by laboratory directors (who might not be fully aware of the pathogenic properties of VACV in humans), concerns over adverse events associated with vaccination, and the extent of VACV education provided to laboratory workers (*2*). After the incident described in this report, VACV laboratory procedures were changed, and counseling and education was extended to all laboratory workers with occupational exposure to VACV.

Laboratory-acquired exposure to VACV can be associated with a high inoculum and can occur through a route (e.g., ocular) with a high risk for complications (*9*). In the event of an exposure, the affected body part should be washed immediately; eyewash protocols should be followed for ocular exposure. The laboratory worker should then report the incident to the laboratory director or to the occupational health clinic. Depending on the timing and circumstances of the exposure and status of the inoculated site, administration of postexposure vaccination, vaccinia immune globulin, or antivirals might be indicated to attenuate adverse clinical outcomes associated with VACV infection (*7*).

Clinicians should maintain a high index of suspicion for VACV infection when evaluating vesiculopapular rashes in patients who are laboratory workers handling nonhighly attenuated VACV strains or are their close contacts. Suspected cases of VACV infection should be reported to state or local health departments for diagnostic guidance. Further characterization of viruses can be performed at specialized reference laboratories such as the poxvirus laboratory at CDC (telephone: 404-639-4129). Contact VACV transmission is uncommon (5.9 cases per 100,000 vaccinations) (*3,6,10*), and infection control measures are effective in preventing such transmission (*7*); therefore, contact investigations should be limited to persons who might have had contact with lesion exudates, whether or not they have risk factors for severe VACV infection.

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Fatalities Caused by Cattle — Four States, 2003–2008

During 2003–2007, deaths occurring in the production of crops and animals in the United States totaled 2,334; of these, 108 (5%) involved cattle as either the primary or secondary cause (*1*). During the same period, Iowa, Kansas, Missouri, and Nebraska accounted for 16% of the nation's approximately 985,000 cattle operations and 21% of the nation's cattle and calf herd (*2*). To better characterize cattle-caused deaths in these four states, investigators reviewed all such deaths occurring during the period 2003–2008 that were detected by two surveillance programs, the Iowa Fatality Assessment and Control Evaluation (IA FACE) and the Great Plains Center for Agricultural Health (GPCAH). This report summarizes that investigation, which identified 21 cattle-related deaths. These deaths occurred throughout the year, and decedents tended to be older (aged ≥60 years) (67%) and male (95%). Except in one case, the cause of death was blunt force trauma to the head or chest. Circumstances associated with these deaths included working with cattle in enclosed areas (33%), moving or herding cattle (24%), loading (14%), and feeding (14%). One third of the deaths were caused by animals that had previously exhibited aggressive behavior. To reduce the risk for death from cattle-caused injuries, farmers and ranchers should be aware of and follow recommended practices for safe livestock-handling facilities and proper precautions for working with cattle, especially cattle that have exhibited aggressiveness.

Data gathering and analysis were performed collaboratively by IA FACE (operated by the University of Iowa on behalf of the Iowa Department of Public Health) and GPCAH (part of the University of Iowa's College of Public Health). Both programs are funded by CDC and collect surveillance data on agricultural deaths.* IA FACE collects basic information on all

* Additional information about IA FACE is available at http://www.public-health.uiowa.edu/face. Information on GPCAH is available at http://www.public-health.uiowa.edu/gpcah.

traumatic occupational fatalities in Iowa as identified primarily through multisource surveillance of the media, including newspapers, radio, television, and the Internet. Once alerted to a potential occupational death, IA FACE requests reports from investigating authorities such as the local police and sheriff's departments, emergency medical services, and the medical examiner. GPCAH surveillance is based solely on reports from Iowa, Kansas, Missouri, and Nebraska newspapers and other periodicals. Since 2003, GPCAH has been building a press report database, which includes descriptive information about the victim, event, circumstances, and nature of the injuries in fatal and nonfatal farm and agricultural injury events within the four states.

In this analysis, cases were defined as occupational fatalities caused by cattle that occurred in Iowa, Kansas, Missouri, or Nebraska during 2003–2008. Fatalities that occurred when motor vehicles crashed into cattle on roadways (such as while cattle were being herded with an all-terrain vehicle or pickup truck in a pasture) were excluded.

Surveillance Results

A total of 21 deaths met the case definition for 2003–2008 (Table 1). Four fatalities occurred in 2003, two in 2004, six in 2005, and three each year during 2006–2008. During these years, eight of the fatalities occurred in Iowa, two in Kansas, seven in Missouri, and four in Nebraska. The 21 decedents ranged in age from 8 to 86 years, with a median age of 65 years (mean age: 61 years) (Table 2). Only one of the victims was female. One of the victims was a boy aged 8 years who was helping castrate cattle when he was crushed against a squeeze chute. One third of the deaths occurred in March and April.

The victims' most common activities at the time of death were working with and treating cattle in enclosed spaces such as pens and chutes (n = 7) and moving or sorting cattle toward pens, barns, or pastures (n = 5). Incidents also occurred while loading cattle into trucks or trailers (n = 3), feeding (n = 3), or working in an open pasture (n = 3).

Ten of the 21 fatalities involved attacks by individual bulls, six involved attacks by individual cows, and five involved multiple cattle. In seven attacks (whether witnessed or not), the bull or cow was known to have exhibited aggressive behavior in the past. In 16 of the cases, the animal was deemed to have purposefully struck the victim; five other deaths were caused by being crushed against a stationary object or struck by a gate (secondary to the action of cattle). All but one death resulted from blunt force trauma to the chest and/or head; one resulted from inadvertent injection of the antibiotic Micotil 300 (tilmicosin phosphate) from a syringe in the victim's pocket when he was knocked down by a cow.

Illustrative Case Reports

The following case summaries illustrate the most common circumstances of the cases identified for this report.

Case 1. In August 2005, a woman in Missouri aged 65 years was removing a dead, newborn calf from a pasture when a cow knocked her down, stomped her, and butted her while she was lying on the ground. The coroner reportedly stated that death resulted from blunt force trauma to the woman's head and chest. No autopsy was performed.

Case 2. In November 2005, a man in Iowa aged 65 years was helping his son sort beef cattle for loading onto a truck. He was attempting to guide one of the animals toward the truck when it turned into him, crushing him against the barn door. According to witnesses, he stopped breathing immediately. The medical examiner's report stated that death was caused by blunt force trauma to the man's chest.

Case 3. In April 2006, a man in Iowa aged 63 years was herding cattle into his dairy barn for milking when a bull came into the barn and repeatedly butted him, pinned him against a fence, and stomped him. According to the attending physician's death record, the man sustained multiple rib fractures, lacerated pulmonary arteries, and head injuries. The man's family said that the bull was known to be dangerous and had been threatening in the past.

Case 4. In August 2007, a man in Iowa aged 45 years who was working alone in a pasture was attacked by a bull that had been bottle-fed and raised by the family but, according to family members, had become more aggressive recently. The attack was not witnessed, but the man was able to call his wife for assistance on his cell phone before he died and told her he had been attacked. According to the state medical examiner's autopsy report, he died of blunt force injuries to the chest.

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Editorial Note: Large livestock are powerful, quick, protective of their territory and offspring, and especially unpredictable during breeding and birthing periods (*3–5*). Mothering livestock often protect their young aggressively. Dairy bulls, which have more frequent contact with humans than do beef cattle, are known to be especially possessive of their herd and occasionally disrupt daily feeding, cleaning, and milking routines (*5*). The findings in this report confirm earlier research substantiating the risk for death to farmers and ranchers from contact with cattle (*3,5–8*). Previously published reports have described the nature and frequency of cattle-related deaths and injuries. Among 739 patients admitted to a referral trauma center in Wisconsin during a 12-year period because of injuries incurred while farming, 30% involved injuries from

TABLE 1. Characteristics of cattle-caused fatalities — Iowa, Kansas, Missouri, and Nebraska, 2003–2008*†

Month and year	State	Decedent	Sex	Age (yrs)	Animal involved	Incident
Mar 2003	IA	Cattle farmer	Male	77	Beef cattle	Struck by gate when cattle charged while being herded
Oct 2004	IA	Cattle farmer	Male	48	Beef cattle	Pinned against barn wall while working with cattle
Nov 2004	IA	Dairy farmer	Male	77	Dairy bull	Attacked from behind by bull when feeding dairy cows
Sep 2005	IA	Veterinarian	Male	64	Beef bull	Attacked by bull when vaccinating and applying insecticide on cattle
Nov 2005	IA	Cattle farmer	Male	65	Beef cattle	Crushed against barn door when sorting cattle
Apr 2006	IA	Dairy farmer	Male	65	Dairy bull	Attacked by bull when herding cows for milking
Apr 2006	IA	Dairy farmer	Male	63	Dairy bull	Attacked by bull while moving cows into milking parlor
Aug 2007	IA	Cattle farmer	Male	45	Beef bull	Attacked by bull when alone in pasture
Apr 2003	KS	Cattle farmer	Male	86	Beef calves	Knocked steel gate on top of himself while loading calves onto a trailer
Jul 2005	KS	Cattle farmer	Male	74	Beef bull	Trampled by bull being moved from one pasture to another
Mar 2003	MO	Cattle farmer	Male	71	Beef cows	Found fatally injured in pen with two cows and newborn calf
Feb 2005	MO	Cattle farmer	Male	62	Beef cow	Kicked in head by cow
Aug 2005	MO	Cattle farmer	Female	65	Beef cow	Attacked by cow when removing dead calf from pasture
Dec 2005	MO	Cattle farmer	Male	53	Beef bull	Mauled by aggressive bull in pasture while retrieving cows
Jan 2006	MO	Dairy farmer	Male	39	Dairy bull	Mauled and crushed against barn wall by bull while feeding cows
Sep 2007	MO	Cattle farmer	Male	75	Beef bull	Gored while loading bull into trailer
Jan 2008	MO	Cattle farmer	Male	72	Beef bull	Rammed by bull while feeding cattle
Mar 2003	NE	Cattle farmer	Male	38	Beef cow	Injected with Micotil from syringe in his pocket when cow pushed him down
Mar 2007	NE	Cattle farmer	Male	47	Beef cow	Crushed in pen when attacked by cow with calf
May 2008	NE	Cattle farmer	Male	81	Beef cow	Attacked by cow while working in pen
Jun 2008	NE	Child§	Male	8	Beef cattle	Crushed while moving cattle through squeeze chute

* Based on cases identified through the Iowa Fatality Assessment and Control Evaluation (IA FACE) (operated by the University of Iowa on behalf of the Iowa Department of Public Health) and the Great Plains Center for Agricultural Health (GPCAH) (part of the University of Iowa's College of Public Health). IA FACE collects basic information on all traumatic occupational fatalities in Iowa as identified primarily through multisource surveillance (by IA FACE staff and professional colleagues across the state) of the media, including newspapers, radio, television, and the internet. Once alerted to a potential occupational death, IA FACE requests reports from investigating authorities such as the local police and sheriff's departments, emergency medical services, and medical examiner. GPCAH surveillance is based solely on reports from Iowa, Kansas, Missouri, and Nebraska newspapers and other periodicals. Additional information about IA FACE is available at http://www.public-health.uiowa.edu/face. Information on GPCAH is available at http://www.public-health.uiowa.edu/gpcah.

† Cases were defined as occupational fatalities caused by cattle that occurred in Iowa, Kansas, Missouri, or Nebraska during 2003–2008. Fatalities that occurred when motor vehicles crashed into cattle on roadways (such as while cattle were being herded with an all-terrain vehicle or pickup truck in a pasture) were excluded.

§ Child was killed while helping on the family farm.

farm animals (*6*). Working with bulls involves higher risk for injury. In a study of farm worker injuries based on surveillance data from New York, bulls were found to account for 25% of animal-related injuries (*7*). Among the deaths described in this report, four (19%) were caused by dairy bulls during feeding or milking operations.

Of the decedents mentioned in this report, 13 of 20 (65%) were men aged ≥60 years. The methodology used in this analysis did not allow the calculation of age-specific risks and could not determine whether this age and sex profile reflected the demographics of farmers involved in close contact with cattle in the four states, or a greater risk for death among older farmers and ranchers. A case-control study of Iowa livestock farmers found that use of a hearing aid (odds ratio [OR] = 5.4) and doctor-diagnosed arthritis or rheumatism (OR = 3.0) were significantly associated with injuries related to animals (*8*). Age-related reduced hearing and reduced ability to react might contribute to this risk. Because approximately one third of the deaths described in this report occurred when the farmer was working alone, some of these deaths might have been prevented if a coworker had been present to help observe cattle behavior and movement and to provide prompt aid in case of injury. This might be especially useful when working with bulls or cows known to be aggressive, given that seven of the deaths described in this report involved such cattle.

TABLE 2. Number and percentage of cattle-caused fatalities, by selected characteristics — Iowa, Kansas, Missouri, and Nebraska, 2003–2008*†

Characteristic	No.	(%)§
Sex of decedent		
Male	20	(95)
Female	1	(5)
Age group (yrs) of decedent		
<60	7	(33)
≥60	14	(67)
Operation/Activity		
Herding/Moving/Sorting	5	(24)
Loading	3	(14)
Feeding	3	(14)
Tending/Treating in enclosed area	7	(33)
Attacked in open pasture	3	(14)
Animal involved		
Bull	10	(48)
Cow with calf	3	(14)
Cow (no calf)	3	(14)
Multiple cattle	5	(24)
Total	**21**	**(100)**

* Based on cases identified through the Iowa Fatality Assessment and Control Evaluation (IA FACE) (operated by the University of Iowa on behalf of the Iowa Department of Public Health) and the Great Plains Center for Agricultural Health (GPCAH) (part of the University of Iowa's College of Public Health). IA FACE collects basic information on all traumatic occupational fatalities in Iowa as identified primarily through multisource surveillance (by IA FACE staff and professional colleagues across the state) of the media, including newspapers, radio, television, and the internet. Once alerted to a potential occupational death, IA FACE requests reports from investigating authorities such as the local police and sheriff's departments, emergency medical services, and medical examiner. GPCAH surveillance is based solely on reports from Iowa, Kansas, Missouri, and Nebraska newspapers and other periodicals. Additional information about IA FACE is available at http://www.public-health.uiowa.edu/face. Information on GPCAH is available at http://www.public-health.uiowa.edu/gpcah.

† Cases were defined as occupational fatalities caused by cattle that occurred in Iowa, Kansas, Missouri, or Nebraska during 2003–2008. Fatalities that occurred when motor vehicles crashed into cattle on roadways (such as while cattle were being herded with an all-terrain vehicle or pickup truck in a pasture) were excluded.

§ Percentages might not sum to 100% because of rounding.

The findings in this report are subject to at least two limitations. First, IA FACE surveillance, which involves more in-depth follow-up, only captured fatalities associated with work in Iowa. GPCAH surveillance, which is conducted in Iowa, Kansas, Missouri, and Nebraska, only captured accounts that appeared in newspapers or other periodicals. Therefore, reports from coroners or medical examiners, law enforcement, and emergency services were not obtained in Kansas, Missouri, or Nebraska. As a result, details about incidents in these three states often were limited (e.g., the age and sex of the decedent always were reported, but occasionally the decedent's activities and surroundings were not well reported). Second, reliance primarily on news reports means that some fatalities might go unreported. In Iowa, during 2003–2007, all seven of the fatalities caused by cattle that were documented by the state-based Census of Fatal Occupational Injuries (CFOI) of the U.S. Department of Labor's Bureau of Labor statistics also were captured through IA FACE and GPCAH surveillance. However, CFOI documented four cattle-caused fatalities in Kansas, seven in Missouri, and four in Nebraska, whereas GPCAH captured only two fatalities in Kansas, six in Missouri, and two in Nebraska. These data indicate that in states where only press clips were used to document agricultural fatalities, five out of 15 (33%) of the fatalities were unreported, suggesting a sensitivity of 67%. However, the advantage of using press reports is that more information regarding the circumstances of the deaths might be collected. In published studies, the sensitivity of newspapers as an injury surveillance source has varied according to the type of injury (*9*).

Previously published reports have recommended that cattle handling facilities be designed for optimum safety, such as the placing of sturdy barriers between cattle and persons, allowing for directed movement of cattle, and providing means for rapid exit from the cattle area (*10*). Information on safe cattle handling and safe cattle-handling facilities is available from the National Agricultural Safety Database at http://www.nasdonline.org/menu/topic/animals.html.

Acknowledgments

This report is based, in part, on contributions by participating state agencies; Bureau of Labor Statistics staff; FACE program staff; J Kraemer, Iowa Office of the State Medical Examiner; K Leinenkugel, Occupational Safety and Health Surveillance Program, Iowa Dept of Public Health; and JR Myers, National Institute for Occupational Safety and Health, CDC.

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Status of State Electronic Disease Surveillance Systems — United States, 2007

The National Electronic Disease Surveillance System (NEDSS) is a web-based system that uses standard health information technology (IT) codes to integrate disease surveillance systems, enabling them to transfer public health, laboratory, and clinical data securely from health-care providers to public health departments (*1*). Each jurisdictions' system consists of a base system and modules that can be used for specific surveillance purposes. States also use NEDSS-like or other electronic systems to conduct surveillance on specific diseases or conditions.* Until recently, no assessment had been done to describe the status and characteristics of state electronic disease surveillance systems. The Council of State and Territorial Epidemiologists (CSTE) conducted such an assessment in August 2007 in all 50 states. This report presents the results of that assessment, which indicated that, in 2007, state electronic disease surveillance systems varied widely and were in various stages of implementation. Each state had either custom-built systems or purchased systems that were customizable, with associated disease modules to meet its own surveillance needs. As interoperability becomes the standard for electronic data sharing, more states will face customization costs and the need to hire more technical specialists who can manage health information and exchange. Further collaboration and support from surveillance and health-care IT stakeholders with public health will be needed to improve the efficacy and quality of electronic disease surveillance systems.

States have developed their electronic disease surveillance systems in a multitude of ways, and states use a combination of vendor products, CDC electronic systems, and state-developed surveillance systems. Some electronic systems are disease specific (e.g., human immunodeficiency virus [HIV]/acquired immunodeficiency syndrome [AIDS] and tuberculosis [TB]), and others serve a particular purpose (e.g., outbreak management, electronic laboratory reporting).† In 2000, CDC developed the NEDSS Base System, a platform for disease-specific modules, which it supports and provides to states for use in surveillance. Except for the hardware costs, states using the NEDSS Base System generally incur only commercial software maintenance fees and licenses. States and vendors have developed enhancements that facilitate surveillance through electronic laboratory reporting, geographic information mapping, and outbreak management software.

In 2007, the NEDSS and Architecture Subcommittee of CSTE developed a survey to assess the status, progress, and features of the various electronic surveillance systems used by states nationwide. CSTE distributed the questionnaire electronically to NEDSS project managers or their designees in each state, who completed a series of multiple-choice questions on the operational status and integration levels of their systems and provided additional data on how their system software was developed. The questionnaire also asked respondents to provide vendor information and to comment on other aspects of their systems.

The assessment collected data on five NEDSS Base System, NEDSS-like, or separate, web-based electronic surveillance systems used by most states: communicable human diseases, HIV/AIDS, lead exposure, sexually transmitted diseases other than HIV/AIDS, and TB. The questionnaire also collected information about IT enhancements, such as electronic laboratory reporting, geographic information mapping, Master Patient Index,§ and outbreak management systems¶ to assess their level of potential integration with other systems and their development status.

For the assessment, CSTE defined "interoperability" as the extent to which the configuration of a surveillance system allowed exchange of information by electronically connecting various stand-alone, disease-specific modules within the state or allowed exchange of information among dissimilar systems in different states. CSTE defined "integration" as the extent to which a system included all of the separate disease modules in the same system.

All 50 states responded to the assessment questionnaire, but not all states answered all questions. Sixteen (32%) states

* The type of systems developed and implemented include federal (e.g., CDC's NEDSS Base System), state (e.g., Pennsylvania PA-NEDSS or Florida's Merlin System), and vendor (i.e., commercial off-the-shelf). The term NEDSS-like is commonly referred to state and vender developed system, but regardless of the term, each adheres to the principles of the NEDSS mission..

† Examples of CDC-created special use electronic surveillance systems include eHARS (human immunodeficiency virus/acquired immunodeficiency virus), STD*MIS (sexually transmitted diseases), and TIMS (tuberculosis surveillance).

§ Master Patient Index technology is used to maintain a master list of all patients in an area or organization. It provides a platform to correlate and cross-reference patient records across public health systems and registries.

¶ Outbreak management systems can generate questionnaires, perform analyses, issue reports, manage case and contact investigations, and perform other epidemiologic functions. It allows public health agencies respond to emergencies and outbreaks. Outbreak management systems often are used to manage patient tracking information for case follow-up.