

Fatal and Nonfatal Injuries Involving Fishing Vessel Winches — Southern Shrimp Fleet, United States, 2000–2011

Workers in the commercial fishing industry have the highest occupational fatality rate in the United States, nearly 35 times higher in 2011 than the rate for all U.S. workers (1). During 2000–2009, a total of 504 fishermen were killed in the U.S. fishing industry, most commonly by drowning as a result of vessels sinking (51%) and falls overboard (30%). Another 10% of fatalities (51 deaths) were caused by injuries sustained onboard vessels, such as entanglement in machinery (2). This type of fatality occurred most often in the Gulf of Mexico. To analyze fatal and nonfatal injuries involving deck winches in the Southern shrimp fleet during 2000–2011, CDC obtained data from its Commercial Fishing Incident Database and the U.S. Coast Guard. Injury patterns were examined, and risk ratios (RRs) were calculated to compare the probability of fatal outcomes from incidents involving different winch mechanisms and operating situations. During 2000–2011, eight fatal and 27 work-related injuries involving deck winches occurred in the Southern shrimp fleet, which operates in the Gulf of Mexico and off the Atlantic coast from Florida to North Carolina.* Injuries involving the winch drum had a higher risk for fatal outcomes compared with injuries involving the winch cathead. Fatal outcomes also were associated with being alone on the vessel and being alone on deck. Interventions to prevent deck winch injuries might include guarding of winch drums and catheads, avoiding working alone on deck, not wearing baggy clothing, and improvements to cable winding guides. Training of deckhands in first aid and emergency procedures might reduce the severity of injuries when entanglements occur.

Data on fatal injuries in the Southern shrimp fleet involving winches during 2000–2011 were identified in the Commercial Fishing Incident Database, a CDC surveillance system. Data on nonfatal injuries during the same period were collected from a U.S. Coast Guard database. The nature of injury and body part injured were coded using the Occupational Injury and Illness Classification System (3).

*The Southern shrimp fleet covers a region of eight warm-water shrimp-producing states in the Gulf of Mexico and South Atlantic. The vessels are similar with respect to gear types, fishing processes, equipment, and hazards, and are represented by the Southern Shrimp Alliance, an organization that unites vessels across the many state and federal fishery management plans.

Injury severity was coded with the Abbreviated Injury Scale (4). Investigators also conducted site visits to major shrimp fishing ports in Louisiana during October 2012, in partnership with local U.S. Coast Guard personnel. Winches on shrimp boats were observed in operation and examined to understand their mechanical features.

During 2000–2011, a total of 35 work-related injuries involving deck winches occurred in the Southern shrimp fleet, an average of three per year. Winch injuries occurred throughout the year, with no notable seasonal pattern. Among the 32 injuries for which time of occurrence was available, injuries occurred equally during daylight hours (16) and darkness (16). Twenty-six (74%) of the injury incidents occurred in the Gulf of Mexico, including 17 off the coasts of Texas and Louisiana; nine (26%) were scattered around the coasts of Florida. The median distance from shore of the vessels at the time of injury was 9 miles (range: 0.2–90.0 miles). Type of shrimp boat was known for 31 of the injuries; 28 (90%) of the injuries occurred on side trawlers, and three (10%) on skimmers. The median age of the

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vessels was 19 years (range: 5–32 years), and the median length was 74 feet (range: 25–88 feet).

Of the 30 injured workers whose age was known, the median age was 50 years (range: 23–73 years). Of the 20 injured workers with known work history, nine (45%) had ≥ 21 years of experience (Table 1). Of the 34 with known job positions, 15 (44%) were employed as masters (captains), and 19 (56%) as deckhands.

Eight injuries (23%) were fatal, although only two fatalities involved injuries that were not survivable (i.e., massive crushing injuries to the head and torso). No minor injuries were reported (Table 2). All 21 workers with moderate or serious injuries (4) survived; one of the six severely injured workers and five of the six critically injured workers died.

Injuries involving the deck winch drum (Figure) had a higher risk for fatal outcomes compared with injuries involving the winch cathead (RR = 7.5; 95% confidence interval [CI] = 1.1–53.7), but injuries involving the main winch (Figure) did not have an increased risk for fatal outcomes compared with the try-net winch (RR = 2.3; CI = 0.5–9.9).[†] Fatal outcomes also were associated with

being alone on the vessel (RR = 5.8; CI = 2.1–15.9) and being alone on deck (RR = 4.0; CI = 1.2–13.6).

In 14 (41%) of the 35 cases, an item of loose clothing such as shorts, long sleeves, or gloves was cited as the first thing entangled in the winch. Nine of the 18 injuries to the upper extremities resulted in amputations; five of the upper extremity injuries were fractures. Six of the seven lower extremity injuries resulted in amputations; one amputation was fatal. Five of the seven workers with injuries to multiple body parts died (Table 2). Two workers who were alone on their vessels died from mechanical asphyxiation (i.e., compression of the chest by winch cables).

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Editorial Note

Deck winches are extremely hazardous mechanisms, with entanglements causing death to some workers and amputated limbs and other permanent disabilities to others. Among all U.S. fisheries, onboard injuries occurred most commonly in the Gulf of Mexico shrimp fishery (5). However, a search of the literature found only one previous study of injuries to workers in that fishery. The study found that, during 1986–2006, 19 patients with injuries involving shrimp winches were treated at a Texas hospital (6). All of the injuries were nonfatal, and 17 of the 19

[†]Side-trawl shrimp vessels typically employ two main winches mounted in the same frame on the aft deck (Figure). These winches wind multiple strands of wire cable that tow the main trawl nets. A smaller third winch, the “try-net” winch, is similarly located and drags a small net used to sample the expected catch of the main trawls. The try-net winch is driven by an electric motor, whereas the two main winches are mechanically driven through a power-take-off linkage system from the vessel's main engine. A cathead spool mounted on the end of each winch shaft spins when the power-take-off controlling lever is engaged. Each winch operator is required to manually guide the retrieved cable evenly onto the drum with a pivoting lever. Guiding the cable requires the operator to exert considerable force pushing and pulling the pivoting lever. Typically, few or no machine guards are present to prevent the worker from falling into or becoming entangled in moving machinery or the cable.

The *MMWR* series of publications is published by the Office of Surveillance, Epidemiology, and Laboratory Services, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30333.

Suggested citation: Centers for Disease Control and Prevention. [Article title]. *MMWR* 2013;62:[inclusive page numbers].

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TABLE 1. Demographic characteristics of workers (N = 35) injured by deck winches — Southern shrimp fleet, United States, 2000–2011

Characteristic	No.	(%)*
Age group (yrs)		
<24	1	(3.3)
25–44	6	(20.0)
45–64	18	(60.0)
≥65	5	(16.7)
Unknown	5	—
Sex		
Male	34	(97.1)
Female	1	(2.9)
Race/Ethnicity		
White, non-Hispanic	7	(31.8)
Asian	11	(50.0)
Hispanic	4	(18.2)
Unknown	13	—
Experience (yrs)		
≤1	1	(5.0)
2–5	2	(10.0)
6–10	4	(20.0)
11–20	4	(20.0)
≥21	9	(45.0)
Unknown	15	—
Job position		
Master	15	(44.1)
Deckhand	19	(55.9)
Unknown	1	—

* Missing values were excluded from percentage distributions.

affected the upper extremities. Injuries ranged in severity from crushed fingers to transhumeral amputations.

In August 2012, before the analysis described in this report was conducted, a deckhand aged 15 years on a commercial shrimp fishing vessel died in the Gulf of Mexico after becoming entangled in a winch (7); investigations of this fatality were ongoing as of March 8, and whether the youth had been working legally was unknown. The fatality of the young worker highlights the continuing workplace hazard found on many vessels employed in the U.S. fishing industry. In the 35 injuries described in this report, winch injuries occurred almost exclusively on side trawlers (vessels towing a trawl net from each side) and often involved experienced workers. Wearing loose fitting clothing was a contributing factor, as was working alone. Both masters (captains) and deckhands were vulnerable to winch injuries.

In 2005, a team of CDC injury epidemiologists and safety engineers collaborated to address the hazard of winch-related injuries on fishing vessels that use a purse seine (a large weighted net) in Alaska (8). An emergency stop button located strategically on the hydraulically powered winch was determined to be the most effective means for preventing winch injuries. The device was developed, tested, and licensed to a manufacturer for installation on new winches and for retrofitting on existing winches. A similar approach appears to be needed to develop

TABLE 2. Characteristics of injuries caused by deck winches, by fatal/nonfatal status — Southern shrimp fleet, United States, 2000–2011

Characteristic	Nonfatal (n = 27)		Fatal (n = 8)	
	No.	(%)*	No.	(%)
Year of injury				
2000	3	(11.1)	0	(0.0)
2001	5	(18.5)	0	(0.0)
2002	1	(3.7)	0	(0.0)
2003	2	(7.4)	2	(25.0)
2004	1	(3.7)	2	(25.0)
2005	1	(3.7)	1	(12.5)
2006	2	(7.4)	0	(0.0)
2007	0	(0.0)	0	(0.0)
2008	1	(3.7)	0	(0.0)
2009	4	(14.8)	0	(0.0)
2010	0	(0.0)	1	(12.5)
2011	7	(25.9)	2	(25.0)
Injury severity				
Minor	0	(0.0)	0	(0.0)
Moderate	5	(18.5)	0	(0.0)
Serious	16	(59.3)	0	(0.0)
Severe	5	(18.5)	1	(12.5)
Critical	1	(3.7)	5	(62.5)
Unsurvivable	—	—	2	(25.0)
Body part				
Head	1	(3.7)	0	(0.0)
Trunk	0	(0.0)	2	(25.0)
Upper extremities	18	(66.7)	0	(0.0)
Lower extremities	6	(22.2)	1	(12.5)
Multiple body parts	2	(7.4)	5	(62.5)
Nature of injury				
Amputations	14	(51.9)	1	(12.5)
Fractures	7	(25.9)	0	(0.0)
Compression asphyxia	0	(0.0)	2	(25.0)
Multiple unspecified	2	(7.4)	5	(62.5)
Other	4	(14.8)	0	(0.0)
Source of injury				
Winch drum	8	(34.8)	7	(87.5)
Winch cathead	15	(65.2)	1	(12.5)
Unknown	4	—	0	—

* Missing values were excluded from percentage distributions.

viable prevention solutions to the unique hazards winches present on shrimp vessels.

The findings in this report are subject to at least two limitations. First, the absence of minor injuries and the small number of moderate injuries likely were a result of underreporting rather than actual characteristics of the distribution of injury severity in the population. Reporting to the U.S. Coast Guard of injuries requiring treatment beyond first aid is mandatory, but compliance with reporting less severe injuries is low. Data on these less severe injuries might have provided additional insights on the development of interventions. Second, large proportions of missing data on certain variables (such as race/ethnicity and work experience) might have introduced bias in calculations involving those variables.

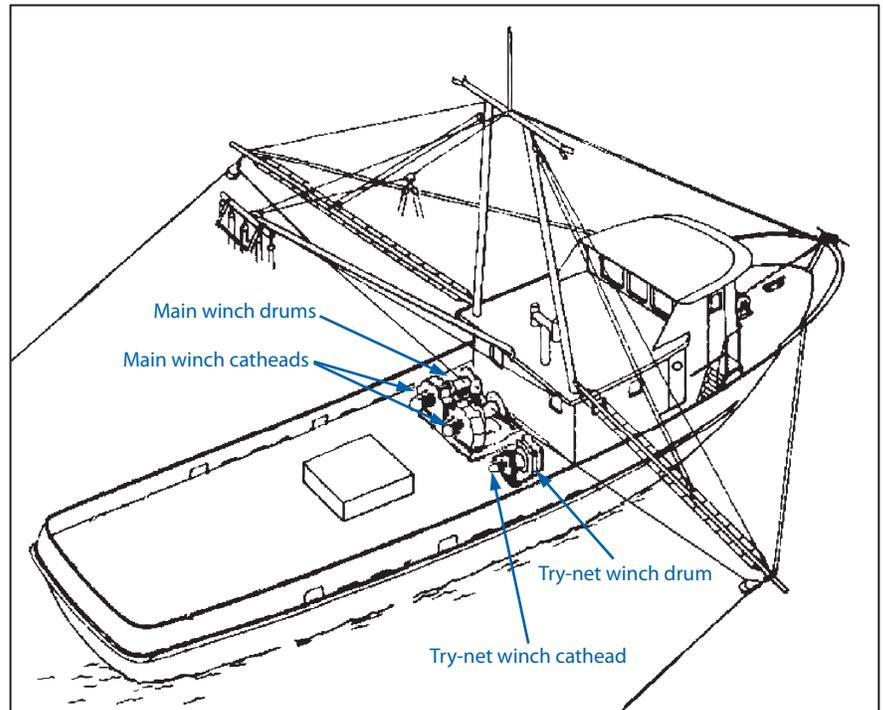
Several interventions might help reduce or eliminate the shrimp winch entanglement hazard. An ideal solution is to remove the worker completely from the hazardous operation of manually guiding the cable. Installing and using hydraulic devices to guide the cable is an option, but the high cost might deter widespread adoption. Less ideal, but more affordable solutions might include minor modifications that could be made to existing deck machinery. Strong passive guarding could be attached around the main winch drums to prevent or reduce the severity of an entanglement injury. Welding extensions onto the cable guides would move the worker away from the cable.

Other interventions might involve mechanisms to stop the winch, either by disconnecting the power-take-off linkage, stopping the main engine, or disengaging the winch clutch arm. Further research is needed to develop and test the efficacy of these and other interventions. In addition to applying these safety interventions, crew members should be discouraged from working alone on deck, and training should include procedures for stopping the winch in an emergency and administering first aid (e.g., tourniquet use and cardiopulmonary resuscitation) for serious injuries such as those requiring amputations.

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FIGURE. Typical deck layout, showing types of winches on a side trawler — Southern shrimp fleet, United States, 2000–2011



What is already known on this topic?

Fatalities in the fishing industry are most commonly the result of vessel disasters and falls overboard. Other fatal injuries, such as entanglement in fishing apparatus, are sustained onboard vessels while working on deck. The majority of onboard injuries in the U.S. fishing industry occur in the Gulf of Mexico.

What is added by this report?

During 2000–2011, a total of 35 work-related injuries, including eight fatal injuries, caused by deck winches occurred in the Southern shrimp fleet. Working alone and becoming entangled in the winch drum (as opposed to the winch cathead) were risk factors for fatal injury outcomes.

What are the implications for public health practice?

Further research is needed to develop effective and appropriate strategies for preventing winch injuries in the southern shrimp fleet. Potential interventions include improvements to cable winch guide systems, installing guards on the winch drums and catheads, and discouraging workers from working alone on deck.

National Assessment of Capacity in Public Health, Environmental, and Agricultural Laboratories — United States, 2011

In 2011, the University of Michigan's Center of Excellence in Public Health Workforce Studies and the Association of Public Health Laboratories (APHL) assessed the workforce and program capacity in U.S. public health, environmental, and agricultural laboratories (1). During April–August 2011, APHL sent a web-based questionnaire to 105 public health, environmental, and agricultural laboratory directors comprising all 50 state public health laboratories, 41 local public health laboratories, eight environmental laboratories, and six agricultural laboratories. This report summarizes the results of the assessment, which inquired about laboratory capacity, including total number of laboratorians by occupational classification and self-assessed ability to carry out functions in 19 different laboratory program areas. The majority of laboratorians (74%) possessed a bachelor's degree, associate's degree, or a high school education or equivalency; 59% of all laboratorians were classified as laboratory scientists. The greatest percentage of laboratories reported no, minimal, or partial program capacity in toxicology (45%), agricultural microbiology (54%), agricultural chemistry (50%), and education and training for their employees (51%). Nearly 50% of laboratories anticipated that more than 15% of their workforce would retire, resign, or be released within 5 years, lower than the anticipated retirement eligibility rate of 27% projected for state public health workers (2). However, APHL and partners in local, state, and federal public health should collaborate to address gaps in laboratory capacity and rebuild the workforce pipeline to ensure an adequate future supply of public health laboratorians.

The main objectives of the National Laboratory Capacity Assessment were to count and characterize the public health, environmental, and agricultural laboratory workforce, measure laboratory program area capacity, and assess worker recruitment, retention, and retirement plans. Information was collected on laboratory type, overall equipment quality, and number of workers in nine different job classifications by degree type: aide/assistant, technician, scientist, scientist-supervisor, scientist-manager, developmental scientist, environmental or agricultural laboratory director/assistant director, public health laboratory assistant/deputy director, and public health laboratory director. Questions evaluated capacity in 13 technical/scientific program areas: agricultural chemistry, agricultural microbiology, bacteriology, clinical chemistry/hematology, environmental microbiology, environmental chemistry, molecular biology, mycology, newborn screening, parasitology, serology/immunology, and virology, and in six administrative program areas, including emergency preparedness and response, education and training, quality assurance, regulation and inspection, safety and/

or security, and laboratory administration/operations. Additional questions focused on worker recruitment, retention, and planned releases, retirements, and resignations.

The organizational survey was pilot tested in four states and included interviews with all pilot testers; the assessment was available online to all states during July 1–August 30, 2011. The director of the state public health, environmental, or agricultural laboratory was the designated key informant. In follow-up, APHL contacted laboratory directors by e-mail and telephone to maximize response. Eighty (76%) of 105 laboratory directors participated. A laboratorian was defined as a person whose principal work was in a governmental public health, environmental, or agricultural laboratory; positions could be reported as one-quarter fractions of full-time equivalents. For each program area, the director was asked if they had adequate capacity to perform necessary services for that program area. Estimates were categorized as follows: full = 100% capacity to perform; almost full = 75%–99%; substantial = 50%–74%; partial = 25%–49%; minimal = 1%–24%; and none. Fifty-six (71%) of the laboratories self-identified as a public health (49), environmental (three), or agricultural (four) laboratory; 23 (29%) self-identified as some combination of these categories; and one did not specify laboratory type.

In 2011, a total of 6,656 employees, of whom 5,555 (83%) were laboratorians in one of the eight job classifications identified, worked in the 80 responding laboratories; the remaining 894 employees (13%) were administrative support staff, and 207 (4%) were information technology staff (Table 1). The distribution of full-time equivalents in 19 different laboratory program areas showed the greatest number of employees working in environmental chemistry (780 [14%]), followed by bacteriology (558 [10%]), administration/operations (533 [10%]), newborn screening (514 [9%]), other (480 [9%]), emergency preparedness and response (414 [7%]); laboratory regulation and inspection (343 [6%]), and serology/immunology (325 [6%]), with 5% or fewer of employees working in each of the remaining 12 laboratory program areas. Education and training background was provided for 4,927 employees by position (Table 2). Of these, 587 (12%) had a doctoral or professional degree, 701 (14%) had a master's degree, 3,249 (66%) had a bachelor's or associate's degree, and 390 (8%) had a high school education or equivalency. Laboratory scientists were the largest group (59%), with 13% scientist-supervisors, 9% technicians, 7% aides or assistants, 6% scientist-managers, 3% developmental

TABLE 1. Number and percentage of administrative, information technology, and scientific staff in laboratories, by program area — National Laboratory Capacity Assessment, United States, 2011

Program area	No.	(%)
Administrative staff	894	(13)
Information technology staff	207	(3)
Scientific laboratory staff	5,555	(83)
Agricultural chemistry	133	(2)
Agricultural microbiology	74	(1)
Bacteriology	558	(10)
Clinical chemistry/Hematology	70	(1)
Education and training	84	(2)
Emergency preparedness and response	414	(7)
Environmental microbiology	241	(4)
Environmental chemistry	780	(14)
Administration/Operations	533	(10)
Quality assurance	127	(2)
Regulation and inspection	343	(6)
Safety and/or security	64	(1)
Molecular biology	286	(5)
Mycology	48	(1)
Newborn screening	514	(9)
Parasitology	61	(1)
Serology/Immunology	325	(6)
Toxicology	136	(2)
Virology	284	(5)
Other	480	(9)
Total laboratory staff	6,656	

scientists, 2% directors, and 1% deputy or assistant directors. On average, 38% of laboratory employees were supported by state funding, 21% by local sources, 20% by federal funds, 19% by fee-for-service, and 2% by other sources.

For those laboratories indicating any capacity in a given program area (i.e., a response other than “not applicable”), more than half reported either no, minimal, or only partial capacity to perform necessary activities in toxicology (65%), agricultural chemistry (80%), agricultural microbiology (80%), clinical chemistry/hematology (68%), and education and training (55%). Conversely, more than 75% of laboratories reported substantial to full capacity in emergency preparedness and response (89%), safety and/or security (91%), bacteriology (91%), administration/

operations (86%), molecular biology (92%), quality assurance (83%), serology/immunology (85%), and regulation and inspection (80%); however, fewer than half reported substantial to full capacity in agricultural chemistry (20%), agricultural microbiology (20%), clinical chemistry/hematology (32%), toxicology (35%), and education and training (45%) (Figure). Several program areas with lower capacity also were the same ones for which approximately one third or more laboratories selected “not applicable,” including clinical chemistry/hematology (41%), agricultural chemistry (38%), agricultural microbiology (33%), and toxicology (31%). Fifty-one percent of laboratories reported the overall quality of their equipment and instrumentation on a 5-point scale as fair, the remainder as good or very good.

More than half of laboratories (42 [53%]) anticipated that up to 15% of their workers would retire, resign, or be released within 5 years, whereas 27 (34%) laboratories predicted a loss of 16%–25%, 10 (13%) predicted a loss of 26%–50%, and one anticipated losing more than 75% within 5 years. The lack of opportunities for promotion and lack of a career path for advancement were the two most common barriers to recruitment; both were reported by 76% of responding laboratories. Other major barriers to recruitment were inadequate salary scale (59 [74%]), hiring policies/procedures (54 [68%]), and complexity of the administrative bureaucracy (49 [61%]). Lack of promotion opportunities and career path for advancement were reported as obstacles to worker retention by 66 (83%) and 64 (80%) of laboratories, respectively, as was inadequate salary scale by 58 (73%) of laboratories.

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TABLE 2. Number and percentage of laboratory workers, by position and degree type — National Laboratory Capacity Assessment, United States, 2011

Degree	Aide/ Assistant	Technician	Scientist	Scientist- supervisor	Scientist- manager	Developmental scientist	Assistant/ Deputy director	Director	Total	
									No.	(%)
Doctoral degree	1	1	168	67	120	81	30	61	529	(11)
Professional degree*	1	2	21	13	4	3	2	12	58	(1)
Master's degree	5	9	399	143	83	17	23	22	701	(14)
Bachelor's degree	70	167	2,177	416	94	31	14	5	2,974	(60)
Associate's degree	44	120	94	14	1	0	0	2	275	(6)
High school or equivalent	217	138	26	7	1	0	0	1	390	(8)
Total	338 (7)	437 (9)	2,885 (59)	660 (13)	303 (6)	132 (3)	69 (1)	103 (2)	4,927[†]	(100)

* E.g., MD, DVM, and DDS.

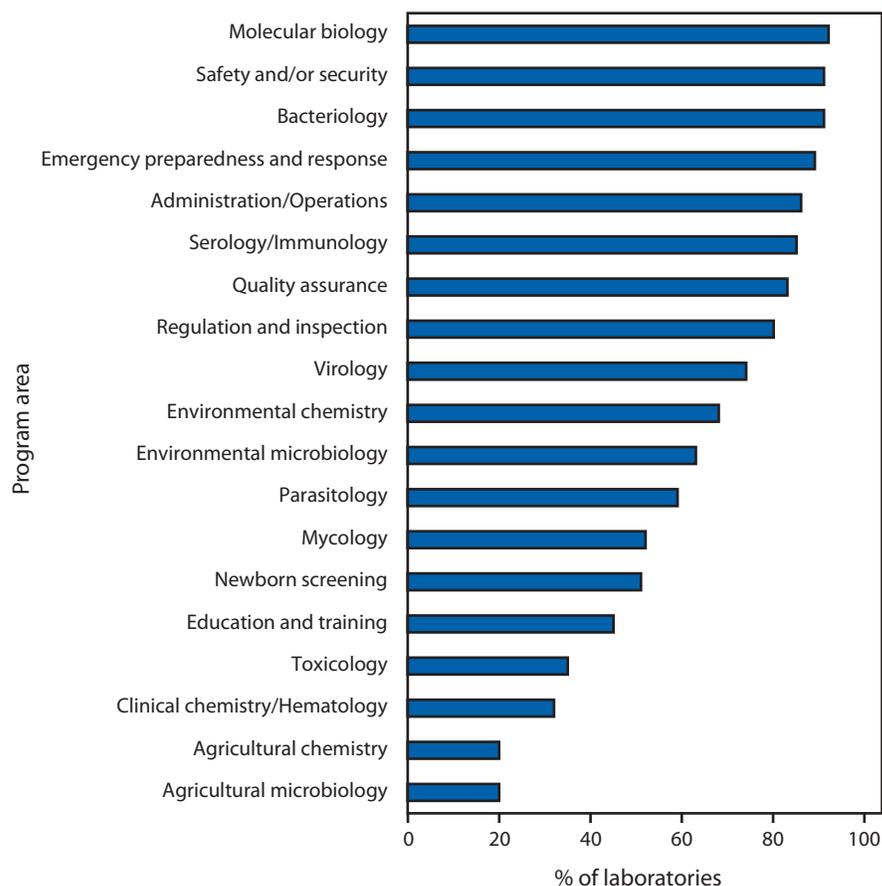
[†] Position and degree information was not reported for 628 laboratory workers.

Editorial Note

The public health, environmental, and agricultural laboratory workforce is a vital component of the nation's public health infrastructure. Laboratory capacity is essential for protection against health hazards and provision of essential community services (3). The 2011 National Laboratory Capacity Assessment revealed that laboratories have low capacity in several key program areas, especially in agriculture-related services, toxicology, and in the general area of worker training; laboratories also were much more likely to select "not applicable" regarding their capacity in the areas of clinical chemistry/hematology, agricultural chemistry, agricultural microbiology, and toxicology, indicating that testing and services in these areas are not provided. Given the growing importance of the human-animal interface in the risk for emerging disease threats (4), the gaps in agricultural microbiology and chemistry should be addressed, and opportunities for creating stronger links among public health, agricultural, and veterinary laboratories should be explored. Dealing with low reported capacity in toxicology is equally imperative because environmental pollution and human exposures, such as pharmaceuticals in drinking water, are expected to increase (5), and the nation's ability to quickly respond to unintentional and intentional chemical releases represents a core component of its preparedness capacity.

The lack of many laboratories' ability to provide training to their staff is a concern because access to continuing education is essential to ensuring a well-trained public health workforce. This might be particularly true for laboratorians because only one quarter of laboratorians have a graduate or professional degree. Laboratory directors and public health, environmental, and agricultural laboratory workers reported lack of opportunities for promotion and a clear career path to advancement as the most common barriers to worker recruitment and retention (1), which might be related to the limited number of educational and training opportunities available to laboratorians because of funding or other restrictions. This poses special challenges in the context of the findings on the projected laboratory workforce losses through planned resignation, release, and retirement. A need exists to increase the number and type of laboratory science degree and other training offerings in schools and programs of public health to successfully build the worker pipeline, especially given

FIGURE. Percentage of laboratories (N = 80) reporting substantial to full capacity, by program area — National Laboratory Capacity Assessment, United States, 2011



the severe and continuing shortage of scientists qualified to assume leadership and management positions within public health, environmental, and agricultural laboratories, a concern noted by APHL since 2006 (6). This could include training in laboratory leadership because currently no academic doctoral program in public health laboratory science and practice exists at any school of public health nationwide.

The assessment of laboratories' program area capacity should be based on the Laboratory System Improvement Plan (LSIP) standards, which were developed by APHL and CDC to assess laboratory performance (7,8). However, very few laboratories completed the section of the survey concerning LSIP, which might indicate that they are not using the standards, are not familiar with them, or do not know how to evaluate their use. Additional marketing and educational efforts should be directed at increasing awareness and encouraging use of the LSIP.

The findings of this report are subject to at least three limitations. First, only three quarters of laboratory directors completed the survey; nonresponders might have differed systematically from responders and yielded dissimilar results if they had participated. Second, the questions used to assess

What is already known on this topic?

The public health, environmental, and agricultural laboratory workforce is a vital component of the nation's public health infrastructure. Well-trained laboratorians are essential to providing protection against newly emergent diseases and other health hazards through diagnostic testing; reporting and surveillance; chemical, toxicologic, and environmental analysis; emergency preparedness; and provision of other vital services for the community.

What is added by this report?

Data from a 2011 National Laboratory Capacity Assessment indicate that national public health laboratory capacity needs to improve in several areas to achieve optimal testing and response capacity. Laboratory workers need better access to training and educational opportunities to ensure a well-qualified laboratory workforce.

What are the implications for public health practice?

Agencies at the local, state, and federal level should collaborate to improve laboratory capacity, including worker training and education, and encourage the development of a greater number and type of available laboratory degree programs.

program area capacity in the laboratory were subjective, and their interpretation might have varied by respondent. Finally, some subjective questions have objective correlates, such as assessment of equipment quality.

The *Healthy People 2020* public health infrastructure objective no. 11 (PHI-11) aims to increase the proportion of tribal and state public health agencies that provide or ensure comprehensive laboratory services to support essential public health services (9). The National Laboratory Capacity Assessment described in this report represents an initial attempt to measure baseline national capacity in public health, environmental, and agricultural laboratories and should be repeated in the future.

Acknowledgments

The 2010–2011 Association of Public Health Laboratories (APHL) Workforce Research and Pipeline Subcommittee: David F. Carpenter, Lou F. Turner, Masau Wakabongo, and Susanne Zanto; APHL staff members: Eva Perlman, Pandora Ray, and Scott Becker; Univ of Michigan staff members: Brad Carlson and Kay Leopold.

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Vital Signs: Carbapenem-Resistant Enterobacteriaceae

On March 5, this report was posted as an MMWR Early Release on the MMWR website (<http://www.cdc.gov/mmwr>).

Abstract

Background: Enterobacteriaceae are a family of bacteria that commonly cause infections in health-care settings as well as in the community. Among Enterobacteriaceae, resistance to broad-spectrum carbapenem antimicrobials has been uncommon. Over the past decade, however, carbapenem-resistant Enterobacteriaceae (CRE) have been recognized in health-care settings as a cause of difficult-to-treat infections associated with high mortality.

Methods: The percentage of acute-care hospitals reporting at least one CRE from health-care-associated infections (HAIs) in 2012 was estimated using data submitted to the National Healthcare Safety Network (NHSN) in 2012. The proportion of Enterobacteriaceae infections that were CRE was calculated using two surveillance systems: 1) the National Nosocomial Infection Surveillance system (NNIS) and NHSN (for 2001 and 2011, respectively) and 2) the Surveillance Network–USA (TSN) (for 2001 and 2010). Characteristics of CRE culture-positive episodes were determined using data collected as part of a population-based CRE surveillance project conducted by the Emerging Infections Program (EIP) in three states.

Results: In 2012, 4.6% of acute-care hospitals reported at least one CRE HAI (short-stay hospitals, 3.9%; long-term acute-care hospitals, 17.8%). The proportion of Enterobacteriaceae that were CRE increased from 1.2% in 2001 to 4.2% in 2011 in NNIS/NHSN and from 0% in 2001 to 1.4% in 2010 in TSN; most of the increase was observed in *Klebsiella* species (from 1.6% to 10.4% in NNIS/NHSN). In the EIP surveillance, 92% of CRE episodes occurred in patients with substantial health-care exposures.

Conclusions: Carbapenem resistance among common Enterobacteriaceae has increased over the past decade; most CRE are associated with health-care exposures.

Implications for Public Health: Interventions exist that could slow the dissemination of CRE. Health departments are well positioned to play a leading role in prevention efforts by assisting with surveillance, situational awareness, and coordinating prevention efforts.

Introduction

The Enterobacteriaceae are a large family of gram-negative bacilli that are normal inhabitants of the gastrointestinal tract of humans and other animals (1). These organisms are a common cause of community-acquired and health-care-acquired infections. Although this family includes more than 70 genera, the health-care-associated Enterobacteriaceae most commonly reported to CDC's National Healthcare Safety Network (NHSN) surveillance system are *Escherichia coli*, *Klebsiella* species, and *Enterobacter* species (2). The past several decades have seen the spread of Enterobacteriaceae with resistance to broad-spectrum antimicrobials; however, clinicians in the United States have relied on the carbapenem antimicrobial class (imipenem, meropenem, doripenem, and ertapenem) to treat infections caused by these resistant organisms. Carbapenem-resistant Enterobacteriaceae (CRE) were relatively uncommon in the United States before 2000 (3). Unlike resistance in

methicillin-resistant *Staphylococcus aureus* (MRSA), which is one bacterial species and is mediated by a single mechanism, carbapenem resistance is complex; it can occur in different Enterobacteriaceae and be mediated by several mechanisms, including production of enzymes that inactivate carbapenems (carbapenemases). *Klebsiella pneumoniae* carbapenemase (KPC), an enzyme encoded by a highly transmissible gene, was first identified from a *Klebsiella* isolate in 2001 (4) and has now spread widely throughout the United States and around the world. In addition to KPC, a number of additional carbapenemases that have emerged among Enterobacteriaceae outside the United States (e.g., New Delhi metallo-beta-lactamase [NDM]) have been identified in this country. CRE can spread in health-care settings and cause infections with mortality rates of 40% to 50% (5–7). In this report, recent changes in the epidemiology and incidence of CRE in the United States are described.

Methods

The objectives of this evaluation were to 1) describe the extent of CRE spread among acute-care hospitals, 2) estimate the proportion of clinical isolates of Enterobacteriaceae that are resistant to carbapenems in the United States, and 3) determine characteristics of CRE culture-positive episodes. Because no single surveillance system includes all the data required for these analyses, data from three systems are included in this report. CRE definitions used for objectives 1 and 2 were slightly different than that used for objective 3 because of the use of these different systems.

The first objective was accomplished using NHSN data for the first 6 months of 2012. All facilities performing surveillance for central-line-associated bloodstream infections (CLABSIs) or catheter-associated urinary tract infections (CAUTIs) were reviewed for reports of CRE isolates, defined as *E. coli*, *Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Enterobacter cloacae*, or *Enterobacter aerogenes* that were nonsusceptible to imipenem, meropenem, or doripenem.

For the second objective, data from NHSN and its predecessor, the National Nosocomial Infection Surveillance system (NNIS), were used. Intensive-care unit (ICU) CLABSIs, ICU CAUTIs, and surgical site infections after colon surgery or coronary artery bypass grafting reported to NNIS in 2001 or NHSN in 2011 for which an isolate of one of the Enterobacteriaceae listed above was reported were included. To evaluate infections across another set of isolates collected hospital-wide, a similar analysis was performed by the Center for Disease Dynamics, Economics, and Policy, using data from the Surveillance Network-USA (TSN) (managed by Eurofins Medinet; Chantilly, Virginia). TSN is an electronic repository of susceptibility test results collected from approximately 300 laboratories that are selected to be demographically representative of the United States at the level of the nine U.S. Census regions (8). Similar definitions were used for the TSN analysis; however, *K. oxytoca* was not included, and surveillance periods included 2001 and the first 6 months of 2010.

The third objective was accomplished using data collected during the internally funded pilot of a population-based CRE surveillance project conducted through CDC's Emerging Infections Program (EIP) at three sites (Atlanta, Georgia; Minneapolis-St. Paul, Minnesota; and Portland, Oregon metropolitan areas). Laboratories were asked for reports of CRE, defined in this report as Enterobacteriaceae from sterile-site and urine cultures that were nonsusceptible to imipenem, meropenem, or doripenem and resistant to all third-generation cephalosporins tested (e.g., ceftriaxone, cefotaxime, and ceftazidime). Resistance to third-generation cephalosporins was included in this surveillance system to increase the specificity for carbapenemase-producing Enterobacteriaceae. Medical

records for CRE patients were reviewed. CRE-positive clinical cultures were classified as hospital-onset if the culture was taken from a hospital inpatient after the third day of admission. A health-care exposure was defined as a recent (i.e., within the past year) hospitalization, long-term-care admission, surgery, dialysis, or the presence of an indwelling device in the 2 days before the positive culture.

Results

During the first 6 months of 2012, among the 3,918 U.S. acute-care hospitals performing surveillance for either CAUTI or CLABSI in any part of their hospital, 181 (4.6%) reported one or more infections with CRE (145 [3.9%] in short-stay hospitals; 36 [17.8%] in long-term acute-care hospitals [LTACHs]). The percentage of facilities with CRE was stratified by selected characteristics; of note, the percentage of hospitals reporting CRE was highest in the Northeast and among larger and teaching hospitals (Table 1).

The percentage of Enterobacteriaceae that were CRE reported to NNIS in 2001 was 1.2%; in NHSN in 2011, it was 4.2%. The proportion CRE varied by organism and increased most for *Klebsiella* species, from 1.6% to 10.4% (Table 2). Data from TSN demonstrated an increase from 0% to 1.4%, with the largest increase among *K. pneumoniae* (0% to 5.3%).

During the 5-month EIP project pilot, 72 CRE were identified from 64 patients (56 patients had one positive culture; eight had two). Most came from the Atlanta metropolitan area (59) followed by Minneapolis-St. Paul (10), and Portland (three). Most CRE were *Klebsiella* species (49) followed by *Enterobacter* species (14) and *E. coli* (nine). The most common source was urine (89%), followed by blood (10%). CRE culture-positive episodes were stratified by selected characteristics (Table 3). Most isolates were from cultures collected outside of acute-care hospitals (47 of 71); however, most of these community-onset isolates were from patients with health-care exposures (41 of 47), particularly recent hospitalization (72%).

Conclusions and Comment

Although CRE remain relatively uncommon in most acute-care hospitals in the United States, they have become an increasingly recognized cause of infection during the past decade, especially among *Klebsiella*, likely because of the emergence of carbapenemase-producing strains. In 2012, the number of facilities reporting CRE as a cause of infection was small, and spread of these organisms appears to be uneven both regionally and among facilities within regions. Fewer than 5% of short-stay acute-care hospitals reported CRE from health-care-associated infections in the first half of 2012; CRE more often were reported from LTACHs. Data from population-based surveillance suggest most CRE clinical isolates came from cultures collected outside of hospitals from

TABLE 1. Number and percentage of facilities reporting carbapenem-resistant* Enterobacteriaceae† from a catheter-associated urinary tract infection (CAUTI) or a central-line-associated bloodstream infection (CLABSI), by selected characteristics — United States, National Healthcare Safety Network, January–June 2012

Characteristic	No. of facilities with carbapenem-resistant Enterobacteriaceae from CAUTI or CLABSI	Total no. of facilities performing CAUTI or CLABSI surveillance (N = 3,918)	(%) ^{§¶}
Facility type			
All acute-care hospitals	181	3,918	(4.6)
Short-stay acute-care hospital	145	3,716	(3.9)
Long-term acute-care hospital	36	202	(17.8)
Hospital size (no. of beds)			
<100	48	1,609	(3.0)
100–299	46	1,480	(3.1)
300–499	41	541	(7.6)
≥500	45	258	(17.4)
Medical school affiliation			
Yes	102	1,079	(9.5)
No	53	2,839	(1.9)
U.S. Census region**			
Northeast	63	658	(9.6)
Midwest	30	927	(3.2)
South	50	1,503	(3.3)
West	29	804	(3.6)
Other††	9	26	(34.6)

* Intermediate or resistant to imipenem, meropenem, or doripenem.

† *Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Escherichia coli*, *Enterobacter aerogenes*, or *Enterobacter cloacae*.

§ Total percentage of facilities performing any surveillance for any CAUTI and CLABSI during the first 6 months of 2012.

¶ For each category, $p < 0.01$ by chi-square test.

** *Northeast*: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; *Midwest*: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South*: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; *West*: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

†† Armed Forces, Puerto Rico, and U.S. Virgin Islands.

patients with substantial health-care exposures. These findings suggest that although CRE are increasing in prevalence, their distribution is limited.

CRE are important for several reasons. First, invasive infections (e.g., bloodstream infections) with CRE are associated with mortality rates exceeding 40% (5); this is significantly higher than mortality rates observed for carbapenem-susceptible Enterobacteriaceae. Of note, because the majority of positive cultures were from urine, overall in-hospital mortality rates associated with positive cultures were lower in the EIP CRE surveillance (4%). Second, carbapenem-resistant strains frequently possess additional resistance mechanisms that render them resistant to most available antimicrobials; pan-resistant CRE have been reported (9). Further, novel antimicrobials for multidrug-resistant gram-negative bacilli are in early stages of development and not likely to be available soon (10). Third, CRE can spread rapidly in health-care settings (11, 12). Fourth, Enterobacteriaceae are a common cause of community infections, and CRE have the potential to move from their current

niche among health-care-exposed patients into the community (13). Multidrug-resistance is a problem in other gram-negative bacilli such as *Pseudomonas* and *Acinetobacter* species. However, these organisms are a less common cause of health-care infections and have less potential to spread resistance to other bacteria and into the community (2).

Current CRE prevention strategies are based on the identification of patients colonized or infected with CRE followed by implementation of contact precautions. Colonization commonly is detected through rectal surveillance cultures of patients at risk for CRE (e.g., patients exposed to known cases of CRE). Active case detection and immediate implementation of interventions, often including cohorting staff and CRE patients (i.e., segregating CRE-colonized or CRE-infected patients and the health-care personnel who care for them from those without CRE and the health-care personnel who care for them), has been used successfully to control CRE in acute-care and long-term-care settings (6, 7, 14). Efforts to ensure appropriate antibiotic use in hospitals and nursing homes also are critical to slowing CRE emergence.* Patients who are colonized or infected with CRE often are cared for in multiple types of health-care institutions during their

illnesses. Therefore, having a broader, multi-institutional or regional approach to prevention is necessary for control, particularly in regions where CRE are just beginning to be recognized. Regional efforts to control multidrug-resistant organisms (MDROs) have been employed successfully, including a coordinated effort to control vancomycin-resistant *Enterococcus* in the Siouland region of Iowa, Nebraska, and South Dakota (15) and a national response to MRSA in the Netherlands (16). For CRE, Israel has effectively employed a nationwide coordinated control effort since KPC-producing strains emerged there in 2006 (6).

State and local health departments are well positioned to lead CRE control efforts because of their expertise in surveillance and prevention and their ability to interact among all the health-care facilities in their jurisdiction. To date, many health departments have conducted surveillance efforts in an

* Detailed prevention recommendations for acute-care and long-term-care facilities are available at <http://www.cdc.gov/hai/organisms/cre/cre-toolkit>.

TABLE 2. Number of Enterobacteriaceae isolates, percentage reported to be tested against carbapenems, and percentage reported as carbapenem-resistant,* by data source, year, and type of organism — United States, National Nosocomial Infections Surveillance system (NNIS), National Healthcare Safety Network (NHSN), and the Surveillance Network—USA (TSN)[†]

Type of organism	NNIS (2001)			NHSN (2011)		
	No. of isolates	Reported as tested against ≥ 1 carbapenem No. (%)	Reported as carbapenem-resistant* No. (%)	No. of isolates	Reported as tested against ≥ 1 carbapenem No. (%)	Reported as carbapenem-resistant* No. (%)
<i>Klebsiella pneumoniae</i> and <i>oxytoca</i>	654	253 (38.7)	4 (1.6)	1,902	1,312 (69.0)	136 (10.4)
<i>Escherichia coli</i>	1,424	421 (29.6)	4 (1.0)	3,626	2,348 (64.8)	24 (1.0)
<i>Enterobacter aerogenes</i> and <i>cloacae</i>	553	288 (52.1)	4 (1.4)	1,045	728 (69.7)	26 (3.6)
Total	2,631	962 (36.6)	12 (1.2)	6,573	4,388 (66.8)	186 (4.2)

Type of organism	TSN (2001)			TSN (2010) [§]		
	No. of isolates	Reported as tested against ≥ 1 carbapenem No. (%)	Reported as carbapenem-resistant* No. (%)	No. of isolates	Reported as tested against ≥ 1 carbapenem No. (%)	Reported as carbapenem-resistant* No. (%)
<i>Klebsiella pneumoniae</i>	19,522	19,522 (100.0)	0 —	11,155	11,155 (100.0)	593 (5.3)
<i>Escherichia coli</i>	47,603	47,603 (100.0)	0 —	31,890	31,890 (100.0)	32 (0.1)
<i>Enterobacter aerogenes</i> and <i>cloacae</i>	14,764	14,764 (100.0)	3 (0)	5,768	5,768 (100.0)	69 (1.2)
Total	81,889	81,889 (100.0)	3 (0)	48,813	48,813 (100.0)	694 (1.4)

* Intermediate or resistant to imipenem, meropenem, or doripenem.

[†] NNIS and NHSN include Enterobacteriaceae reported from hospital infections (i.e., intensive-care unit central-line-associated bloodstream infections, intensive-care unit catheter-associated urinary tract infections, and surgical site infections after colon surgery or coronary artery bypass grafting). TSN includes Enterobacteriaceae isolates from clinical cultures from acute-care hospitals submitted to participating laboratories.

[§] Includes isolates reported during January–June 2010.

attempt to identify the CRE incidence in their region (17).[†] In addition, six states have made CRE reportable, and three additional states are actively pursuing this option. Requiring CRE reporting can allow for a better understanding of the changing CRE burden and can help facilitate intervention. Beyond surveillance, several states have developed and implemented plans to assist health-care facilities with control efforts when CRE are identified. As new MDROs emerge over time, this regional approach to MDRO prevention has implications beyond CRE as well.

The findings in this report are subject to at least three limitations. First, antimicrobial susceptibility data reported to NNIS and NHSN were generated at individual institutions rather than a central laboratory, and testing methodologies vary between facilities. Second, susceptibility interpretation is based on the recommended breakpoints used when tested. Although carbapenem breakpoints for Enterobacteriaceae were lowered in 2010 (18) and might have influenced the increase in the percentage of isolates that were carbapenem-resistant, most laboratories would not have incorporated those changes by 2011. Finally, in some instances, complete susceptibility test results, particularly for carbapenems, were not reported to NNIS or NHSN, leading to a subset of isolates that were not included in these analyses. Not reporting results for

carbapenems would be more likely when organisms were susceptible to less broad-spectrum antimicrobials; therefore, many of the organisms for which carbapenem susceptibility information was not available might have been susceptible. As a result, the percentage resistant reported from NNIS and NHSN likely represents an overestimate of the actual percentage resistant; however, the proportion of NHSN facilities reporting at least one CRE should not be affected.

The high proportion of LTACHs with CRE in 2012 highlights the need to expand prevention outside of short-stay acute-care hospitals into settings that, historically, have had less developed infection prevention programs. Additional research is needed to clarify unanswered questions, including assessing which CRE prevention strategies are most effective and investigating new prevention approaches such as decolonization. Fortunately, many regions are in a position to prevent the further emergence of these organisms if they act aggressively. To do so will require expanded and coordinated action from clinicians, facility administrators, and public health officials.

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[†] An example of a survey that has been adapted by health departments to evaluate CRE incidence and CRE prevention activities in a region is available at <http://www.cdc.gov/hai/organisms/cre/cre-toolkit/index.html>.

TABLE 3. Number and percentage of episodes of positive cultures for carbapenem-resistant* *Enterobacteriaceae*[†] (N = 72) from three communities,[§] by selected characteristics — United States, Emerging Infections Program, August–December 2011

Characteristic	No.	(%)
Patient characteristics		
Female sex	36	(50)
White race	32	(45)
Median age (range) (yrs)	60	(8–91)
<18	2	(3)
≥65	30	(42)
Type of health-care exposure[¶]		
Hospitalization	34	(72)
Presence of urinary catheter within the past 2 days	22	(47)
Long-term care facility	17	(36)
Surgery	12	(26)
Presence of other indwelling device within the past 2 days	11	(23)
Presence of central line within the past 2 days	9	(19)
None	6	(4)
Dialysis	3	(13)
Outcome		
Hospitalized	59	(82)
Intensive-care unit within 7 days of positive culture	16	(22)
Died	3	(4)

* Nonsusceptible to imipenem, meropenem, or doripenem and resistant to all third-generation cephalosporins tested (e.g., ceftriaxone, cefotaxime, ceftazidime).

[†] *Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Escherichia coli*, *Enterobacter aerogenes*, or *Enterobacter cloacae*.

[§] Atlanta, Georgia; Minneapolis-St. Paul, Minnesota; and Portland, Oregon.

[¶] Within the past year, unless noted otherwise, among community-onset cultures (n=47).

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Acknowledgment

Pioneer Portfolio, Robert Wood Johnson Foundation, Princeton, New Jersey.

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Key Points

- Enterobacteriaceae are gram-negative bacteria (e.g., *Klebsiella*, *Proteus*, *Serratia*, *Enterobacter*, and *Escherichia coli*) that can cause invasive disease but generally have been susceptible to a variety of antibiotics. Carbapenem-resistant Enterobacteriaceae (CRE) are Enterobacteriaceae that have become highly resistant to most or all antibiotics through several mechanisms. Carbapenem resistance, while relatively uncommon among Enterobacteriaceae (observed in about 4% of Enterobacteriaceae in this study), has increased from about 1% during the past decade. CRE bloodstream infections are associated with mortality rates approaching 50%.
- CRE has now spread throughout the United States but in most areas they remain relatively uncommon; about 4% of acute-care hospitals and 18% of long-term acute-care hospitals reported at least one CRE to the National Healthcare Safety Network in the first 6 months of 2012. Nearly all patients with CRE were currently or recently treated in a health-care setting. However, CRE could spread into the community among otherwise healthy persons.
- Preventing spread is important before CRE gains a foothold in more hospitals or in the community. This requires active case detection and contact precautions for colonized or infected patients as well as cohorting of patients and staff; appropriate antibiotic use in all settings; and communication about infections when patients transfer. Regional and state-based approaches have been shown to be effective in reducing incidence.
- Additional information is available at <http://www.cdc.gov/vitalsigns>.

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Notes from the Field

Outbreak of Infections Caused by *Shigella sonnei* with Decreased Susceptibility to Azithromycin — Los Angeles, California, 2012

In May 2012, the Los Angeles County Department of Public Health's Acute Communicable Disease Control Unit and Environmental Health, Food, and Milk Program investigated an outbreak of shigellosis associated with a private bridge club. This investigation documented the first known transmission of *Shigella sonnei* with decreased susceptibility to azithromycin in the United States.

Cases were defined as an illness clinically compatible with shigellosis in a patient or *S. sonnei* isolated from stool of a person with an epidemiologic link to the bridge club during May 22–26, 2012. Investigators attempted to interview all bridge club workers and members who had visited the bridge club during the week of May 22; they collected stool specimens from workers who handled food and from workers and members with diarrhea who had not already submitted a stool specimen for culture at a health facility. Thirty-nine cases were identified among club members with diarrhea and four among club workers; of the four workers, two, including one who handled food, reported no symptoms. The average age of affected persons was 75.3 years (range: 54–98 years); 55% were female. Among those with symptoms, the duration of illness averaged 5.9 days (range: 1–14 days). Common symptoms included diarrhea in 95% of patients, abdominal cramps in 70%, and fever in 56%. Thirty-one (72%) persons sought medical care, and 10 (23%) were hospitalized. No specific exposures implicated a source for the outbreak.

Among the 43 cases, 14 were culture-confirmed; 10 isolates underwent pulsed-field gel electrophoresis (PFGE), yielding indistinguishable patterns. Four isolates submitted to CDC's National Antimicrobial Resistance Monitoring System (NARMS) displayed resistance to streptomycin, sulfisoxazole, tetracycline, and trimethoprim-sulfamethoxazole. Unlike most *Shigella* isolates tested by NARMS, these isolates also showed elevated azithromycin minimum inhibitory concentrations (MICs) of $>16 \mu\text{g/mL}$ (1) and harbored a plasmid-encoded macrolide resistance gene, *mphA* (2).

CDC's PulseNet identified two additional isolates indistinguishable from the outbreak PFGE pattern. One was from a man in Pennsylvania aged 23 years who had visited Los Angeles

in April, and the other from a man in Hawaii aged 53 years who visited Los Angeles during April and May; both men were hospitalized with diarrhea. Neither case was epidemiologically linked to the bridge club or to each other.

Although sporadic cases of shigellosis caused by *Shigella* strains with increased azithromycin MICs have occurred, this is the first outbreak documented in the United States and might indicate increasing circulation of such strains (1). Illnesses in this outbreak tended to be severe; however, the affected population was much older than the general U.S. population. Clinical management of such illnesses is likely to be complex; although azithromycin currently is recommended for treatment of infections caused by multidrug-resistant *Shigella*, options for alternative treatment among children with such infections primarily include parenteral antimicrobial medications (3,4).

Guidelines for azithromycin susceptibility testing and criteria for interpretation of MICs for *Shigella* species have not been published. Clinicians are urged to report azithromycin treatment failure among shigellosis patients to public health authorities and to retain *Shigella* isolates from such cases for further analysis.

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Notes from the Field

School Reporting of a Dengue Outbreak — St. Croix, U.S. Virgin Islands, 2012

Dengue is endemic in the U.S. Virgin Islands, but no outbreaks have been reported since 2005 (1). In November 2012, a school nurse in St. Croix reported suspected dengue in 27 (7%) of 369 students and staff members to the Virgin Islands Department of Health (VIDOH) and the CDC Dengue Branch in Puerto Rico. Four of 12 patient specimens sent to the CDC Dengue Branch for diagnostic testing were confirmed as dengue. Although VIDOH had observed an increase in passive dengue reporting, reliable baseline case counts were unavailable for comparison. An investigation was begun to determine the incidence of recent dengue virus (DENV) infection in schools and islandwide.

A seroincidence study was conducted at six schools in addition to the index school, using a stratified two-stage cluster sampling methodology. Of 320 participants, 40 (20%) of 203 students and 20 (17%) of 118 staff members were immunoglobulin M (IgM) anti-DENV positive, indicating DENV infection within the preceding 3 months. Four students were polymerase chain reaction–positive for DENV-1 or DENV-4, indicating viremia and current infection.

Environmental sampling was conducted at the seven study schools and three additional schools to determine the presence of adult and immature mosquitoes. Containers with immature mosquitoes were found at all schools, and adult *Aedes aegypti* mosquitoes, the primary vector for dengue in St. Croix, were found in all but one school.

Retrospective case finding for suspected dengue cases was performed at St. Croix's only hospital by looking for patients tested for IgM anti-DENV in 2012. Of 194 tests performed, 61 (31%) were IgM anti-DENV positive, and 42 (22%) were reported to VIDOH, with an average delay of 20 days (range: 0–47 days) after testing; 152 (78%) of the 194 tests were performed in November–December. On average, patients with dengue seek medical attention on day 4 after illness onset (2), but IgM anti-DENV is only detected by the test kit in 58% of patients at this time (Dengue Branch, Division of Vector-Borne Diseases, National Center for Emerging and Zoonotic Infectious Diseases, CDC, unpublished data, 2012). These findings highlight the need to use a combination of molecular

diagnostics and immunodiagnostics to diagnose dengue early in the course of the illness (3). Initiatives to enhance dengue surveillance and reporting are ongoing at VIDOH.

This investigation suggested that students and school staff members were part of a larger islandwide dengue outbreak that might not have been identified without school reporting because only a small proportion of suspected cases were reported to VIDOH. However, because both *A. aegypti* and viremic students were detected in schools, transmission in this environment could not be excluded.

U.S. Virgin Islands residents should undertake practices to reduce mosquito production around dwellings and schools, and residents and visitors should take personal protective measures to avoid mosquito bites.* Health-care personnel in the United States should remain alert for dengue in travelers returning from the Caribbean, the most common regional source for dengue imported into the United States by travelers (4).

*Additional information available at <http://www.cdc.gov/dengue/prevention>.

Reported by

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Announcements

Epidemiology in Action Course

CDC and Rollins School of Public Health at Emory University will cosponsor the course, *Epidemiology in Action*, to be held June 3–14, 2013, at Emory University in Atlanta, Georgia. This course is designed for state and local public health professionals.

This course emphasizes practical application of epidemiology to public health problems and consists of lectures, workshops, classroom exercises (including actual epidemiologic problems), and roundtable discussions. Topics scheduled for presentation include descriptive epidemiology and biostatistics, analytic epidemiology, epidemic investigations, public health surveillance, surveys and sampling, and Epi Info training, along with discussions of selected prevalent diseases. Tuition is charged.

Additional information and applications are available at <http://www.sph.emory.edu/epicourses>; or by mail (Emory University, Hubert Department of Global Health [Attn: Pia Valeriano], 1518 Clifton Rd. NE, CNR Bldg., Rm. 7038, Atlanta, GA 30322); telephone (404-727-3485); fax (404-727-4590); or e-mail (pvaleri@emory.edu).

Online Career Master of Public Health Program for Working Professionals

Designed for working professionals who are unable to leave their jobs, the Career Master of Public Health (CMPH) program at the Rollins School of Public Health, Emory University, is a distance-learning program. Each semester, students are required to attend two long weekends on the Emory University campus in Atlanta, Georgia. All additional coursework is taught using the Internet and distance-learning techniques.

The CMPH program offers three majors: Applied Epidemiology, Applied Public Health Informatics, and Prevention Science. In addition to coursework in their major, students in the CMPH program take six required core courses (epidemiology, biostatistics, social behavior, environmental health, global health, and the U.S. health-care system) and additional coursework that includes competencies in public health informatics, evaluation, and surveillance. All CMPH students also complete a practicum and culminating experience that are relevant to their areas of specialization.

Program faculty members represent both academia and public health practice and include persons who work at Emory, CDC, and local public health departments. Completion of coursework for the CMPH degree takes 7 semesters for the full-time student and is fully accredited by the Council on Education for Public Health and the Southern Association of Colleges and Schools. Prospective students should apply by May 1, 2013, to guarantee consideration for the fall 2013 semester. Additional information is available via e-mail at cmph@sph.emory.edu or visit online at <http://www.sph.emory.edu/cmph>.

Announcements

Ground Water Awareness Week — March 10–16, 2013

CDC is collaborating with the National Ground Water Association to highlight National Ground Water Awareness Week, March 10–16, 2013. Water is essential for life. However, many persons are not aware that much of the water they use flows from below ground to the surface. The National Ground Water Association uses this week to stress ground water's importance to the health and well-being of humans and the environment (1).

The majority of public water systems in the United States use ground water as their primary source, providing drinking water to nearly 90 million persons (2). An additional 15 million U.S. homes use private wells, which also rely on ground water (3).

Usually, ground water in the United States is safe to use. However, ground water sources can be contaminated naturally or as a result of imperfect agricultural, manufacturing, or sanitation practices (4). The presence of contaminants, such as pesticides, factory waste, and sewage, can lead to acute and chronic illness (5).

The U.S. Environmental Protection Agency has worked with individual states to develop new regulations to provide increased protection against microbial pathogens in public water systems that use ground water sources (6). Private ground water wells serving fewer than 25 persons might not be regulated but nonetheless must be properly maintained by well owners to ensure that the water remains free from harmful

chemicals and pathogens.* Resources are available from state and local health departments to help homeowners protect their ground water.†

* Additional information available at <http://www.cdc.gov/healthywater/drinking/private/wells/index.html>.

† Additional information available at <http://www.apha.org/about/public+health+links/linksstateandlocalhealthdepartments.htm>.

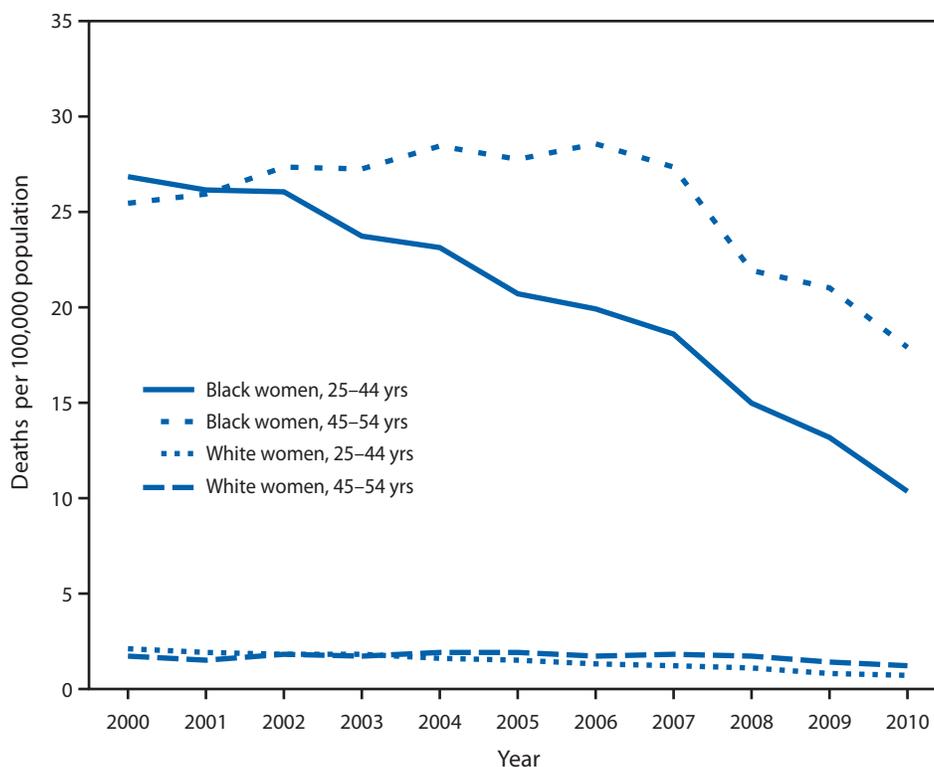
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QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Human Immunodeficiency Virus (HIV) Disease Death Rates* Among Women Aged 25–54 Years, by Race and Age Group — National Vital Statistics System, United States, 2000–2010



* Per 100,000 population. Deaths include those coded as B20–B24 in the *International Classification of Diseases, 10th Revision*.

From 2000 to 2010, HIV disease death rates decreased 61% for black women and 67% for white women aged 25–44 years. For women aged 45–54 years, the rates declined later in the decade. In that age group, rates decreased by 37% from 2006 to 2010 for black women and by 33% from 2007 to 2010 for white women. Throughout the 2000–2010 period, HIV disease death rates for black women were at least 12 times the rates for white women.

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

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Morbidity and Mortality Weekly Report

The *Morbidity and Mortality Weekly Report (MMWR)* Series is prepared by the Centers for Disease Control and Prevention (CDC) and is available free of charge in electronic format. To receive an electronic copy each week, visit *MMWR*'s free subscription page at <http://www.cdc.gov/mmwr/mmwrsubscribe.html>. Paper copy subscriptions are available through the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402; telephone 202-512-1800.

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U.S. Government Printing Office: 2013-623-030/02053 Region IV ISSN: 0149-2195