encouraged to receive a PPCV 4–6 weeks postpartum, and the importance of this visit should be communicated to women before their discharge from the hospital after delivery. Monitoring PPCV should be expanded and standardized, and data collected during these visits should be used to guide health-care–system planning. Understanding who is at risk for not receiving PPCVs is a first step in developing targeted messages for women, clinicians, and public health practitioners to encourage the receipt of PPCVs.

Acknowledgments

The findings in this report are due in part, to contributions by members of the PRAMS Working Group and the CDC PRAMS Team, Div of Reproductive Health, CDC.

References

1. American Academy of Pediatrics, American College of Obstetricians and Gynecologists. Guidelines for perinatal care, 6th ed. Washington, DC: American College of Obstetricians and Gynecologists; 2007.
2. National Committee for Quality Assurance. The state of health care quality 2007. Washington, DC: National Committee for Quality Assurance; 2007. Available at http://web.ncqa.org/tabid/543/default.aspx.
3. Bryant AS, Haas JS, McElrath TF, McCormick MC. Predictors of compliance with the postpartum visit among women living in Healthy Start Project areas. Matern Child Health J 2006;10:511–6.
4. Kogan MD, Leary M, Schaetzel TP. Factors associated with postpartum care among Massachusetts users of the Maternal and Infant Care Program. Fam Plann Perspect 1990;22:128–30.
5. American College of Obstetricians and Gynecologists. American College of Obstetricians and Gynecologists Committee on Practice bulletins–obstetrics. Clinical guidelines for obstetricians-gynecologists. Gestational diabetes. Obstet Gynecol 2001;98:525–38.
6. Russell MA, Phipps MG, Loson CL, Welch G, Carpenter MW. Rates of postpartum glucose testing after gestational diabetes mellitus. Obstet Gynecol 2006;108:456–62.
7. Smirnakis KV, Chasan-Taber L, Wolf M, Markenson G, Ecker JL, Thadhani R. Postpartum diabetes screening in women with a history of gestational diabetes. Obstet Gynecol 2005;106:1297–303.
8. Kim C, Newton KM, Knopp RH. Gestational diabetes and the incidence of type 2 diabetes. Diabetes Care 2002;25:1862–8.
9. Knowler WC, Barrett-Connor E, Fowler SE, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. N Engl J Med 2002;346:393–403.

Evaluation of Results from Occupational Tuberculin Skin Tests — Mississippi, 2006

In October 2006, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from a fire department in Mississippi. In June 2006, the fire department had administered two-step tuberculin skin tests (TSTs) and determined that nine firefighters tested positive for tuberculosis (TB) infection. Local investigation had identified no source of TB infection. The NIOSH evaluation was conducted to 1) determine whether TB transmission was occurring among department firefighters, 2) assess the accuracy of positive TST results, and 3) make recommendations regarding administration of future fire department TB-testing programs. This report describes the results of that evaluation, which indicated that all nine firefighters had false-positive TST findings, likely caused by errors in interpretation of the test results. These results highlight the importance of conducting TB testing only when indicated by TB risk assessment and following CDC guidelines to avoid errors in TST administration and interpretation that might result in unnecessary medical evaluation and follow-up (*1*).

The fire department had instituted TSTs in June 2006 to comply with National Fire Protection Association guidelines that recommend annual TSTs for all firefighters. Testing was conducted by the same local hospital that administered occupational medical examinations for the fire department. Nine (9%) of 101 firefighters had positive TST results, using the Mississippi state criteria of ≥10 mm induration as indicative of a positive test for TB infection.*

The nine firefighters were evaluated by interview for symptoms consistent with TB disease, and chest radiographs were administered by Mississippi Department of Health District 6 medical personnel; no cases of TB disease were identified among the firefighters. All nine firefighters had latent tuberculosis infection (LTBI) diagnosed and were evaluated for isoniazid therapy. Five of the nine firefighters began isoniazid therapy; the four others either refused therapy or stopped soon after starting. No source of TB exposure was identified. However, because no reason for the positive TSTs among the firefighters was identified, the community continued to be concerned about possible ongoing TB transmission.

In October 2006, the fire department asked NIOSH to conduct a health hazard evaluation. State and district TB program personnel told NIOSH that the annual incidence of TB disease in the area served by the fire department was 2.5 cases per 100,000 population during 2005–2006. In

* With TSTs, tuberculin is placed intradermally, and results are read 48–72 hours later. Induration is measured in millimeters along the horizontal axis of the forearm. CDC recommends two-step baseline testing (or a single blood assay for *M. tuberculosis*) for: health-care workers upon hire who are in low- or medium-risk categories for TB infection (*1*); and for residents admitted to long-term–care facilities (*2*). In two-step testing, a TST is administered, and results are interpreted 48–72 hours later. If the result is positive, the person is evaluated for potential TB disease; if negative, a second TST is administered after 1–3 weeks and interpreted 48–72 hours later. If the second test is negative, the person likely is not infected; if positive, this "boosted" reaction might have resulted from various possibilities, including TB infection that occurred several years previously. Persons with positive TST results (on either a first or second test) should be deferred from future TST testing and evaluated annually via interview or questionnaire for symptoms of potential TB disease (*1*).

comparison, annual incidence in the state overall was 3.9 per 100,000, and U.S. incidence was 4.6 per 100,000 (S Quilter, MS, Mississippi State Dept of Health, personal communication, 2007).

The nine firefighters with positive TST results were interviewed by NIOSH personnel to assess their personal and occupational risk factors for TB exposure and infection; no risk factors for TB were identified. No firefighters were foreign born, and none had known or suspected past contact with a person infected with TB disease. Foreign travel among the nine firefighters was limited to brief vacations in resort areas or remote military service. No firefighters reported a history of positive TSTs.

Four months after the two-step TSTs were administered, on October 27, blood samples were collected from all nine firefighters for QuantiFERON®-TB Gold (QFT-G) (Cellestis Limited, Carnegie, Victoria, Australia) testing to measure immune reactivity to *Mycobacterium tuberculosis*. All QFT-G test results from blood samples collected from the nine firefighters were negative.

Medical staff members at the local hospital who administered the firefighter two-step TSTs were interviewed to compare their protocols with CDC guidelines (*1,3*). Three of the nine firefighters had positive results after their first TST. The other six firefighters had negative results after placement of their first TST; however, among these six firefighters, results from their first TST had not been read until 9–21 days after placement, instead of the recommended 48–72 hours, which likely accounted for their interpretation as negative TSTs. The second TST in these six firefighters was read within 48–72 hours and interpreted as positive. Interviewers further determined that hospital staff members had misinterpreted application of the state's alternate two-step schedule. According to state officials, this schedule is to be used primarily for home–health-care patients and nursing-home residents to lower costs (i.e., by reducing visits from four to three through reading the first test and placing the second test on the same visit) but still allow detection of "booster" effects; the schedule is not intended for use with employee surveillance programs (S Quilter, MS, Mississippi State Dept of Health, personal communication, 2007).

Other TST irregularities occurred. Medical personnel read TST induration along the vertical axis of the forearm, instead of the horizontal axis. In addition, the hospital had traditionally used Tubersol® brand of tuberculin for TSTs. However, in 2006, purchasing officials switched to Aplisol® brand of tuberculin, which was used to administer the two-step TSTs to the firefighters. CDC guidelines recommend the consistent use of one brand of tuberculin (*1*); changes in tuberculin antigen have resulted in misreading of results that were erroneously reported as a health-care–associated outbreak (*4*). These firefighters were the first occupational group to receive TST in this specific hospital department since the change to Aplisol was instituted. TSTs conducted among employees in another hospital department using Aplisol revealed no increase in positive test results.

To explore the effects that different tuberculin brands and interpretation errors might have had in the false-positive TST results and to make recommendations regarding future TSTs for these firefighters, seven of nine available firefighters were retested with Tubersol brand tuberculin as part of the NIOSH evaluation; one firefighter was no longer employed at the department, and one refused testing. All seven firefighters tested negative. Investigators concluded that the false-positive results from the hospital-administered TSTs likely were the result of interpretation errors resulting from the change in tuberculin used and inexperience in interpreting TST results. As a result of the NIOSH evaluation, the five firefighters who were still receiving isoniazid for LTBI discontinued their medication. Because the hospital-administered TSTs were false-positives, these firefighters are eligible to receive future TSTs and should not be deferred from future testing on the basis of having a previous positive test result.

Reported by: *EH Page, MD, RJ Driscoll, PhD, Div of Surveillance, Hazard Evaluations, and Field Studies National Institute for Occupational Safety and Health; JD Gibbins, DVM, EIS Officer, CDC.*

Editorial Note: Occupational groups such as firefighters, health-care workers, and military personnel often receive periodic TB tests because of potential occupational exposure to TB disease. An estimated 1.1 million firefighters in the United States are at risk for TB exposure while performing first-responder duties (*5*). In addition, firefighters live in close quarters while on duty, and living conditions might facilitate rapid spread of TB among coworkers. Therefore, the National Fire Protection Association recommends an annual TST for firefighters (*6*).† Fire department compliance with this consensus-based standard is not legally required; however, many departments use this guidance to develop their occupational examination requirements. CDC guidelines recommend that a facility TB-risk assessment be conducted annually for groups at risk for TB infection and that frequency of TB testing be based on the results of that assessment (*1*).

† For those firefighters who also perform emergency medical services duties (and not other firefighters), CDC recommends baseline two-step TST or QFT-G testing at the time of hire, and subsequent TB testing at a frequency determined by TB risk assessment.

The investigation described in this report highlights the importance of conducting TB risk-assessment and treatment programs according to CDC guidelines and using targeted testing at a frequency based on a TB risk assessment. When TST administration is indicated, administrators should 1) interpret TST results 48–72 hours after placement to avoid potential false-negative results; 2) for routine, serial testing, avoid switching brands of tuberculin, which might create potential interpretation errors and false-positive results; 3) interpret test results in millimeters along the horizontal axis of the forearm to help ensure consistency among TST readers; 4) follow manufacturer guidelines for storage and use of tuberculin products; 5) document lot number, brand name, and manufacturer of tuberculin; and 6) receive training to distinguish induration from erythema. Finally, if higher numbers of positive TST results than expected are encountered, potential causes of false-positive results should be explored concurrent with the evaluation of patients for TB disease. False-positive TST results increase medical costs and expose persons to unnecessary medication that can have serious side effects.

The findings in this report are subject to at least one limitation. Five firefighters were still receiving isoniazid therapy for LTBI at the time of QFT-G testing. The effect of isoniazid prophylaxis on T-cell response and gamma-interferon (INF-gamma) production, which is the basis for the QFT-G test, is equivocal (*7*). Concurrent isoniazid therapy might have played a role in the negative test results of these firefighters; however, their low risk for TB infection and subsequent negative TST results using Tubersol provide strong evidence that these firefighters had never been infected with *M. tuberculosis.*

QFT-G is an alternative to TSTs in TB testing programs. Advantages of QFT-G include the following: 1) greater specificity than TSTs can be achieved with similar sensitivity; 2) test results are not affected by previous bacille Calmette-Guérin vaccination against TB; 3) two-step testing is not required; and 4) only a single office visit is required, with results available in 24 hours (*8*). A discussion of the advantages and disadvantages of using QFT-G has been published (*9*).

As a result of the pseudoconversions described in this report, the fire department strengthened its infection-control and respiratory-protection programs. Health-care professionals should conduct periodic training and evaluation of their TB testing programs to ensure that CDC guidelines are followed.

Acknowledgments

This report is based, in part, on contributions by A Turk, R James, MD, Mississippi Dept of Health, District 6; BP Bernard, MD, TR Hales, MD, AL Tepper, PhD, E Galloway, Div of Surveillance, Hazard Evaluations, and Field Studies; B MacKenzie, Div of Applied Research and Technology, National Institute for Occupational Safety and Health, CDC.

References

1. CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. MMWR 2005;54 (No. RR-17).
2. CDC. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. MMWR 2005;54 (No. RR-12).
3. CDC. Guide for primary healthcare providers: targeted tuberculin testing and treatment of latent tuberculosis infection, 2005. Department of Health and Human Services, CDC. Available at http://www.cdc.gov/tb/pubs/ltbi/pdf/targetedltbi05.pdf.
4. Blumberg HM, White N, Parrott P, Gordon W, Hunter M, Ray S. False-positive tuberculin skin test results among health care workers. JAMA 2000; 283:2793.
5. National Fire Protection Association. U.S. fire department profile through 2003. Quincy, MA: National Fire Protection Association; 2005
6. National Fire Protection Association. Standard on comprehensive occupational medical program for fire departments. Quincy, MA: National Fire Protection Association, 2007: NFPA 1582.
7. Goletti D, Parracino M, Butera O, et al. Isoniazid prophylaxis differently modulates T-cell responses to RDI-epitopes in contacts recently exposed to *Mycobacterium tuberculosis*: a pilot study. Respir Res 2007; 8:5.
8. Cellestis Limited. QuantiFERON®-TB Gold package insert, February 2007. Available at http://www.cellestis.com/irm/content/gold/gold_usapackageinsert.pdf.
9. CDC. Guidelines for using the QuantiFERON®-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States, 2005. MMWR 2005;54 (No. RR-15):49–55.

Interim Recommendations for the Use of *Haemophilus influenzae* Type b (Hib) Conjugate Vaccines Related to the Recall of Certain Lots of Hib-Containing Vaccines (PedvaxHIB® and Comvax®)

On December 19, this report was posted as an MMWR Dispatch *on the* MMWR *website* (http://www.cdc.gov/mmwr).

On December 13, 2007, Merck & Co., Inc. (West Point, Pennsylvania) announced a voluntary recall of certain lots of two *Haemophilus influenzae* type b (Hib) conjugate vaccines, PedvaxHIB® (monovalent Hib vaccine) and Comvax® (Hib/hepatitis B vaccine). Providers should return unused vaccine from these recalled lots using procedures outlined

MMWR™
Morbidity and Mortality Weekly Report
www.cdc.gov/mmwr

Weekly December 21, 2007 / Vol. 56 / No. 50

Carbon Monoxide–Related Deaths — United States, 1999–2004

Carbon monoxide (CO) is a colorless, odorless, tasteless toxic gas produced by incomplete combustion in fuel-burning devices such as motor vehicles, gas-powered furnaces, and portable generators (*1*). Persons with CO poisoning often overlook the symptoms (e.g., headache, nausea, dizziness, or confusion), and undetected exposure can be fatal (*1*). Unintentional CO exposure accounts for an estimated 15,000 emergency department visits and 500 unintentional deaths in the United States each year (*1*). The most recent state-level estimates of CO-related deaths were described in 1991 for the years 1979–1988 (*2*). Using the most recent mortality data available, this report updates national and state-specific unintentional, non–fire-related CO mortality rates and describes the demographic, seasonal, and geographic patterns for 1999–2004. During this period, an average of 439 persons died annually from unintentional, non–fire-related CO poisoning, and the national average annual death rate was 1.5 per million persons. However, rates varied by demographic subgroup, month of the year, and state. Rates were highest among adults aged ≥65 years, men, non-Hispanic whites, and non-Hispanic blacks. The average number of deaths was highest during January. Among the states, Nebraska had the highest reliable CO mortality rate. These findings indicate that improved population-based prevention measures, including educating the public about the dangers of CO exposure, are needed at the state and national levels.

Mortality rates were calculated from death certificate data obtained from the National Vital Statistics System (NVSS), using the record axis fields from the multiple cause-of-death files compiled by the National Center for Health Statistics (*3*). Records were searched for all deaths occurring among residents of 50 states and the District of Columbia during 1999–2004 that contained *International Classification of Diseases, Tenth Revision* (ICD-10) code T58 (toxic effect of CO) as a contributing cause of death. A case of unintentional CO-related death was defined as one for which both poisoning by accidental exposure to gases or vapors (code X47) and toxic effect of CO (code T58) were listed as causes of death. All records of deaths caused by intentional exposure, exposure of undetermined intent, or fire-related exposure to CO (codes X00–X09, X76, X97, Y26, and Y17) were excluded. Deaths that occurred among foreign residents in the United States and deaths among U.S. residents who died abroad also were excluded.

Crude and age-adjusted rates of unintentional, non–fire-related deaths from CO poisoning were calculated by age group, sex, and race/ethnicity for the period 1999–2004. To assess the seasonality of CO-related mortality, the average daily number of deaths was calculated by month for the period 1999–2004. The national Non-Notifiable Disease Surveillance System was used to identify states in which physicians, laboratories, or hospitals are mandated by law to report acute CO poisoning (*4*). In addition, age-adjusted CO death rates were calculated for each state for the period 1999–2004 (*5,6*). Populations at risk were defined using the U.S. intercensal population estimate for 1999, the U.S. Census 2000 population count, and population bridged-race estimates (*3*) for 2001–2004. Using the direct method,

INSIDE

DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION