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Hantavirus Pulmonary Syndrome — Colorado and New Mexico, 1998

Hantavirus pulmonary syndrome (HPS) is a severe cardiopulmonary illness resulting in death in approximately 45% of cases. The most frequently recognized etiologic agent of HPS in North America, Sin Nombre virus (SNV), is transmitted to humans from its primary rodent reservoir, *Peromyscus maniculatus* (deer mouse), by direct contact with infected rodents, rodent droppings, or nests or through inhalation of aerosolized virus particles from mouse urine and feces. Sporadic cases occur throughout the United States and Canada, but the potential for spread from rodents to humans in 1998 probably has increased because of increased rodent population densities in some regions of the country. This report describes three cases of HPS that occurred in the southwestern United States with onsets of illness during April 15–28, 1998, and recommends methods to avoid exposure to rodents inside and around human dwellings.

Patient 1

On April 15, a 17-year-old man in Teller County, Colorado, developed fever (103.1 F [39.5 C]), headache, myalgia, and lower back pain. By April 17, he was somnolent and complained of a nonproductive cough and progressive shortness of breath. On medical examination he was hypotensive and dyspneic and was admitted to a hospital in respiratory distress. Bilateral infiltrates consistent with pulmonary edema were observed on his chest radiograph. Complete blood count (CBC) showed decreased platelets (32,000/mm^3 [normal: 150,000/mm^3–450,000/mm^3]); a white blood cell count (WBC) of 19,600/mm^3 (normal: 3200/mm^3–9800/mm^3), and a hematocrit (Hct) of 65% (normal: 39%–49%). He was intubated within 3 hours of admission, and serous fluid subsequently poured out of the endotracheal tube. The patient suffered a cardiac arrest on April 18 and could not be revived. Serologic studies conducted at the Colorado Department of Public Health and Environment's virology laboratory were positive for anti-SNV IgM antibodies (*1*).

The patient lived with his family on a sheep ranch with open pastures surrounded by Ponderosa pine forest. The patient spent a large amount of time in a converted garage used as a studio where he often slept on a rodent-infested couch. Evidence of rodent infestation was observed in the numerous buildings, barns, and unused vehicles on the property.

Hantavirus Pulmonary Syndrome — Continued

workplace include eliminating food sources available to rodents in structures used by humans, limiting possible nesting sites, sealing holes and other possible entrances for rodents, and using "snaptraps" and rodenticides (*6*). Other methods include using a 10% bleach solution to disinfect dead rodents and wearing rubber gloves before handling trapped or dead rodents; gloves and traps should be disinfected after use. Before entering areas that have potential rodent infestations, doors and windows should be opened to ventilate the enclosure. Persons entering these areas should avoid stirring up or breathing potentially contaminated dust. Dusty or dirty areas or articles should be moistened with a 10% bleach solution or other disinfectant solution before being cleaned—brooms or vacuum cleaners should not be used to clean rodent-infested areas. Decreasing the number of rodents inside and around human dwellings remains the most effective means to prevent peridomestic hantavirus infection.

References

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Deaths Associated with Occupational Diving — Alaska, 1990–1997

During 1989–1997, the Occupational Safety and Health Administration (OSHA) recorded 116 occupational diving fatalities in the United States (OSHA, unpublished data, 1998).* During 1990–1997, nine persons in Alaska died in work-related diving incidents (four were investigated by OSHA); only one had training beyond a recreational diving certificate, and three lacked any certification. In response to concerns about adequate training of occupational divers in Alaska and recent public inquiry, CDC's National Institute for Occupational Safety and Health (NIOSH) reviewed the nine occupational diving fatalities in Alaska.† This report describes three of these incidents, summarizes the results of the review, and provides recommendations to improve the safety of commercial diving.

*This includes all diver deaths that had an employer/employee relationship, regardless of training level or dive-relatedness, except those involved in search and rescue, training, and government work. Self-employed divers are not subject to OSHA regulations and are not included.

†Data about diving fatalities were obtained from OSHA, the National Traumatic Occupational Fatalities database, and the Alaska Occupational Injury Surveillance System maintained by NIOSH, Division of Safety Research Alaska Field Station.

Occupational Diving — Continued

Case Reports

Case 1. In July 1996, a 24-year-old commercial fisherman with no diving certification used scuba gear while attempting to clear a fishing net wrapped around the propeller of a fishing vessel. He became entangled in the net and was unable to free himself. Other crew members were unable to assist because they had no diving gear. He was retrieved approximately 3 hours later, and no attempt was made to resuscitate him. The scuba tank still contained an adequate amount of air. The cause of death was drowning.

Case 2. In October 1996, a 32-year-old certified recreational diver with minimal experience was harvesting sea cucumbers using surface-supplied air in approximately 40 feet of water. After approximately 1 hour, the tender[§] lost sight of the diver's air bubbles. The diver did not respond to a recall signal, and the tender pulled him to the surface. His air regulator was not in his mouth, and cardiopulmonary resuscitation (CPR) was unsuccessful. Inspection of the dive gear indicated it to be fully operational, with no obvious defects. The cause of death was drowning, but the specific cause of the incident was unknown.

Case 3. In September 1997, a 47-year-old experienced commercial diver who had made no dives during the previous 2–3 years used scuba gear while attaching a mooring line to a buoy anchor line. The equipment was not in good condition, and both the primary and alternate regulator were leaking and in need of repair. Shortly after he submerged, the tether line floated to the surface. After he was signaled without response, the team leader put on scuba gear, submerged, and found the diver on the sea floor with a weight belt on and both tether line and tank high-pressure hose severed. The diver was recovered, and CPR was unsuccessful. The investigation did not determine how the hose was severed, and the cause of death was listed as drowning. OSHA cited the employer for violations including inadequate training in using tools/equipment and in CPR, absence of a ready standby diver, diver not line tended, lack of a reserve tank, and rescue not conducted in a timely manner.

Summary of Cases

All nine of the diving fatalities in Alaska occurred in males aged 19–47 years (median: 25 years). Three were harvesting sea cucumbers, three were diving to clear tangled lines or nets from fishing boats, two were conducting vessel-related activities (i.e., hull inspection and anchor attachment), and one was a U.S. Navy diver undergoing training. Six divers were using scuba gear, and three were using surface-supplied air. Three deaths were attributed to equipment failure, two to entanglement in lines or nets, one to exhaustion of air supply, and three to unknown causes. None of the divers had an adequately prepared standby diver, the three divers using surface-supplied air and one scuba diver were line tended, one diver was accompanied, and one diver carried a reserve air supply.

Reported by: Div of Safety Research, National Institute for Occupational Safety and Health, CDC.

Editorial Note: Of the 116 occupational diving fatalities reported by OSHA for 1989–1997 (13 deaths per year), 49 (five per year) occurred among an estimated 3000 full-time commercial divers (OSHA, unpublished data, 1998). The average of five deaths per year corresponds to a rate of 180 deaths per 100,000 employed divers per year,

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[§]A person who remains aboard the dive boat and supports the diver underwater—for example, operating the air compressor, maintaining lines, or monitoring for signs of diver distress or danger.

Occupational Diving — Continued

which is 40 times the national average death rate for all workers. This group, which accounts for most of the commercial dive time underwater, includes divers involved in construction, maintenance, and inspection of vessels and structures such as oil rigs, bridges, and dams. The remaining 67 deaths occurred among workers who were not full-time divers; these include seafood harvest divers, search and rescue divers, scientific divers, dive instructors, and nonmilitary federal agency divers. NIOSH's National Traumatic Occupational Fatalities database reported 56 occupational diving deaths for 1989–1994 (11 deaths per year) (CDC, unpublished data, 1998); causes of deaths listed most often for divers included drowning (73% of cases), asphyxia (14%), and embolism (7%). Other causes included trauma, hypothermia, and late medical complications, but hypothermia and air embolus may be underestimated because of difficulties in diagnosing these conditions.

During the 1990s, dive fisheries have expanded in response to increasing demands for sea urchins, sea cucumbers, geoduck clams, abalone, and other products harvested by diving. In Alaska, the number of permits for dive fisheries has increased 950%, from <59 in 1987 to approximately 628 in 1995 (*1*). Many permit holders make only one or two trips yearly (*1*), and no evidence of experience or training is required to obtain a permit. In addition to dive harvesting, Alaskan divers often assist in untangling lines and nets from boat propellers. These divers are often sport divers who solicit such work, but also may be crew members with little or no training in the use of dive equipment.

Drowning was listed as the official cause of death for all the cases in this report. Although the circumstances of the incidents are known in most of the cases, specific causes could not be determined for three cases. Lack of experience and possibly panic were mentioned as contributing factors in several cases. Lack of a reserve air supply contributed to the one death from exhaustion of air supply and perhaps others.

The findings in this report illustrate a pattern of fatal incidents associated with inadequately trained divers; only one diver with commercial dive training has died in Alaska since the 1960s (G. Cleary, Alaska Divers and Pile Drivers Union, personal communication, 1998). No commercial or fishery-related dive training is available in Alaska. In 1994, CDC reported six fatalities among commercial divers in Maine during 1992–1993 and identified insufficient training as an important contributing factor in the incidents (*2*). The fatal diving incidents in Maine resulted in legislation in 1993 to require specific training of sea harvest divers before they are licensed (*2*). The 3-day course covers first aid/CPR, operations management, emergency procedures for tenders and divers, and advanced dive tables¶ and physiology. From 1994 (when this legislation was implemented) to 1997, only two dive fishery-associated fatalities in Maine were reported (*1*). Similar training requirements for dive-fishing permits should be considered in all states that have this industry; recreational diving certification is not sufficient training for commercial diving activities.

Divers performing work-related diving activities should understand and follow standard diving precautions (i.e., those recommended by OSHA and the U.S. Coast Guard [*3,4*]), including 1) developing familiarity with equipment and safety procedures, 2) avoiding diving without a "buddy" or being line tended, 3) avoiding diving without an available backup diver, and 4) carrying reserve air supplies. Equipping vessels with shrouded propellers (to reduce net entanglement), propeller clearing ports,

¶Dive tables are used to determine the maximum safe time and depth limits for divers to avoid developing decompression sickness from accumulation of excess nitrogen in the body.

Occupational Diving — Continued

or line cutters on the propeller shaft would reduce the need for divers to untangle nets and lines.

Additional information about diving is available from the Association of Dive Contractors, telephone (281) 893-8388; the Alaska Marine Safety Education Association, telephone (907) 747-3287; e-mail amsea@ptialaska.net; or from the World-Wide Web site http://www.ilo.org/public/english/90travai/sechyg/idhind01.htm.

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Community Exposure to Toluene Diisocyanate from a Polyurethane Foam Manufacturing Plant — North Carolina, 1997

In August 1996, residents of a community in Randolph County, North Carolina, contacted the Agency for Toxic Substances and Disease Registry (ATSDR) because of health concerns about possible exposure to chemical emissions from a polyurethane manufacturing plant. ATSDR and the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR) conducted ambient air monitoring to characterize air contamination near the plant. ATSDR and Randolph County health officials also conducted biologic monitoring to determine whether residents were being exposed to toluene diisocyanate (TDI) emitted from the plant. This report summarizes the results of these investigations, which indicate that residents were being exposed to TDI in ambient air surrounding the plant.

The facility produced polyurethane foam by reacting a polyether resin with TDI and water. Emissions from the manufacturing process were directed to exhaust stacks, which vented them to ambient air. Foam production occurred in batches, resulting in episodic releases of emissions. The facility had produced polyurethane foam for approximately 20 years; during the previous 5 years, foam was produced by a quick-cure process that used greater amounts of TDI.

Since January 1996, NCDEHNR conducted investigations of the facility including air sampling, interviews with residents, risk assessment of ambient air and emissions data, and reviews of medical records. Using a direct monitoring filter-tape instrument, ATSDR detected TDI in ambient air in a residential area near the facility. Concentrations of TDI as high as 29 parts per billion (ppb) were detected at a monitoring station approximately 100 feet outside the facility's fence line. The presence of TDI was confirmed by an alternative method in which diisocyanates were captured on glycerol-impregnated filters, chemically derivatized, and analyzed using high performance