

Infection Control Resource

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Prevention Strategies for IC Practitioners and Professional Nurses

In this issue

Recently, a US Army hospital announced that more than 2,000 insulin-dependent diabetic may be at risk for developing a bloodborne disease because of incorrect procedures used during the administration of insulin using pen devices. The ISMP noted that studies have shown biological contamination of insulin occurred in up to half of all reused insulin pen cartridges. Pens are not suitable for multiple patients without risking cross-contamination. FDA also warned about this risk. In her article, Dr. Kraus describes the risks to healthcare workers, patients and the community with the improper use and disposal of insulin pens.

Today, the incidence of tuberculosis in the United States is the lowest ever recorded. This downward trend has been driven largely by steady decreases in incidence among persons born in this country. However, case rates have not decreased among foreign-born persons living in the United States, and tuberculosis in the foreign-born now accounts for most of the reported domestic cases. In their article, Ms. Gerdtz and Ms. Caffery outline the strategies to reduce TB, including early and accurate detection, diagnosis, and reporting of TB. They stress that efforts need to be increased to address the gap that exists between different ethnic groups in the United States.

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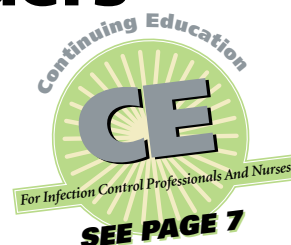
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Safe Practices for Health Care Providers and Patients with Diabetes Mellitus

Vicki L. Kraus, PhD, ARNP, CDE, and Sherry A. David, RN, BS, CIC



Currently an estimated 23.6 million people, or 7.8 percent of the US population, have diabetes. A comparison of prevalence data from 2002 suggests that the net number of patients with diabetes is growing by approximately 1 million per year. Of this number, 17.9 million have been diagnosed, and an additional 5.7 million are undiagnosed. Approximately 186,300 people aged younger than 20 years have either type 1 or type 2 diabetes; approximately 23.5 million, or 10.7% of all people aged 20 or older, have diabetes; and about 12.2 million, or 23.1% of people aged 60 or older, have diabetes. In 2007, 1.6 million new cases of diabetes were diagnosed in people aged 20 years and older.¹

Furthermore, there are 57 million people with pre-diabetes, a condition in which blood sugars are above normal but not high enough to merit a diagnosis of diabetes.² Individuals with pre-diabetes have been found to be at risk for developing type 2 diabetes at a rate of 10% per year if preventive lifestyle interventions are not implemented.³ These statistics indicate that it is likely that a significant number of patients who are hospitalized will have diabetes, either diagnosed or undiagnosed.

Types of Diabetes

Diabetes is a group of diseases that consist of elevated levels of blood glucose. The elevation is the result of defects in insulin production, insulin action, or both. Type 1 diabetes develops when the beta cells of the pancreas no longer produce insulin. This is thought to be due to destruction of these cells by an autoimmune process. Type 1 diabetes occurs most often in children and young adults, but onset can occur at any age. In adults, type 1 diabetes accounts for 5% to 10% of all diagnosed cases of the disease.

Type 2 diabetes usually begins as insulin resistance, in which muscle, fat, and liver cells do not

respond properly to insulin. As a consequence, more insulin must be produced by the pancreas to keep the blood glucose levels normal. The pancreas gradually loses its ability to keep up with this increased insulin requirement. Type 2 diabetes accounts for 90% to 95% of all adults diagnosed with diabetes. It is associated with older age, obesity, family history of diabetes, history of gestational diabetes, impaired fasting glucose, impaired glucose tolerance, physical inactivity, and race/ethnicity. African Americans, Hispanic/Latino Americans, American Indians, and some Asian Americans and Native Hawaiians or other Pacific Islanders are at high risk for type 2 diabetes and its complications. Type 2 diabetes is diagnosed in children and adolescents, and even though it is relatively rare, it occurs more frequently in the abovementioned racial/ethnic groups.

Gestational diabetes is impaired glucose tolerance that occurs during pregnancy. During pregnancy, blood glucose levels must be normalized to prevent complications in the infant. It is more common among obese women, women with a family history of diabetes, and women who are African American, Hispanic/Latino American, or American Indian. After delivery, 5% to 10% of women are found to have diabetes, usually type 2. Women who have had gestational diabetes have a 40% to 60% chance of developing diabetes in the next 5 to 10 years.¹

Treatment for Diabetes

People with type 1 diabetes require insulin by injection to survive. The amount of insulin needed depends on many factors, including diet and activity levels. Treatment regimens for type 2 diabetes are more varied. The first tier of recommended therapy for type 2 diabetes, which involves lifestyle interventions to decrease weight and increase physical activity along with an oral agent, metformin,

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Mycobacterium Tuberculosis: A Review

Nicole Gerdtz, BSN, RN, CIC, and Lisa Caffery, MS, BSN, RN, BC, CIC

Tuberculosis (TB) is a communicable disease caused by *Mycobacterium tuberculosis* (*Mtb*) or the tubercle bacillus, which is spread from person to person through the air. TB usually affects the lungs but can also affect other parts of the body, such as the brain, kidneys, or spine. Left untreated, TB can be fatal.

During the twentieth century, TB morbidity and mortality decreased in the United States. There was hope that TB would be eradicated with the advent of anti-TB medications in the 1940s. With the introduction of effective anti-TB medications, prolonged hospitalizations in specialized facilities became unnecessary. After approximately 30 years of declining trends, a TB epidemic occurred in the United States from 1985 to 1992. Today, the World Health Organization (WHO) estimates that 2 billion patients are infected with *Mtb*, 95% of whom live in developing countries. The 2006 data estimate that 9.2 million people became ill from TB, including 1.7 million who died from the disease.¹ In 2008, a total of 12,898 cases of TB (4.2 per 100,000 population) were reported in the United States. This figure represents a 3.8% decline from the 2007 rate. The TB rates among African-Americans, Asians, and Hispanics were between 8 and 23 times higher than the rates among Caucasians. Four states accounted for 49.2% of all TB cases. Those four states (California, Florida, New York, and Texas) reported more than 500 cases each for 2008. In 2008, approximately half (50.1%) of the TB cases among foreign-born patients were reported from four countries: Mexico, the Philippines, Vietnam, and India. In 2008, the rate declined by 0.4%, the lowest recorded rate since international reporting began in 1953.² Rates among foreign-born patients continue to be 10 times higher than those of American-born patients.

The essential components of TB control in the United States include case detection, case management, investigation of contacts, targeted testing, and treatment of latent TB infection (LTBI). Strategies to reduce TB include early and accurate detection, diagnosis, and reporting.

Pathophysiology

It is important to understand the difference between *Mtb* infection and TB disease, along with multidrug-resistant TB (MDR-TB) and extensively drug-resistant TB (XDR-TB). It is estimated that more than one-third of the world's population has the TB bacterium in their bodies, which means they have *Mtb*

The advantage of the QuantiFERON-TB Gold test is that results can be available in 24 hours and do not require a follow-up visit by the patient.

infection. In addition, new infections are occurring at the rate of 1 per second. Those who do not get sick are known to have noncontagious LTBI, in which the bacteria are inactive or "asleep" in the body. When someone has LTBI, the only sign of TB is a positive tuberculin skin test (TST) or the QuantiFERON-TB Gold Test. These patients have a normal chest x-ray and are sputum negative for acid-fast bacillus (AFB). They cannot spread the TB bacteria to others and do not feel sick. Overall, in 5% to 10% of patients with LTBI, the bacteria overcome the immune system, multiplying and progressing to active TB disease. TB bacteria can remain in this dormant state for months, years, and even decades without increasing in number and making the patient sick. Most patients with latent *Mtb* infection will test positive on the tuberculin skin test or show signs of LTBI on their chest x-ray. Such findings indicate that they have the TB bacteria in their bodies, but most infected people will not develop active TB disease and may never get sick, have any symptoms, or spread the bacteria to others. However, 1 in 10 patients infected with TB bacteria does develop active TB disease.

In the 1980s, physicians and TB-control programs started to treat growing numbers of patients with MDR-TB. MDR-TB is a strain of TB that is resistant to at least 2 first-line drugs. Isoniazid and rifampicin are the first-line drugs used to treat patients with TB. XDR-TB is a rare type of MDR-TB that is resistant not only to rifampicin and isoniazid, but also to any fluoroquinolone and at least 1 of the 3 second-line drugs. The list of second-line drugs includes amikacin, kanamycin, and capreomycin.

Patients with weakened immune systems (eg, those with human immunodeficiency vi-

rus [HIV], those receiving chemotherapy, or children aged younger than 5 years) are at a greater risk for developing TB disease. When they breathe in TB bacteria, the bacteria settle in the lungs and start growing because the immune system cannot fight the bacteria. In these patients, TB disease may develop within days or weeks after the infection. However, in others, TB disease may develop months or years after the initial infection if the immune system becomes weak for other reasons and is no longer able to fight the bacteria. Those who have been shown to be at a higher risk for contracting TB include people who inject illicit drugs; children exposed to adults in high-risk categories; high-risk racial or ethnic minority populations; medically underserved, low-income populations; close contact with a person known or suspected to have *Mtb*; foreign-born people from Asia, Africa, Latin America, Eastern Europe and Russia; residents and employees of high-risk congregate settings; healthcare workers who serve high-risk clients; HIV-infected and recently HIV-infected patients; and those with certain medical conditions.³

When a patient contracts active TB, it means the TB bacteria are multiplying and attacking the lung(s) or other parts of the body such as the lymph nodes, bones, kidney, brain, spine, and even the skin. From the lungs, the TB bacteria move through the blood to different parts of the body. Symptoms of active disease include cough, loss of weight and appetite, fever, chills, and night sweats, as well as symptoms from the specific organ or system that is affected; for example, coughing up blood or sputum in TB of the lungs, or bone pain if the bacteria have invaded the bones. TB disease usually can be cured with prompt and appropriate treatment, but it remains a major cause of death and disability in the world, particularly among patients infected with HIV.

Transmission

This infection is spread by small droplet nuclei that are produced and expelled when a person with TB coughs, talks, or sneezes. These small droplet nuclei are tiny particles that remain suspended in the air for an extended amount of time and can even be carried on air currents. These small droplet nuclei then travel directly to the alveoli on inspiration, where they are ingested by macrophages. The tubercle bacilli multiply within these alveolar macrophages, which in turn starts the infection process. When the macrophages die, some of the bacilli spread through the bloodstream. The immune system response usually contains the tubercle bacilli and prevents the development of TB disease. When patients are infected but do not develop TB disease, they are asymptomatic and not infectious but usually will have a positive TST. Approximately 10% of these infected patients will go on to develop TB disease. There are many factors that determine the transmis-

sion of *Mtb*, such as the characteristics of the exposure, features of the source case, attributes of the exposed person, and the virulence of the infecting strain of *Mtb*.

Any patient presenting symptoms of *Mtb*, such as fever, chills, drenching night sweats, loss of appetite, weight loss, cough lasting longer than 3 weeks, and a tendency to become easily fatigued, should be considered as TB suspects.³ Patients presenting these symptoms should have a complete medical history and physical, screening with the Mantoux skin test or QuantiFERON-TB Gold, chest x-ray, and sputum smear and culture.³¹ TST must be done using a tuberculin syringe with a 25-27 gauge needle. The needle and syringe are to be disposed of in an approved sharps container. Needles are never to be recapped, bent, broken or removed from the syringe. Blood for the QuantiFERON-TB Gold test is to be collected according to the manufacturer's guidelines. Blood should be collected using a blood tube holder and safety needle in order to protect the person drawing the specimen from an accidental needle stick, for example, the Magellan™ Safety Blood collection device (Figure 1). TST involves injecting purified protein derivative (PPD), which is derived from the mycobacterial wall.⁴ The PPD solution is injected intradermally into the patient's forearm. A properly placed TST will produce a small wheal at the injection site.⁴ TST is a screening tool used to detect latent TB infection (LTBI). It is not a test for ruling out or diagnosing active TB.⁴ A positive TST simply means that a patient has been exposed sometime in the past. Approximately 20% of people with active TB will have negative TST results.

A drawback to TST is that it must be read between 48 and 72 hours after placement. If the patient does not return for the reading, the test must be repeated. The test is read by millimeters of induration, not by the presence of redness.



Figure 1. QFT-G with safety blood collection needle. (Courtesy of Covidien Monoject Magellan)

In 2005, the FDA approved the QuantiFERON-TB Gold Test (QFT-G) as an aid in diagnosing both LTBI and TB disease.^{5,6} The advantage of the test is that results can be available in 24 hours and do not require a follow-up visit by the patient. Although the test does require a blood draw, it does not require a follow-up appointment, as is the case with the TST. The test is much more convenient for the patient and providers, yet there is one significant limitation: after the blood is drawn, it must be received by a qualified laboratory within 12 hours of collection in order for the test to be done.⁶

QFT-G can be used in all circumstances in which the TST is used, including contact investigations, evaluation of recent immigrants who have had Bacillus Calmette-Guéri (BCG) vaccination, and TB screening of healthcare workers and others undergoing serial evaluation for *Mtb* infection. In most cases, the test can replace TST.⁶

Patients with a positive QFT-G test should be evaluated for TB disease, whether they have signs or symptoms of the disease or not. At minimum, a chest x-ray should be performed to look for abnormalities consistent with TB disease.⁶

Healthy adults with a negative QFT-G rarely have TB infection and do not require further follow-up. However, if a patient has been ex-

posed to someone with *Mtb*, the blood test should be repeated 8 to 10 weeks following the exposure, as is recommended with the TST.⁶

In patients with pulmonary TB, radiographic abnormalities are often seen in the apical and posterior segment of the upper lobe or in the superior segment of the lower lobe.³ Lesions may appear anywhere in the lungs and may differ in size, shape, density, and cavitation, especially in HIV-positive and immunosuppressed patients.⁴ A chest x-ray does not confirm the presence or absence of TB but may be used to rule out the possibility of pulmonary TB in a patient who has a positive reaction to the TST and no symptoms of disease.

The only definitive test is a sputum culture for acid-fast bacillus (AFB). In patients with suspected pulmonary or laryngeal TB, 3 sputum specimens for smear and culture are needed. The specimens should be collected 8 to 24 hours apart, with at least 1 collected early in the morning.⁶ The patient should be in a negative airflow isolation room or in a sputum induction booth while the specimens are collected.⁶ The healthcare worker must wear proper respiratory protection such as an N-95 mask or powered air purifying respirator (PAPR) during specimen collection and while the patient is in airborne precautions.⁶ The sputum must be sent to the laboratory as soon as possible after collection in order for the specimen to be set up and processed.

If the patient is unable to produce sputum specimens and *Mtb* is highly suspected, it may be necessary to order respiratory treatments to induce a cough and sputum. Another method to obtain a specimen is through bronchoscopy with bronchoalveolar lavage and possible biopsy.⁴ Staff must wear appropriate respiratory protection while performing these procedures in a negative airflow room.

After AFB has been isolated in the culture, further testing is required to confirm the presence of *Mtb*. The organism and species are slow-growing, but molecular testing has decreased the amount of time in which results are available.⁴ A DNA probe and polymerase chain reaction (PCR) testing can provide species identification on the same day the organism is identified.⁴ This early identification can allow for treatment to begin sooner, and with negative test results, isolation can be discontinued.

Even with the quick results, susceptibility testing is still required. Susceptibility testing should be done on all initial isolates from newly diagnosed patients.⁴ It also should be done on anyone who has been on therapy for more than 3 months and still has positive sputum.

Isolation

Patients with suspected or known *Mtb* infection must be placed in airborne precautions until the disease has been ruled out or they have received the appropriate treatment for the recommended period of time. Patients be-

Criteria for Positive Mantoux Tuberculin Test Reactions

Induration size for positive test,	Group
5 mm	HIV-positive persons Recent contacts of TB case Fibrotic changes on chest radiograph consistent with old TB Patients with organ transplants and other immunosuppressed patients (≥15 mg prednisone for 1 month)
10 mm	Recent arrivals (<5 years) from high-prevalence countries Injection drug users (HIV-negative) Residents and employees of high-risk congregate settings: healthcare facilities, prisons, shelters, etc. Microbiology laboratory personnel Persons with "high-risk" clinical conditions (eg, chronic renal failure, silicosis, cancer, gastrectomy, malnutrition) Medically underserved, high-risk minorities Children aged <4 years or infants and children exposed to adults in high-risk categories
15 mm	Persons with no risk factors for TB Healthcare workers who otherwise are at low risk for TB disease and who receive baseline testing at the beginning of employment as part of a TB screening program

HIV, human immunodeficiency virus; TB, tuberculosis. Adapted from APIC test of infection control and epidemiology. Washington, D.C.: Association for Professionals in Infection Control and Epidemiology, Inc.; 2005.

ing treated for pulmonary TB should remain in isolation for at least two weeks, until they have had a resolution of cough and fevers and three consecutive negative AFB smears.⁴ Institutional policies should always be followed, as this practice may vary between organizations.

Airborne isolation rooms must meet the following specifications: in existing facilities, at least six air exchanges per hour; and in new construction, twelve air exchanges per hour.⁸ The exhaust of air should be directed to the outside; if that is not possible, the air may be returned to the air-handling system or to adjacent spaces if all air is directed through high-efficiency particulate air (HEPA) filters.⁸ Whenever the room is in use, the pressure must be monitored daily with visual indicators such as smoke tubes to ensure the room is functioning properly.⁸ The door to the room must remain closed while the room is in use.

Any personnel entering the room of a patient in airborne precautions must wear appropriate respiratory protection. Always follow the organization's policy on the type of protection required. The type of respiratory protection varies by organization. Some hospitals have begun to use Powered Air Purifying Respirators (PAPRs) in place of the N-95 mask for respiratory protection. The N-95 mask must be approved by the National Institute for Occupational Safety and Health (NIOSH) and requires fit testing of the employee before the mask can be used in the work setting. Employees must be educated on the use of the device upon hire and annually thereafter.⁸

Standard cleaning procedures are acceptable for airborne isolation rooms. The personnel cleaning the room while the room is occupied must wear the appropriate personal protective equipment. After the patient has been discharged and if the room has had adequate ventilation, no special precautions are needed.⁸

Treatment

Treatment options for LTBI and active disease are quite different. Patients with active disease usually will start on a 4-drug regime while waiting for the final culture sensitivities. The medications used most often are isoniazid (INH), rifampicin (RIF), ethambutol (EMG), and pyrazinamide (PZA). The drug regimen can be changed after the sensitivities are known.⁴ It is crucial that the medications be taken as ordered, and directly observed therapy (DOT) should be considered the standard of care for all patients.⁴ DOT means that a health-care worker or another designated person watches the patient swallow each dose of TB medication.⁴ DOT ensures that the person is taking the prescribed dose and that the medication is actually taken. The medications do have a number of side effects for which the patient must be closely monitored. Patient education about these side effects is key to compliance

with therapy. The ordering physician should be notified immediately if the patient experiences any of the following side effects:

- Lack of appetite
- Nausea
- Vomiting
- Jaundice
- Fever for more than 3 days
- Abdominal pain
- Tingling in the fingers or toes
- Skin rash
- Aching joints
- Dizziness
- Tingling or numbness around the mouth
- Easy bruising
- Blurred or changed vision
- Ringing in the ears
- Hearing loss^{9,10}

Many of these medications can be neuro- and hepatotoxic. Patients taking these medications require close monitoring for signs and symptoms of liver failure and peripheral neuropathy. Pyridoxine (vitamin B₆) should be considered for patients receiving INH therapy to reduce the risk of peripheral neuropathy.⁴ In persons with a history of liver disease, baseline alanine aminotransferase (ALT), aspartate aminotransferase (AST), and bilirubin should be obtained. Follow-up testing should occur at regular intervals during treatment or if the patient begins to show signs of hepatotoxicity.

Patients taking RIF should be educated on the possible minor side effects of the medication. These include orange discoloration of tears or saliva. Patients should be advised not to wear soft contact lenses because they may become stained orange.⁹ Women should use another form of birth control, as RIF can make birth control pills and implants less effective.⁹ The dose may need to be adjusted in patients taking methadone to prevent withdrawal symptoms.⁹

Treatment for LTBI is usually a single drug. The drug of choice in most cases is INH taken for 6 to 9 months.¹⁰ Children, adolescents, and HIV-infected patients will need to take medications for 9 months.¹⁰ As with treatment for active disease, patients experiencing any of the side effects listed above should contact their physician. Patients being treated for LTBI should be evaluated at least monthly for adherence to the prescribed regimen, for signs and symptoms of active TB, and for signs and symptoms of hepatitis. Because of the high risk for liver toxicity while taking these medications, patients should avoid drinking alcohol. They should also be counseled to contact their doctor immediately if they develop signs or symptoms of active TB disease.

Conclusion

Although there has been progress in decreasing *Mtb* in the United States, continued

vigilance and attention need to be paid to this important microorganism. Worldwide, TB continues to be one of the leading causes of death from an infectious disease. Funding needs to continue to be available for the essential components of TB control in the United States, which include case detection, case management, investigation of the contacts, targeted testing, and treatment of LTBI. The strategies to reduce TB include early and accurate detection, diagnosis, and reporting of TB. Efforts need to be increased and intensified to address the gap that exists between different ethnic groups in the United States. The slowing decline in TB incidence is another area in which we need place more emphasis.

References

1. Trends in Tuberculosis—United States, 2008. *MMWR*. 2009;58(10):249-253. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5810a2.htm>.
2. World Health Organization. Global tuberculosis control: surveillance, planning, financing. Geneva, Switzerland: World Health Organization; 2008. http://www.who.int/tb/publications/global_report/2008/en/.
3. Core curriculum on tuberculosis, 4th ed. U.S. Department of Health & Human Services, Centers for Disease Control and Prevention, National Center for HIV, STD, and TB Prevention; 2000.
4. APIC test of infection control and epidemiology. Washington, D.C.: Association for Professionals in Infection Control and Epidemiology, Inc.; 2005.
5. Centers for Disease Control and Prevention. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC. *MMWR Recomm Rep*. 54(RR15):1-37.
6. Centers for Disease Control and Prevention. Guidelines for using the QuantiFERON-TB Gold Test for detecting Mycobacterium tuberculosis infection, United States. *MMWR Recomm Rep*. 2005;54(RR15):49-55.
7. Jensen PA, Lambert LA, Iademarco MF, Ridzon R; Centers for Disease Control and Prevention. Guidelines for preventing the transmission of Mycobacterium tuberculosis in health-care settings, 2005. *MMWR Recomm Rep*. 2005;54(RR17):1-141.
8. Siegel JD, Rhinehart E, Jackson M, Chiarello L, and the Healthcare Infection Control Practices Advisory Committee. Guidelines for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings 2007. http://www.cdc.gov/ncidod/dhqp/gl_isolation.html.
9. Centers for Disease Control and Prevention. Division of Tuberculosis Elimination (DTBE). Questions and answers about TB, 2009. Active disease. http://www.cdc.gov/tb/publications/faqs/qa_TBdisease.htm.
10. Centers for Disease Control and Prevention. Division of Tuberculosis Elimination (DTBE). Questions and answers about TB, 2009. Latent TB infection. http://www.cdc.gov/tb/publications/faqs/qa_latenttbinf.htm.

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Safe Practices for Health Care Providers and Patients with Diabetes Mellitus—continued

to decrease insulin resistance, has been well validated. If these initial interventions are not effective in controlling blood glucose levels, additional therapy with insulin or a sulfonylurea is recommended.

The second tier of treatment for type 2 diabetes includes agents that are less well validated: an insulin sensitizer, pioglitazone; and a glucagon-like peptide (GLP)-1 agonist, exenatide. Other therapies for type 2 diabetes include alpha-glucosidase inhibitors, glinides, pramlintide, and a dipeptidyl peptidase (DPP)-4 inhibitor. All of these medications are expensive; some, such as alpha-glucosidase inhibitors, have frequent side effects; and others, including pramlintide and DPP-4 inhibitor, do not have established long-term safety.⁴

Infection Control

Thousands of needles and lancets are used and disposed of every day by patients with diabetes. Procedures for the safe disposal of sharps are not always given, and sometimes there is conflicting advice from diabetes educators, infection-control nurses, professional organizations, and local health authorities. Improper disposal of sharps, known as regulated medical waste, puts other household members as well as the general public, including sanitation workers, in danger of exposure to hazardous diseases from needlestick injuries.

It is important that all nurses working with patients with diabetes become knowledgeable about local medical waste disposal. Educating the patient with diabetes at the time of initial diagnosis and periodically assessing his or her sharps disposal practices for ongoing educational needs are imperative to reducing needlestick injuries resulting from improper disposal practices.

Infection Control Data

The number of needlestick and sharps-related injuries sustained by hospital-based healthcare personnel was estimated for 1997 and 1998 at 384,325 per year (95% confidence interval, 311,091–463,922) using data from 15 National Surveillance System for Health Care Workers (NaSH) hospitals and 45 Exposure Prevention Information Network (EPINet™) hospitals.⁵ The true magnitude is unknown because data are not collected in settings other than hospitals, and probably 50% or more of these injuries are not reported.

Data from the EPINet system suggest that in an average hospital, healthcare workers incur approximately 30 needlestick injuries per 100 beds per year. Most of these injuries involve nursing staff, but other healthcare workers, including physicians and housekeepers, may be affected as well. These injuries can expose

healthcare workers to bloodborne pathogens that may cause infection. The most important of these pathogens are the hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV).⁷ Thirty-nine percent of needlestick injuries occur during use of the sharp, 41% during and after use and before disposal, and 16% during or after disposal. Needlestick injuries carrying the greatest risk for pathogen contact are those occurring from a hollow-bore needle that is visibly contaminated with blood from an infected person.⁶ Insulin syringe needles and insulin pen needles fall into this category. The data were interpreted as a sample from all US hospitals and adjusted for underreporting.

Data from NaSH show that nurses have the highest incidence of percutaneous sharps injuries, at least in part because they are the largest segment of the workforce at most hospitals.⁶ Trinkoff and others examined the association between working conditions and needlestick injuries among registered nurses by conducting a 3-wave longitudinal survey between November 2002 and April 2004. There were 2,624 actively licensed registered nurses from 2 states included in the sample. The nurses in the sample had to have worked in the preceding year. Nearly 16% of the nurses reported a needlestick injury in the year before wave 1, and the cumulative incidence by wave 3 was 16.3%. The risk for sustaining a needlestick injury was significantly associated with the number of needles used per day, hours worked per day, weekends worked per month, working on shifts other than the day shift, and working 13 or more hours per day at least once per week. When these variables were combined, the association with needlestick injuries was somewhat explained by physical job demands.⁸

The American Nurses Association conducted a survey of nurses in 2008 to determine opinions, concerns, and experiences about workplace safety climate and needlestick injuries. Of the more than 700 nurses surveyed, nearly two-thirds (64%) reported being accidentally stuck by a needle while working, and 74% reported being stuck by a contaminated needle. In 2008, 39% of the nurses had experienced 1 contaminated needlestick injury. In detailing the event triggering their most recent needlestick injury, 3 principal circumstances were associated with two-thirds of the injuries: while giving an injection, before activating the safety feature, and during disposal of a non-safety device.⁹

Federal Guidelines to Protect Healthcare Workers

Federal regulations have provided mandates for use of safe medical devices in healthcare settings. The Occupational Safety and Health Administration (OSHA) issued the Bloodborne Pathogens Standard (29 CFR 1910.1030) in 1991 to protect workers from exposure to

bloodborne pathogens. In November 2000, the Needlestick Safety and Prevention Act (Pub. L. 106-430) was signed into law, and OSHA's Bloodborne Pathogens Standard was revised and set forth in greater detail. The revised act makes specific the requirement for employers to identify, evaluate, and implement safer medical devices. It also mandates additional requirements for maintaining a sharps injury log and involving non-managerial healthcare workers in evaluating and choosing safer medical devices.¹⁰ States and territories that operate their own OSHA-approved programs must include these revisions or adopt a more stringent amendment to their existing standard. To date, there are 24 states and 2 territories that have OSHA-approved state plans.¹¹

Whether the patient with diabetes receives care in a hospital, a long-term care setting, a clinic, or independently in the community, attention to safety equipment used and disposal devices must follow minimum standard requirements to prevent bloodborne pathogen exposure. Insulin administration devices are no exception to regulated sharps practices.

Another infection control concern for a patient with diabetes is the use of a “community” insulin vial. Insulin vials are intended for single use only and should never be shared between people in any setting. The Centers for Disease Control and Prevention (CDC) *2007 Guideline for Isolation Precautions: Preventing the Transmission of Infectious Agents in Healthcare Settings* provided recommendations for safe injection practices, including the use of multidose vials.¹²

Insulin Administration Devices

Insulin Syringes

Multiple insulin syringes are available for use by patients with diabetes. The syringes come in various sizes by volume (1-mL, 1/2-mL, and 3/10-mL), barrel markings (2-unit, 1-unit, and 1/2-unit), needle lengths (3/8-inch, 5/16-inch, and 1/2-inch), and needle gauges (28-G, 29-G, 30-G, and 31-G). There are several options for safety-engineered insulin syringes for use by healthcare workers. Effective safety devices permit the healthcare workers' hands to remain behind the needle at all times, have the safety feature integrated into the design, are simple and easy to use, and can be used effectively by both left- and right-handed individuals. Additionally, the activation of the safety feature can be easily determined, the safety mechanism is permanent once engaged, and the device is safe and effective for use in patient care.¹³ Manufacturers of safety engineered syringes include, Monoject® Insulin Syringe (Covidien), SurGuard™ Safety Insulin syringes (Terumo Medical), and BD SafetyGlide™ Insulin Syringe.

Insulin Pens

Use of insulin pens for injection has become increasingly common, by both patients

with diabetes in the community and healthcare professionals in hospitals. There are 12 insulin pen products listed in the January 2009 *Resource Guide* issue of *Diabetes Forecast*. These products include reusable pens with disposable cartridges and disposable pens that are prefilled with insulin. The prefilled cartridges and pens contain 1.5 to 3 mL of insulin, and most commonly 3 mL or 300 units of insulin. Most of the pens deliver insulin in 1-unit increments and can be used to give 1 to 80 units by dialing the desired dose. Currently, 2 pens can actually give insulin in ½-unit increments for children and adults who have small insulin requirements (eg, HumaPen® Luxura™ HD by Eli Lilly and NovoPen® Junior by Novo Nordisk).¹⁴

Insulin Pen Needles

Needles for insulin pens are prescribed separately, and 2 major pen needle manufacturers make needles compatible, although not totally standardized, with all available insulin pens: Becton, Dickinson and Company (BD) and Novo Nordisk.¹⁵

Safety Concerns Related to the Use of Insulin Pens

Use of insulin pens has been associated with an increase in needlestick injuries. The pen device itself may contribute to these injuries because the injection technique is different, making it difficult to visualize the injection site.¹⁵ One publication from 2005 reported a 6-fold increase in needlestick injuries when using pens instead of vials and syringes.¹⁶ Because the actual delivery of insulin cannot be visualized when using a pen, it is recommended that the needle remain in the subcutaneous tissue for 6 seconds after the injection to assure administration of the entire dose of insulin. Nurses who are not knowledgeable about insulin pens may use them like vials, actually trying to withdraw insulin from the pen as they would from a vial. This procedure is not recommended, as air is introduced into the pen that would lead to dosing errors when the pen is used to inject a future dose.

On March 19, 2009, the US Food and Drug Administration (FDA) published an alert and the following recommendations for the use of insulin pens and cartridges in healthcare settings:

Insulin pens containing multiple doses of insulin are meant for use by a single patient only and are not to be shared between patients.

Identifying the insulin pen with the name of the patient and other patient identifiers provides a mechanism for verifying that the correct pen is used on the correct patient and can help minimize medication errors. Ensure that the identifying patient information does not obstruct the dosing window or other product information, such as the product name and strength.

- Be aware that the likelihood of sharing insulin pens and cartridges is increased

Use of insulin pens has been associated with an increase in needlestick injuries.

when the pens are not marked with the patient name or other patient identifiers.

- The disposable needle should be ejected from the insulin pen and properly discarded after each injection. A new needle should be attached to the insulin pen before each new injection.
- Although the incident leading to this FDA alert occurred with insulin pens, the same risk may exist with shared use of any reusable injection device.
- Hospitals and other healthcare facilities should review their policies and educate their staff regarding the safe use of insulin pens.
- The FDA alert goes on to provide direction for counseling patients and suggests the following be shared with patients:
- Insulin pens are for single-patient use only and should never be shared with anyone else.
- Sharing insulin pens could result in transmission of hepatitis viruses, HIV, and other bloodborne pathogens.¹⁷
- Being alert to look-alike, sound-alike names of insulin products is as important for pens as it is for vials.¹⁸

Safe Practices

Needlestick Safety and Sharps Disposal

OSHA's Bloodborne Pathogen Standard requires that healthcare workers be protected from exposure to HIV, HBV, and HCV. Healthcare facilities must implement control measures to prevent needlestick injuries and exposure to bloodborne pathogens. This hierarchy of controls from most to least effective consists of elimination of hazards, engineering controls, administrative controls, work practice controls, and personal protective equipment (PPE). Elimination of hazards includes removal of sharps and needles and elimination of all unnecessary injections. Jet injectors can sometimes be used to substitute for needles and syringes. Engineering controls include needles that retract, sheathe, or blunt immediately after use. Administrative controls consist of policies that limit exposure to hazards and include allocating resources for healthcare worker safety, having a needlestick prevention committee, developing an exposure control plan, removing all unsafe devices, and ensuring consistent training on the use of safety devices. Work practice

controls include mandates for no recapping of needles, placing sharps containers at eye level and within arm's reach, emptying sharps containers before they are full, and disposing of sharps devices before beginning a procedure. PPE provides barriers and filters between the worker and the hazard and includes eye goggles, masks, and gowns.¹⁹

Proper disposal of sharps is an important part of needlestick prevention. Requirements for the use of safe sharps disposal containers include placing the containers where sharps are used; placing them at a height that allows users to see the tops of the containers; making them lockable when used in areas where security is an issue (eg, in pediatrics or psychiatry); making them closable, puncture-resistant, and leak-proof; ensuring they are clearly and correctly labeled (eg, red in color or with biohazard label), and replacing them promptly when full to avoid overfilling.¹⁴

In the community, sharps disposal is a concern due to accidental needlesticks to the public and waste workers. Janitors and housekeepers are also at risk for injury if loose sharps poke through garbage bags. The Coalition for Safe Community Needle Disposal (the Coalition), made up of businesses, community groups, nonprofit organizations, and the government, is working with the Environmental Protection Agency (EPA) to evaluate and promote alternative disposal methods for used needles and other medical sharps.²⁰ These guidelines are useful for nurses, whether diabetes educators, clinic nurses, or home-care nurses, who are teaching people about home disposal of infectious waste and sharps.

The Coalition has identified several types of safe disposal programs for self-injectors. Instead of putting used sharps in the trash, any of the following should be encouraged:

- Drop-off collection sites
- Household hazardous waste collection sites
- Residential special waste pick-up services
- Mail-back programs
- Syringe exchange programs
- Needle destruction devices

These safe disposal programs are outlined in a brochure from the EPA, *Protect Yourself, Protect Others. Safe Options for Needle Disposal*. The brochure can be downloaded or ordered and used for patient and family education.²¹

Safe Practices Recommendations

Several recommendations have been made by the Institute for Safe Medication Practices (ISMP) to overcome the safety concerns associated with the use of insulin pen devices in hospitals. These include conducting a failure mode and effects analysis prior to using any pen and implementing risk reduction strategies to prevent failures in pen usage. The variety of

pens to be used in one institution should be limited to simplify staff education requirements and ensure ongoing staff competency. Initial and ongoing education of the staff is critical along with the availability of personnel to troubleshoot any problems that may occur. Written guidelines for each pen in use should be developed and should incorporate safety (eg, not sharing pens) and technical (eg, leaving the needle under the skin for 6 seconds after the injection) information.¹⁶ Patients who did not use an insulin pen prior to admission but plan to transition to one will need education regarding the use of the pen at home. Not all patients will use an insulin pen after discharge, so patients must be taught how to use a vial and syringe along with proper disposal methods.²²

Prevention of needlestick injuries in the hospital as well as in the community requires implementation of prevention strategies, including guidelines for safe disposal of sharps. Many resources are available for both patient and healthcare provider, from the CDC's *Sharps Injury Prevention Program Workbook* to the EPA's brochure about safe sharps disposal programs. The importance of these guidelines cannot be overemphasized. Procedures for the safe use and disposal of sharps must be rigorously and uniformly implemented and monitored. The entire community, from patients to nurses to sanitation workers, is put at risk for bloodborne illnesses such as HIV, HBV, and HCV, when sharps are not used and disposed of properly. Consistent patient and healthcare provider education, as well as implementation and follow-up of guidelines, may help to lessen the unnecessary burden of needlestick-associated infection and disease that is on the rise in the United States.

References

1. National Diabetes Statistics, 2007. National Diabetes Information Clearinghouse Web site. Bethesda, MD: National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health; 2007. <http://diabetes.niddk.nih.gov/dm/pubs/statistics/>. Accessed January 21, 2009.
2. Diabetes Statistics. Total prevalence of diabetes and pre-diabetes. American Diabetes Association Web site. <http://www.diabetes.org/diabetes-statistics/prevalence.jsp>. Accessed January 21, 2009.
3. Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med*. 2002;346(6):393-403.
4. Nathan DM, Buse JB, Davidson MB, Ferrannini E, Holman RR, Sherwin R, Zinman B. Medical management of hyperglycemia in type 2 diabetes: a consensus algorithm for the initiation and adjustment of therapy. *Diabetes Care*. 2009;32(1):1-11.
5. Panlilio AD, Orelain JG, Srivastava PU, Jagger J, Cohn RD, Cardo DM, the NaSH Surveillance Group, and the EPINET Data Sharing Network. Estimate of the annual number of percutaneous injuries among hospital-based healthcare workers in the United States, 1997-1998. *Infect Control Hosp Epidemiol*. 2004;25(7):556-562.
6. Centers for Disease Control and Prevention. *Sharps Injury Prevention Program Workbook*. Atlanta, GA: Centers for Disease Control and Prevention; 2004. www.cdc.gov/sharpsafety/pdf/WorkbookComplete.pdf. Accessed April 3, 2009.
7. Centers for Disease Control and Prevention. NIOSH Alert. What every worker should know. How to protect yourself from needlestick injuries. Centers for Disease Control and Prevention, Columbus, OH: US Dept of Health and Human Services; 1999. DHHS (NIOSH) Publication No. 2000-108.

8. Trinkoff, A.M., Rong Le, Geiger-Brown, J., Lipscomb, J. Work schedule, needle use, and needlestick injuries among registered nurses. *Infect Control Hosp Epidemiol*. 2007;28(2):156-164.
9. American Nurses Association. 2008 study of nurses' views on workplace safety and needlestick injuries. <http://www.nursingworld.org/MainMenuCategories/OccupationalandEnvironmental/occupationalhealth/SafeNeedles/2008InviroStudy.aspx>. Accessed April 3, 2009.
10. US Dept of Labor. Occupational Safety and Health Administration. 2009. Bloodborne pathogens and needlestick prevention. www.osha.gov/SLTC/bloodbornepathogens/index.html. Accessed April 19, 2009.
11. US Dept of Labor. Occupational Safety and Health Administration. Frequently asked questions. <http://www.osha.gov/needlesticks/needlefaq.html>. Accessed April 19, 2009.
12. Siegel JD, Rhinehart E, Jackson M, Chiarello L, and the Healthcare Infection Control Practices Advisory Committee, 2007. *Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings*. June 2007. <http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf>.
13. *Prevent Needlestick Injuries*. Charlotte, NC: Premier, Inc.; 2007. <http://www.premierinc.com/quality-safety/tools-services/safety/topics/needlestick/downloads/needlestickprevention-booklet.pdf>. Accessed April 19, 2009.
14. American Diabetes Association. Insulin (and other injected drugs). *Diabetes Forecast*. 2009;62(1):41-46.
15. Magnotti MA, Rayfield EJ. An update on insulin injection devices. *Insulin*. 2007;2(4):173-181.
16. Pellissier G, Miqueres B, Tarantola A, Abiteboul D, Lolom I, Bouvet E, the Geres Group. Risk of needlestick injuries by injection pens. *J Hosp Infect*. 2005;63:60-64.
17. United States Food and Drug Administration Alert. March 19, 2009. Information for Healthcare Professionals. Risk of transmission of blood-borne pathogens from shared use of insulin pens. Rockville, MD: US Dept of Health and Human Services. <http://www.fda.gov/Drugs/DrugSafety/PostmarketDrugSafetyInformationforPatientsandProviders/DrugSafetyInformationforHealthcareProfessionals/ucm133352.htm>. Accessed February 17, 2009.
18. Lautier O, Mosnier-Pudar H, Durain D, Gonbert S, Spinuu L, Faure P. Risk of needlestick injuries among nurses using NovoFine Autocover safety needles and nurses satisfaction with the needles: The NOVAC Study. *Insulin*. 2008;3(4):232-237.
19. American Nurses Association. *Needlestick Prevention Guide*. Washington, DC: American Nurses Association; 2002.
20. Environmental Protection Agency. Community Options for Safe Needle Disposal. Washington, DC: Environmental Protection Agency; 2004. <http://www.epa.gov/osw/nonhaz/industrial/medical/med-govt.pdf>. Accessed March 24, 2009.
21. Environmental Protection Agency. *Protect Yourself, Protect Others. Safe Options for Home Needle Disposal*. <http://www.epa.gov/osw/nonhaz/industrial/medical/med-home.pdf>. Accessed April 21, 2009.
22. Institute for Safe Medication Practices. Pen injectors: technology is not without imPENDING risks. Medication Safety Alert. *Acute Care*. November 30, 2006. <http://www.ismp.org/newsletters/acutecare/archives/Nov06.asp>.

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Upon completion of this program, the participant will be able to:

1. Identify the types of diabetes.
2. Discuss safe practice recommendations for the use of insulin syringes and insulin pens in hospitals.
3. Describe diagnostic tests used to diagnosis TB.
4. Discuss methods to prevent the spread of TB.

Instructions

1. Read both articles.
2. Complete the post-test. (You may make copies of the answer form.)
3. Complete the participant evaluation.
4. Mail or fax the complete answer and evaluation forms to the address on back page. **You can also take this test online at www.saxetesting.com.**
5. To earn 1.5 contact hours of continuing education, you must achieve a score of 70% or more. If you do not pass the test you may take it one more time.
6. Your results will be sent within four weeks after the form is received.
7. The fee has been waived through an educational grant from Covidien.
8. Answer forms must be postmarked by Feb. 17, 2012
9. Faculty Disclosure: No conflicts were disclosed.

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- Type 2 diabetes is associated with which of the following:
 - Autoimmune destruction of the beta cells of the pancreas
 - Insulin resistance in fat, liver and muscle cells
 - Obesity and positive family history for diabetes
 - B and C
- Insulin therapy is necessary for the treatment of type 2 diabetes:
 - When diet and exercise fail to control blood sugars
 - As a last resort when other oral agents have not worked
 - When metformin and a sulfonylurea do not control blood sugar
 - As initial therapy in patients aged younger than 30 years
- Measures recommended for prevention of needlesticks in hospitals include:
 - Using needles that retract, sheathe, or blunt immediately after use
 - Providing consistent and ongoing training on the use of needles
 - Prohibiting recapping of needles
 - All of the above
- Safe disposal of needles in the community includes which of the following:
 - Breaking off needles with the needle cap and putting them in the garbage
 - Flushing needles down the toilet
 - Participating in a mail-back program
 - Putting needles in a milk carton and taking them to the local hospital
- Potential threats to the safe and effective use of insulin pens in hospitals include:
 - Lack of knowledge and experience of nursing staff regarding insulin pen use
 - Patient dislike of insulin pens or concerns about the cost of using an insulin pen after discharge
 - Alerts for look-alike, sound-alike insulin names
 - Having each patient's prescribed pens labeled with name and number
- Measures to overcome safety concerns associated with insulin pen use in hospitals include:
 - Minimizing the variety of pens used in one institution
 - Having written guidelines for each pen that is in use
 - Requiring annual competency evaluation of insulin pen use by every nurse
 - All of the above
- A recent FDA alert recommends the following when using insulin pens:
 - Insulin pens should be single-use only
 - Insulin pens should be labeled with the patient's name and other identifiers
 - Insulin is not associated with bloodborne pathogen transmission
 - Both A and B
- Proper disposal of sharps in the community includes:
 - Flushing used sharps down the toilet
 - Throw the used sharp in the trash
 - Following community guidelines for the proper disposal
 - All of the above
- The use of multidose vials including insulin pens is an acceptable practice.
 - True
 - False
- Sharps containers must be:
 - Puncture resistant
 - Sealable
 - Labeled with a biohazard sticker
 - All of the above
- Mtb* can affect other body organs in addition to the lungs?
 - True
 - False
- According to the CDC, almost half of the *Mtb* cases in the United States were reported in which states?
 - Iowa, New York, Texas, Washington
 - Illinois, Indiana, New York, Florida
 - California, Florida, New York, Texas
 - Louisiana, Illinois, Florida, California
- Signs and symptoms of tuberculosis include:
 - Night sweats
 - Cough greater than 3 weeks
 - Weight loss
 - All the above
- Populations at greater risk for developing TB include people who are:
 - HIV positive
 - Receiving chemotherapy
 - Children aged younger than 5 years.
 - All of the above

Participant's Evaluation

What is the highest degree you have earned (circle one)?

1. Diploma 2. Associate's 3. Bachelor's
4. Master's 5. Doctorate

Indicate to what degree this program met the objectives: Using 1 = strongly disagree to 6 = strongly agree rating scale, please circle the number that best reflects the extent of your agreement to each statement.

	Strongly Disagree			Strongly Agree		
Upon completion of this program, the participant will be able to:						
1. Identify the types of diabetes.	1	2	3	4	5	6
2. Discuss safe practice recommendations for the use of insulin syringes and insulin pens in hospitals.	1	2	3	4	5	6
3. Describe diagnostic tests used to diagnosis TB.	1	2	3	4	5	6
4. Discuss methods to prevent the spread of TB.	1	2	3	4	5	6

How long did it take you to complete this home-study program? _____
What other areas would you like to cover through home study?

Name & Credentials _____
Position/Title _____
Address _____
City _____ State _____ Zip _____
Phone _____ Fax _____

Mark your answers with an X in the box next to the correct answer

1	A	B	C	D	9	A	B	C	D
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	A	B	C	D	10	A	B	C	D
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	A	B	C	D	11	A	B	C	D
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	A	B	C	D	12	A	B	C	D
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5	A	B	C	D	13	A	B	C	D
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	A	B	C	D	14	A	B	C	D
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	A	B	C	D	15	A	B	C	D
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	A	B	C	D	16	A	B	C	D
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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