Vaccine-Preventable Disease Among Homeschooled Children: Two Cases of Tetanus in Oklahoma

abstract
Homeschooled children represent an increasing proportion of school-aged children in the United States. Immunization rates among homeschooled children are largely unknown because they are usually not subject to state-based school-entry vaccination requirements. Geographic foci of underimmunized children can increase the risk for outbreaks of vaccine-preventable diseases. In 2012, 2 cases of tetanus were reported in Oklahoma; both cases involved homeschooled children without documentation of diphtheria-tetanus-acellular pertussis vaccination. We describe the characteristics of both patients and outline innovative outreach measures with the potential to increase vaccination access and coverage among homeschooled children. Pediatrics 2013;132:e1686–e1689

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KEY WORDS
Oklahoma, prevention and control, schools, tetanus, vaccines

ABBREVIATIONS
DTaP—diphtheria-tetanus-acellular pertussis
HTIG—human tetanus immune globulin
VPD—vaccine-preventable disease

Dr Johnson conceptualized and drafted the manuscript; Drs Bradley and Tiwari conceptualized the manuscript and critically reviewed the manuscript; Ms Mendus conceptualized the manuscript and reviewed and revised the manuscript; Mr Burnsed oversaw the case investigations and reviewed and revised the manuscript; Ms Clinton carried out the case investigations and reviewed and revised the manuscript; and all authors approved the final manuscript as submitted.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention. www.pediatrics.org/cgi/doi/10.1542/peds.2013-1636
doi:10.1542/peds.2013-1636
Accepted for publication Jun 18, 2013
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FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: No external funding.

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

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Immunization rates among homeschooled children are largely unknown because they are usually not subject to state-based school-entry vaccination requirements. Children who do not receive protection through recommended immunizations are susceptible to potentially life-threatening disease. In addition, geographic foci of underimmunized children can increase the risk for outbreaks of vaccine-preventable diseases (VPDs). States, including Oklahoma, might require additional public health efforts to ensure that homeschooled children are vaccinated in accordance with the national childhood immunization schedule.1–4

Tetanus, a rare VPD, is almost exclusively observed among persons who are unvaccinated, have not completed the primary tetanus toxoid vaccination series, or for whom vaccination history is unknown.5 Human tetanus immune globulin (HTIG) therapy is indicated for unclean wounds among these persons, as well as among completely vaccinated persons who have not received a decennial booster dose. For reporting purposes, the Council of State and Territorial Epidemiologists defines tetanus as an acute illness with muscle spasms or hypertonia and the diagnosis of tetanus by a health care provider, or as death, with tetanus listed on the death certificate as the cause or a significant condition contributing to death.6

During 2012, only 37 tetanus cases were reported to the Centers for Disease Control and Prevention’s National Notifiable Diseases Surveillance System.7 Two patients were from Oklahoma; both were homeschooled children. One child never received the diphtheria-tetanus-acellular pertussis (DTaP) vaccine, and the DTaP vaccination status of the other child was unknown. The current report describes the characteristics of both patients and outlines innovative outreach measures with the potential to increase vaccination access and coverage among homeschooled children.

**HEALTH DEPARTMENT INVESTIGATION**

**Patient 1**

On June 26, 2012, a non-Hispanic white male aged 17 years stepped on a rusty boat anchor and sustained a puncture wound to his foot while working outdoors for a sailing program. He cleaned the wound with hydrogen peroxide. He experienced mild pain but no local erythema, swelling, or drainage from the wound. On June 30, the patient awoke with tightness of his jaw and neck muscles. He presented to an emergency department later that evening with worsening symptoms and pleuritic chest pain. His wound was cleaned, and 250 U of HTIG, tetanus toxoid vaccine, and 500 mg of metronidazole were administered. He was transferred to a tertiary medical center where he received 2 mg of lorazepam and was admitted to the general pediatric ward. During his hospitalization, the patient received 500 mg of metronidazole every 8 hours for 5 days and an additional 6000 U of HTIG. He was discharged from the hospital in stable condition without sequelae on July 4, 2012.

**Patient 2**

On October 23, 2012, a non-Hispanic white male aged 8 years sustained a laceration to his foot from a rusty nail on his parent’s farm. His mother provided wound care. He experienced no local erythema, swelling, or drainage from the wound. On October 25, he began to have trouble chewing his food. On October 27, he also complained of jaw stiffness and was brought to an emergency department by his parents later that evening when he began to complain of neck stiffness. His wound was cleaned, and he was transferred to a tertiary medical center on October 28 where 3000 U of HTIG, tetanus toxoid vaccine, and 200 mg of metronidazole were administered. He was admitted to the PICU in respiratory failure, underwent endotracheal intubation, and was placed on mechanical ventilation. The patient remained on mechanical ventilation for 15 days and was in the ICU for a total of 18 days. He was administered 200 mg of metronidazole every 6 hours for 10 days and an additional 1750 U of HTIG during his hospitalization. He improved slowly and was discharged from the hospital with outpatient physiotherapy on December 17, 2012.

**Public Health Response**

Oklahoma State Department of Health epidemiologists conducted interviews with family members, reviewed medical records, and queried the state immunization registry to obtain clinical history and factors contributing to disease. The mother of patient 1 reported that her son had received some vaccinations while in kindergarten and the third grade, before being homeschooled. However, no documentation existed in medical records at his school, primary care physician’s office, or in the state immunization registry of his ever having received the DTaP vaccination or any other vaccinations. The mother of patient 2 reported that none of her 10 children had ever received the DTaP vaccination; whether patient 2 had previously received any preventive medical care was unclear. The state immunization registry contained no documentation of his ever receiving any vaccinations. Both mothers were unaware of the severity of tetanus and the importance of DTaP vaccination. Oklahoma State Department of Health personnel provided education to both families regarding the childhood vaccination schedule and the importance of routine vaccinations.

**DISCUSSION**

Homeschooling is an increasing trend nationwide and in Oklahoma. The National Household Education Surveys program has been collecting nationally representative data since 1991 to estimate the number of homeschooled children in the United States. According
to their latest report, 1.5 million (3%) students were homeschooled in 2007, defined as parents reporting schooling at home instead of at public or private school for at least part of the child’s education and if their part-time enrollment in public or private school did not exceed 25 hours per week. With only 850,000 students being homeschooled during 1999, the 2007 estimate represents a 74% relative increase over the previous 8 years. Homeschooled children clearly represent a significant and increasing proportion of school-aged children in the United States.

In Oklahoma, no state law requires families to notify government officials of home schooling; therefore, estimating the number of homeschooled children is difficult. According to the Oklahoma State Department of Education, ~33,000 (5%) children were homeschooled in 2009, based on estimates derived from subtracting the number of children enrolled in public and private schools from the total number of school-aged residents in Oklahoma in 2009. Although state-based school-entry vaccination requirements are widely credited for high immunization rates among school-aged children, the majority of states do not monitor the vaccination status of homeschooled children. Certain states require immunizations for homeschooled children, but no mechanism exists for enforcement. Because immunization rates among homeschooled children are largely unknown, this population might be considered at higher risk for contracting more prevalent communicable VPDs (eg, pertussis, influenza). VPD outbreaks have been described among the homeschooled population in recent years; for example, 71% of children involved in a measles outbreak in Indiana in 2009 were homeschooled. A study in 2012 compared health care access and usage by homeschooled and public school children, and determined that homeschooled children were statistically less likely to receive annual preventive medical care and the human papillomavirus vaccine. Another study in 2010 involving e-mail surveys of homeschooled parents demonstrated that only 38% of families stated that their children were up-to-date on recommended vaccinations, and 56% chose to only partially vaccinate their children. Without the reinforcement of school-entry vaccination requirements, immunization scientists agree that homeschooled children likely are not vaccinated adequately and that stronger efforts are needed to improve vaccination coverage among this population.

Many state public health officials propose that homeschooled children should be subject to the same vaccination rules as children in public and private schools. In North Carolina, for example, parents must register with the state to homeschool their children, and they are required to meet the same school-entry vaccination requirements as public and private school students. However, this requirement is challenging in states that do not require even basic registration to homeschool. In addition, strong resistance exists nationwide for any attempt to regulate homeschooling.

Innovative outreach measures are necessary to communicate the importance of childhood vaccination to homeschooling families and maximize vaccination coverage among this population. Primary care clinicians can reinforce the importance of vaccination with parents of homeschooled patients because the majority of childhood vaccinations now occur in the primary care setting rather than in public health clinics. Homeschooled children often participate in school-sponsored programs (eg, sports teams, spelling bees, debates); requiring children to be vaccinated before participating in these activities might reduce the likelihood of VPD transmission. Homeschooling families are also often closely associated with church groups or homeschooling associations; local and state health departments can reach out to these groups to encourage childhood vaccination. Finally, local health departments can host periodic vaccination clinics for homeschooling families or partner with health care provider groups, community coalitions, and private organizations to increase vaccine access for this increasing segment of the population.

As homeschooling continues to increase, more children might be excluded from states’ immunization requirements. This trend can threaten the health of children and their communities. Improved outreach measures from health care providers and local and state health departments to the homeschooling community can help educate parents regarding the merits of childhood vaccinations and increase access to vaccinations.


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