ness by providing information about mental illness and its treatment, and help persons learn how to reassure, be friends with, and accept persons who seek or receive treatment for mental illness.

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* Additional information available at http://www.cdc.gov/brfss.
† These questions were modified from the 2002 National Scottish Survey of Public Attitudes to Mental Health, Well Being and Mental Health Problems, included in more recent versions of the survey available at http://www.scotland.gov.uk/publications/2009/09/15120147/10.
‡ For each question, approximately 2% of respondents answered "did not know" and approximately 0.3% of respondents refused to answer each question.
§ The response rate is the percentage of persons who completed interviews among all eligible persons, including those who were not successfully contacted. The cooperation rate is the percentage of persons who completed interviews among all eligible persons who were contacted. Rates are available at http://ftp.cdc.gov/pub/data/brfss/2007summarydataqualityreport.pdf.
‖ Available at http://www.whatadifference.samhsa.gov.

Acute Antimicrobial Pesticide-Related Illnesses Among Workers in Health-Care Facilities—California, Louisiana, Michigan, and Texas, 2002-2007

MMWR. 2010;59:551-556

2 tables omitted

ANTIMICROBIAL PESTICIDES (E.G., STERilizers, disinfectants, and sanitizers) are chemicals used to destroy or suppress the growth of harmful microorganisms on inanimate objects and surfaces.[1] Health-care facilities use antimicrobial pesticides to prevent pathogen transmission from contaminated environmental surfaces.[2] Occupational exposures to antimicrobial pesticides are known to cause adverse health effects. To assess the nature and frequency of such exposures in health-care settings, CDC analyzed data from pesticide poisoning surveillance programs in California, Louisiana, Michigan, and Texas (the only four states that regularly collect data on antimicrobial pesticide-related illness) for the period 2002-2007. This report summarizes the results of that analysis, which identified 401 cases of work-related illness associated with antimicrobial pesticide exposures in health-care facilities. Most cases were identified through workers compensation systems (61%) and occurred among females (82%) and persons aged 25-54 years (73%). The most frequent occupations reported were janitors/housekeepers (24%) and nursing/medical assistants (16%). The reported mechanism of injury usually was splashes/spills (51%). The eyes were the most common organ/system affected (55%); only 15% of the 265 persons who had exposures while handling antimicrobial pesticides reported using eye protection. Reported symptoms were mostly mild and temporary. One fatality due to acute asthma and subsequent cardiopulmonary collapse was identified. Health-care facilities should educate workers about antimicrobial pesticide hazards, promote the use of personal protective equipment (PPE) as appropriate, and implement effective risk communication strategies for antimicrobial pesticide use to prevent bystander exposure. Improved design of handling equipment might prevent handler and bystander exposure.

Approximately 5,000 antimicrobial pesticide products are registered with the U.S. Environmental Protection Agency, and approximately 60% of these are targeted to control infectious microorganisms in health-care settings.[1] Antimicrobial pesticide products are formulated into sprays, liquids, concentrated powders, and gases.[1] Occupational exposure to disinfectants (e.g., glutaraldehyde), cleaning products (e.g., bleach), or sanitizers (e.g., quarternary ammonium compounds [QACs]) can cause acute irritant symptoms, respiratory and skin sensitization, and asthma.[3-5] Although information on the risks for occupational exposure to antimicrobial pesticides is available, little is known about the magnitude and characteristics of acute antimicrobial pesticide illnesses among workers in health-care facilities.

The four states require health-care providers to report pesticide-related illness to designated state agencies. State surveillance programs collect data on acute pesticide illness cases from vari-

ous sources (e.g., physicians, poison control centers, workers compensation systems, and state and local government agencies) and classify cases based on the strength of evidence for pesticide exposure, health effects, and their causal relationship.[6] CDC obtained data for the California cases from the California Department of Pesticide Regulation (CDPR), and data for the other three states from the Sentinel Event Notification System for Occupational Risks (SENSOR)-Pesticides program.* Case categories of definite, probable, possible, and suspicious from SENSOR-Pesticides and definite, probable, and possible from CDPR were included in the data analysis. An antimicrobial pesticide-related illness was defined as any acute adverse health effect resulting from exposure to an antimicrobial pesticide product. Healthcare facilities were defined as hospitals, nursing and personal-care facilities, medical clinics, and other health service settings involving patient care.† Home health-care services were excluded. Data were analyzed for demographics, occupation, health effects, severity,‡ outcomes (e.g., hospitalization and lost work time), pesticide toxicity, active ingredients, and nature of exposure (e.g., type of activity, type of exposure, and PPE use).

During 2002-2007, a total of 401 acute illnesses associated with work-related antimicrobial pesticide exposures in health-care facilities were reported: 287 cases (72%) in California, 56 (14%) in Texas, 43 (11%) in Michigan, and 15 (4%) in Louisiana. These antimicrobial pesticide exposure cases accounted for 87% of all work-related pesticide illnesses reported in health-care facilities. The annual number of cases increased from 51 in 2002 to 77 in 2007. The majority of cases were among females (82%) and persons aged 25-54 years (73%). Occupations with the most cases were janitors/housekeepers (24%), followed by nursing/medical assistants (16%) and technicians (15%).

Most cases (85%) had low-severity illness. Fifty-six cases (14%) had moderate-severity illness, two cases had high-severity illness, and one death occurred. Eight cases (2%) were hospitalized, and 68 persons (17%) experienced ≥1 day of lost time from work. Ocular symptoms/signs (e.g., eye irritation/pain and conjunctivitis) were the most commonly experienced health effects (55%), followed by neurologic (e.g., headache and dizziness) (32%), respiratory (e.g., throat irritation/pain, cough, and dyspnea) (30%), and dermal (e.g., irritation and rash) (24%) symptoms/signs. Among the 121 cases with respiratory symptoms/signs, 11 (9%) were in persons with asthma who had acute asthma, and six (5%) were in persons without asthma who experienced wheezing; all 17 were classified with moderate or higher severity illness.

The fatal case occurred in a woman aged 52 years employed as a laundry worker at a Michigan nursing home who had a 2-year history of non—steroid-dependent asthma and chronic bronchitis. She smoked two packs of cigarettes and some marijuana daily. In February 2007, she was exposed to nondiluted bleach fumes from an open pail near a running clothes dryer for 10-15 minutes. She complained of shortness of breath, used her albuterol inhaler, but collapsed. 9-1-1 was called, and cardiopulmonary resuscitation and intubation were performed at the scene. She never regained consciousness and died 5 days later in the hospital.

The most common active ingredients responsible for illnesses were QACs (38%), glutaraldehyde (25%), and sodium hypochlorite (18%). Sixty-six percent of cases were in persons exposed while they handled antimicrobial pesticides and 18% were in bystanders (16% had unknown activity at time of exposure). Inadvertent exposure by splashes/spills/leaks accounted for 51% of cases. Among 265 persons who handled antimicrobial pesticides, 74% were wearing some type of PPE, including primarily work clothes or gowns (60%) and gloves (55%). Only 15% wore eye protection, including safety glasses, goggles, or face shield, and 5% wore surgical masks or respirators.

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CDC Editorial Note: This is the first multistate report on the magnitude and characteristics of acute antimicrobial pesticide illness among workers in health-care facilities. Although no data are available on the level of exposure of these workers to antimicrobial pesticides, these chemicals are used very commonly in health-care facilities. The findings indicate that, during 2002-2007 in the four states, exposure to antimicrobial pesticides used in health-care facilities likely posed a low risk for health effects, and the effects generally were mild and temporary. Health-care workers have a higher prevalence of asthma compared with the general working population (6.0% versus 3.7%),[7] and because of their potential for occupational exposure, they might more often experience severe illness after antimicrobial pesticide. Users of antimicrobial products, especially health-care workers, should take precautions to prevent or minimize exposure to themselves as well as bystanders.

Ocular symptoms were the most common adverse health effect, usually from splashes while not wearing eye protection. A report on occupational disinfectant-related illness among youths also found that ocular symptoms were the most commonly observed (in 51% of cases).[8] These findings suggest the importance of using eye protection and the need to improve product design or handling equipment to prevent splashes.

The chemicals responsible for most health-care facility cases were QACs, glutaraldehyde, and sodium hypochlorite (i.e., bleach). QACs are widely used to disinfect environmental surfaces or medical equipment designed for skin contact (e.g., blood pressure cuffs). Glu-

What is already known on this topic?

Use of antimicrobial pesticides is an important component of infection control practices in health-care facilities, and occupational exposures can cause adverse health effects.

What is added by this report?

During 2002-2007, a total of 401 work-related illnesses associated with antimicrobial pesticide exposures in health-care facilities were identified in four states; most cases occurred among janitors/housekeepers and nursing/medical assistants, usually due to splashes or spills, and the eyes were the most common organ/system affected.

What are the implications for public health practice?

Hazardous exposure to antimicrobial pesticides and subsequent illnesses should be minimized through safe work practices and effective communication, including greater emphasis on use of protective eyewear.

taraldehyde is used as an immersion chemical in disinfecting heat-sensitive medical equipment (e.g., endoscopes). Sodium hypochlorite is used in environmental sanitization and decontaminating blood spills.[3] These chemicals can cause irritant symptoms involving the eyes, skin, and respiratory tract; QACs and glutaraldehyde are known sensitizers.[4] While using these chemicals, eye and skin protection is required to prevent irritant health effects and splash hazards. For glutaraldehyde, local exhaust ventilation and general room ventilation with a minimum rate of 10 air exchanges per hour is recommended to minimize respiratory exposure.[5]§

The findings in this report are subject to at least two limitations. First, the findings likely underestimate the actual magnitude of work-related illnesses associated with antimicrobial pesticide exposures in health-care facilities. Case identification relies on passive surveillance systems in which many cases might be missed by underreporting; also, minor illnesses not requiring medical attention are unlikely to be captured. The extent of underestimation might differ by state because of variations in data sources across states. For example, unlike some other states, California uses workers compensation records as a major source for case identification. Additionally, CDPR's longstanding experience in antimicrobial surveillance and higher staffing levels might have contributed to greater capture of cases. Second, the data might include false-positive cases because clinical findings of pesticide illness are nonspecific and diagnostic tests are not available or rarely performed.

Hazardous exposure to antimicrobial pesticides and subsequent illnesses can be minimized through safe work practices and effective communication. Health-care facilities should be reminded to (1) choose less hazardous antimicrobial pesticide products, if available; (2) inform employees of the health hazards of antimicrobials used in their facilities; (3) provide training on the safe handling of antimicrobial pesticides in accordance with label instructions (e.g., using appropriate quantities/dilution); (4) furnish appropriate PPE, ensure that it is conveniently located, and promote its use; (5) improve risk communication when antimicrobial pesticides are used (e.g., posting signs where antimicrobials are used); and (6) encourage employees to report and seek treatment for any illness/injury arising from antimicrobial pesticide exposure. Additionally, to prevent inadvertent splashes or spills, manufacturers should improve the design of containers, delivery systems, and handling equipment (e.g., adding a pump dispenser rather than pouring from a large container). Finally, greater use of workers compensation records for case identification would enhance surveillance activities.

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* Among 12 states participating in the SENSOR-Pesticides program, Louisiana, Michigan, and Texas collect data on antimicrobial pesticide illness. The California Department of Public Health (CDPH) participates in SENSOR-Pesticides but started to collect data on antimicrobial pesticide illnesses only in 2007. Thus, data from CDPH were not included in the analyses.

† Health-care facility cases initially were identified by the location of the incident or the employed industry. Health-care industry was identified using Standard Industrial Classification codes for CDPR cases (801, 802, 803, 804, 805, 806, 807, and 809) and 1990 Census Industry Codes for SENSOR-Pesticides cases (812, 820, 821, 822, 830, 831, 832, and 840). Cases not meeting the definition of health-care facilities were excluded after a review of case information.

‡ Severity of illness was coded using standardized criteria (available at http://www.cdc.gov/niosh/topics/pesticides). Low-severity illness refers to mild health effects that generally resolve without treatment and where minimal time (<3 days) is lost from work. Moderate-severity illness refers to non—life-threatening health effects that generally are systemic and require medical treatment. These might require hospitalization (≤3 days) and time lost from work is ≤5 days. No residual disability is expected. High-severity illness refers to life-threatening or serious health effects, which usually require hospitalization (>3 days), involve substantial time lost from work (>5 days), and can result in permanent impairment or disability.

§ CDC's National Institute for Occupational Safety and Health set the recommended exposure limit at 0.2 ppm, and the American Conference of Governmental Industrial Hygienists set the threshold limit value at 0.05 ppm for glutaraldehyde, but irritant symptoms were reported at concentrations as low as 0.005-0.050 ppm.[6]