (range) row, the number under clients should be **27**.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Age-Adjusted Death Rates* from Esophageal Cancer† for Persons Aged ≥65 Years, by Race and Sex — National Vital Statistics System, United States, 1990–2010



* Per 100,000 population. Rates have been revised by using populations enumerated as of April 1, for 2000 and 2010, and intercensal estimates as of July 1 for all other years. Therefore, the rates might differ from those published previously.

† Deaths from esophageal cancer include those coded as C15 in the *International Classification of Diseases, 10th Revision* (ICD-10) and as 150 in the *International Classification of Diseases, Ninth Revision* (ICD-9).

§ In 1999, ICD-10 replaced the ICD-9. Little change was observed in the classification of esophageal cancer deaths from ICD-9 to ICD-10.

During 1990–2010, the age-adjusted esophageal cancer death rate decreased 38% for black men and 47% for black women aged ≥65 years. For white men in this age group, the rates increased 26% during 1990–2002 and stabilized during the rest of the decade; for white women the rates stayed nearly the same. In 2010, esophageal cancer death rates were nearly 40 per 100,000 population for white and black men aged ≥65 years and nearly 10 per 100,000 population for white and black women in the same age group.

Sources: CDC. National Vital Statistics System. Available at http://www.cdc.gov/nchs/data_access/vitalstatsonline.htm.

CDC. Health Data Interactive. Available at http://www.cdc.gov/nchs/hdi.htm.

CDC. CDC WONDER. Available at http://wonder.cdc.gov.

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Data presented by the Notifiable Disease Data Team and 122 Cities Mortality Data Team in the weekly *MMWR* are provisional, based on weekly reports to CDC by state health departments. Address all inquiries about the *MMWR* Series, including material to be considered for publication, to Editor, *MMWR* Series, Mailstop E-90, CDC, 1600 Clifton Rd., N.E., Atlanta, GA 30333 or to *mmwrq@cdc.gov.*

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