

# Infection Control in Jails and Prisons

Joseph A. Bick

California Medical Facility, California Department of Corrections and Rehabilitation, and University of California, Davis, California

At the end of 2005, ~7 million people (or 1 of every 33 American adults) were either in jail, in prison, or on parole [1]. Compared with the general public, newly incarcerated inmates have an increased prevalence of human immunodeficiency virus infection, hepatitis B virus infection, hepatitis C virus infection, syphilis, gonorrhea, chlamydia, and *Mycobacterium tuberculosis* infection [2]. While incarcerated, inmates are at an increased risk for the acquisition of blood-borne pathogens, sexually transmitted diseases, methicillin-resistant *Staphylococcus aureus* infection, and infection with airborne organisms, such as *M. tuberculosis*, influenza virus, and varicella-zoster virus. While incarcerated, inmates interact with hundreds of thousands of correctional employees and millions of annual visitors [2]. Most inmates are eventually released to interact with the general public. Tremendous opportunities exist for infectious diseases specialists and infection-control practitioners to have an impact on the health of correctional employees, the incarcerated, and the communities to which inmates return. This article presents a brief review of some of the most important infection-control challenges and opportunities within the correctional setting.

Most jails and prisons were constructed to maximize public safety, not to minimize the transmission of disease or to efficiently deliver health care. The probability of transmission of potentially pathogenic organisms is increased by crowding, delays in medical evaluation and treatment, rationed access to soap, water, and clean laundry, insufficient infection-control expertise, and prohibitions against the use of proven harm-reduction tools, such as condoms and sterile needle exchange. The abrupt transfer of inmates from one location to another further complicates the diagnosis of infection, interruption of transmission, recognition of an outbreak, performance of a contact investigation, and eradication of disease.

Many jails and prisons lack adequate information technology, and clinical information-sharing between facilities and the different jurisdictions responsible for the care of inmates is often poor. The high prevalence of mental illness among inmates often complicates the appropriate management of contagious illnesses. Some correctional facilities have been slow to seek assistance from outside agencies, and published guidelines for the diagnosis and treatment of communicable diseases are often

not readily applicable to correctional facilities. Infection-control practitioners must be innovative in their efforts to protect the health of inmates and correctional employees.

## STANDARD AND TRANSMISSION-BASED PRECAUTIONS IN CORRECTIONAL FACILITIES

Jails and prisons often lack sufficient hand washing areas, isolation rooms, and personal protective equipment. Infection-control supplies are often locked up to discourage theft, and strategies intended to decrease syringe diversion may lead to an inadequate supply of sharps containers. A single facility often houses inmates who require care that is consistent with that provided in infirmaries or subacute-care hospitals, mental health facilities, hospices, assisted living and residential care facilities, and long-term care facilities, such as nursing homes and institutions for the developmentally disabled. Developing rational infection-control strategies that can be readily implemented in such complex settings can challenge even the best-prepared infection-control practitioner. Table 1 details some specific challenges involved in implementing standard and transmission-based precautions in jails and prisons.

## EMPLOYEE POSTEXPOSURE MANAGEMENT

Correctional employees are exposed to blood-borne pathogens during medical, housekeeping, and laundry duties [3]. Syringes, tattoo paraphernalia, and inmate-manufactured stabbing

Received 1 May 2007; accepted 21 June 2007; electronically published 6 September 2007.  
Reprints or correspondence: Dr. Joseph A. Bick, California Medical Facility, 1600 California Dr., Vacaville, CA 95696 (joseph.bick@cdcr.ca.gov).

**Clinical Infectious Diseases** 2007;45:1047–55

© 2007 by the Infectious Diseases Society of America. All rights reserved.  
1058-4838/2007/4508-0019\$15.00  
DOI: 10.1086/521910

**Table 1. Challenges to the implementation of standard and transmission-based precautions in jails and prisons.**

Precaution	Challenge(s)
Hand hygiene	Many areas in which clinical care is provided lack hand washing stations. Soap and soap dispensers are valuable commodities and may be stolen by inmates. Alcohol-based hand washes burn with a clear flame and may raise concerns with custody staff.
PPE	Custody employees routinely search inmates and conduct cell searches, increasing the risk for sharps injuries and contact with blood and other potentially infectious materials. Inmates may intentionally expose staff to blood and other potentially infectious materials by either spitting or throwing fluids. PPE is often stored in locked containers to prevent theft, limiting access.
Sharps	To limit syringe diversion, puncture-resistant leak-proof containers may not be available at the site where sharp instruments are used. Use of sharps in nonclinical areas, such as housing units (e.g., cells and dormitories), increases the risk for injury.
Patient care equipment	Patient care equipment (e.g., stethoscopes, blood pressure cuffs, and otoscopes) can be made into weapons or escape paraphernalia and, therefore, cannot be left in the rooms of inmates who are on contact precautions. These items can become contaminated and lead to transmission of pathogenic organisms.
Housing	Most jails and prisons are overcrowded and have an inadequate number of single cells that can be used for isolation, facilitating the transmission of contagious illnesses. Large dormitories make it difficult to cohort inmates.
Patient hygiene	Many inmates do not have ready access to soap and water. Shower access is often restricted. The number of toilets may be insufficient to serve the population.
Laundry	Clothing and linen is strictly rationed. Inmates who have conditions that predispose to soiling clothing with blood and/or body fluids may not be able to secure additional clothing. Inmates often wash their own clothes in buckets, sinks, or bags to ensure that they do not lose their clothes. This may remove dirt and odors, but it does not disinfect clothing. Bleach is contraband and is not available to inmates.
Housekeeping and sanitation	Most housecleaning is performed by inadequately trained inmates who do not have access to effective cleaning supplies. Housing areas and common areas (such as booking and bus screen areas, showers, toilets, day rooms, gymnasiums, weight equipment, and clinic waiting rooms) may be infrequently cleaned.
Patient transport	Inmates are often moved without informing clinical services. Transportation vehicles may be inappropriate for transmission-based precautions. Vehicles may not be routinely cleaned and can be a source of transmission of contagious illnesses. Custody restraints are often reused without disinfection.
Access to medical care	Many facilities have lengthy delays for inmates to see clinicians. Copayments discourage inmates from seeking care and may lead to further transmission of contagious conditions.

**NOTE.** Prisons are defined as detention centers operated by state and federal governments that serve as detention centers for persons who have been sentenced to >1 year of incarceration. Jails are defined as detention centers operated by city and county governments that serve as detention centers for persons who are either awaiting trial or who have been sentenced to <1 year of incarceration. Inmates are defined as residents of jails and prisons. Prisoners are defined as residents of prisons. PPE, personal protective equipment.

devices are encountered during cell and clothed-body searches. Some inmates intentionally expose employees to potentially infectious materials by throwing body fluids (“gassing”). The increased prevalence of HIV infection and viral hepatitis among inmates increases the risk associated with each exposure [1]. To minimize these risks, each correctional facility requires a

written exposure-control plan that includes vaccination of at-risk staff and inmates, education on the use of personal protective equipment, environmental controls to decrease the likelihood of sharps injuries, and a postexposure prophylaxis program [4, 5]. Because prisons are often in remote locations, correctional clinicians should be authorized to initiate post-

exposure prophylaxis for employees. Prompt follow-up evaluation of exposed employees must be ensured.

## **INMATE POSTEXPOSURE MANAGEMENT**

Transmission of HIV and other blood-borne pathogens among inmates has been well documented [6–9]. Inmates are exposed to blood-borne pathogens during injection drug use, tattooing, sharing of razor blades, fights, and consensual and nonconsensual sexual activity. Most inmates do not have access to condoms, and the risks associated with in-custody injection drug use may be higher than those associated with injection drug use in the nonincarcerated population because of decreased access to needle exchange programs and to materials used to sterilize injection equipment [10, 11]. Correctional facilities should provide nonoccupational postexposure prophylaxis to inmates who experience a significant potential exposure to blood-borne pathogens [12].

## **CULINARY SERVICES**

Food-borne illnesses due to *Norovirus*, *Campylobacter*, *Salmonella*, *Shigella*, and *Staphylococcus* species and to *Streptococcus pyogenes* have been reported in correctional facilities. All correctional facilities should adhere to basic infection-control guidelines regarding culinary services [13, 14]. Most food preparation and scullery work is performed by inmates under the supervision of noninmate staff. Inmates who have open sores on their hands or arms, active respiratory infections, jaundice, vomiting, or diarrhea should be prohibited from working. Persons who have poorly controlled mental illness and those who lack the intellectual ability to adhere to appropriate standards of hygiene should not be employed as culinary workers. Culinary workers should be educated and tested to assure comprehension of basic concepts of cleanliness and disease prevention. Employees who develop an illness that can be transmitted through culinary work should be promptly unassigned until medically cleared to return. Routine inspections should be performed to ensure compliance with published recommendations concerning toilet and hand washing facilities, hygiene, food storage temperatures, vermin control, and other infection-control standards.

Inmates often store, prepare, and eat perishable food in their cells. When investigating an outbreak of gastrointestinal illness, it is important to consider other sources of food, including the on-site prisoner store and packages sent from outside the facility.

## **LAUNDRY**

Clothing and linen are strictly rationed to prevent inmates from making nonapproved clothing, curtains, and escape paraphernalia, such as ropes and altered clothing. These concerns not-

withstanding, inmates should be provided with an adequate supply of clothing and linens, and these items should be laundered frequently. Inmates commonly wash their own clothes with soap and water in a sink, bucket, or plastic bag. This process may remove soil and odors, but it does little to kill pathogenic organisms. Bleach is not provided to inmates, because it can be used to change the color of hair and clothing. Inmates should be educated that the only way to reliably remove organisms that can cause disease is to use the institutional laundry. Routine inspections should be performed to ensure that laundry operations are being performed in accordance with published recommendations [15–17].

## **BARBERING**

Although inmates perform the majority of haircuts in jails and prisons, they often receive little or no infection-control education. Barbering tools may be reused without appropriate disinfection, facilitating the transmission of disease. To minimize these risks, all potential barbers should receive training, undergo posteducation testing, and be periodically observed to ensure adherence with infection-control practices. Barbers should be provided access to necessary tools and disinfection supplies [18].

## **INFLUENZA**

Outbreaks of influenza commonly occur in congregate living environments, such as correctional facilities. Because jails and prisons are chronic-care facilities, all residents and employees should be offered influenza vaccination annually [19]. Essential components of a correctional influenza-control program are detailed in table 2.

## **ECTOPARASITE CONTROL**

Ectoparasites, such as scabies and lice, are common problems in correctional facilities. All inmates who have pruritus, rashes, or skin lesions should be promptly evaluated by a clinician. Appropriate management of suspected cases includes oral or topical medication, clothing and linen exchange, shower access, and housing changes, necessitating close cooperation between clinical and custodial staff [20].

## **METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS* (MRSA)**

MRSA is hyperendemic in most correctional facilities [21–23]. Risk factors include prolonged incarceration; skin lacerations and abrasions; previous antibiotic use; poor skin hygiene; draining one's own abscesses or performing one's own wound dressing changes; washing clothing by hand; sharing razors, clothing, linen, or soap; and requiring copayments to see a clinician [21–23]. Evidence-based experience with MRSA-control measures

**Table 2. Key components of an influenza prevention and control program for correctional facilities.**

Subject	Comment(s)
Annual influenza vaccination of all inmates and employees	All employees and volunteers should be encouraged to receive annual influenza vaccination. Standing order programs should be used to increase vaccination levels. Offer vaccination during intake screening or en masse at the beginning of the influenza season.
Respiratory hygiene and cough etiquette programs	Educate inmates and employees concerning the importance of respiratory hygiene and cough etiquette throughout the influenza season. Ensure that supplies for hand washing are available where sinks are located. Consider additional measures, such as providing tissues and masks to inmates and employees who are coughing or sneezing so that they can cover their mouth and nose and providing tissues and alcohol-based hand rubs in common areas and waiting rooms.
Active surveillance and influenza testing for patients with new illness	Conduct surveillance for acute febrile respiratory illness and use rapid influenza testing and influenza cultures for prompt identification of outbreaks. Once an outbreak is identified, inform local and state health department officials within 24 h. Once an outbreak is confirmed, continue daily active surveillance for respiratory illness among inmates and employees until at least 1 week after the last confirmed influenza case is documented.
Use of standard and transmission-based (droplet) precautions	Standard precautions should be used during the care of all patients who have symptoms of a respiratory infection. In addition, droplet precautions should be used during the care of any patient who has suspected or confirmed influenza. Single-cell housing is recommended for patients who have suspected or confirmed influenza. If single-cell housing is not available, patients who have suspected or confirmed influenza should be cohorted. Surgical or procedure masks should be used when entering the patient's room or when working within 3 feet of the patient.
Additional infection-control measures during an outbreak	Cancel common activities. Limit movement within the facility. Suspend movement into and out of affected units
Transportation	Inmates who must be transported should wear a surgical or procedure mask.
Visiting	Inmates who have confirmed or suspected influenza should not participate in visiting. Persons who have respiratory symptoms should not be allowed to visit the facility.
Administration of antiviral medications for prophylaxis and treatment	Use antiviral agents for treatment and prophylaxis of inmates and employees as per current guidelines.
Access to care	Liberalize access to medical care for inmates who have respiratory illnesses.

in correctional facilities is quite limited. To prevent nosocomial MRSA transmission, the Society for Health Care Epidemiology of America recommends screening all at-risk patients at the time of hospital admission for infection or colonization with MRSA, contact precautions for all individuals found to be colonized or infected with MRSA, and antibiotic use restrictions to decrease the likelihood of antibiotic resistance [24]. The Health Care Infection Control Practices Advisory Committee of the Centers for Disease Control and Prevention recommends that hospitals only implement active surveillance if other measures fail to control the transmission of drug-resistant bacteria [25]. The most compelling data for routine surveillance come from experiences in the control of hospital outbreaks and high-risk settings, such as intensive care units and hemodialysis units. Correctional facilities considering a more intensive approach to MRSA screening and isolation should consider the potential

for negative consequences. The workload and expense associated with routine specimen collection is formidable, and the physical plant of most facilities does not allow for single-cell contact isolation or cohorting of those who are found to be infected or colonized. Isolated hospitalized patients experience twice as many adverse events, are less likely to have vital signs measured, have more days without a doctor's progress note, have longer lengths of stay, and are more likely to file a formal complaint, compared with those who are not isolated [26].

Liberalizing access to soap, showers, and clean clothing, eliminating the copayment requirement for contagious conditions, maintaining round-the-clock access to urgent care, and using dedicated wound evaluation and treatment clinics may lead to more-rapid diagnosis, treatment, and resolution of skin lesions and less opportunity for secondary transmission. Although there are insufficient data to support routine decolonization

**Table 3. Performing a tuberculosis (TB) contact investigation within a correctional facility**

Issue	Comment(s)
Potential for rapid spread of MTB within congregate-living environment of jail and prison	<p>Waiting for culture results and then methodically expanding the contact evaluation in a series of concentric circles is inadequate in congregate-living environments, such as jails and prisons. By the time that culture results are available, hundreds of exposed inmates may have been transferred or released to distant areas. To most efficiently interrupt the further spread of TB, the following strategy is recommended:</p> <ol style="list-style-type: none"> <li>(1) Immediate isolation of patients in whom active TB is suspected in a private room that has negative pressure relative to the hallway.</li> <li>(2) Prompt collection of respiratory specimens for acid-fast bacilli smear and culture.</li> <li>(3) Reporting of sputum smear results within 24 h after collection.</li> <li>(4) Initiation of a preliminary contact investigation immediately upon identification of a suspected case. This investigation should identify those employees and inmates who were in close contact with the individual with the suspected case during the potentially contagious period. If the diagnosis of MTB infection is confirmed, the investigation can proceed further.</li> <li>(5) Testing of all positive acid-fast bacilli smear specimens by nucleic acid amplification testing to more rapidly identify the mycobacterial species.</li> <li>(6) Use of rapid acid-fast bacilli culture techniques to decrease the time to culture results.</li> <li>(7) Performance of DNA probe testing on all culture-positive samples to more rapidly identify the mycobacterial species.</li> <li>(8) If MTB is identified by PCR, gene probe, or culture, proceed to a full-scale contact investigation.</li> </ol>
Inmate movement	<p>Many exposed inmates will have moved within the facility, been transferred, or been released. Transmission may occur in housing units, gymnasiums, work sites, schools, chapels, canteens, dining halls, and visiting areas. A database that can rapidly provide accurate historical information about inmate movement, staff assignments, and visiting records is essential.</p>
Evaluation of contacts	<p>All exposed persons should be evaluated with a symptom interview and tuberculin skin test. Those found to have a positive skin test or positive symptom interview require an immediate chest radiograph. Those who have a positive symptom interview and either abnormal chest radiograph findings or a new positive tuberculin skin test result<sup>a</sup> should be rehoused to respiratory isolation and further evaluated.</p>

**NOTE.** MTB, *Mycobacterium tuberculosis*.

<sup>a</sup> A positive tuberculin skin test result is defined as an induration  $\geq 5$  mm in diameter for those who have had close contact with an individual with an active case of MTB infection, who are known to be HIV infected, who are at risk for HIV infection but are of unknown HIV status, and/or have chest radiograph findings consistent with latent TB infection, and it is defined as an induration  $\geq 10$  mm for all other inmates and employees, including those who have received bacille Calmette-Guérin vaccination.

efforts, the practice may be useful in those who develop repeated episodes of infection [27].

Skin and soft-tissue infections in jails and prisons have often been mistakenly diagnosed as spider bites, resulting in delays in appropriate treatment and misguided vector-control measures. "Spider bites" should be considered to be infections due to MRSA until proven otherwise. Once MRSA is endemic within a facility, empiric antibiotic selection for skin and soft-tissue infections should include an agent that has activity against this organism. Incision and drainage are often sufficient for treatment of minor skin and soft-tissue infections. Antibiotics should be used in treating patients with sepsis, large facial lesions, and periorbital lesions, and they should be strongly considered in treating patients who are immunocompromised be-

cause of neutropenia, end-stage renal disease, diabetes, or HIV infection [28].

### **VARICELLA-ZOSTER VIRUS (VZV)**

VZV is introduced to correctional facilities by employees, visitors, or inmates who have chicken pox or zoster. To decrease the potential for institutional outbreaks, all nonimmune employees and inmates should be offered vaccination against VZV. Inmates who develop chicken pox should be housed in negative-pressure respiratory isolation until they are no longer contagious. If negative-pressure rooms are not available, inmates with chicken pox should be cohorted with those who have had VZV infection. Because of the high prevalence of at-risk HIV-

**Table 4. Challenges to the implementation of a comprehensive viral hepatitis infection-control and prevention program in jails and prisons.**

Issue	Comment
Short stays, transient populations, insufficient interjurisdictional cooperation and communication, and inadequate information technology	Custody-initiated patient movement, poor communication, and lack of computerized medical records impair efforts to complete immunization series as inmates move throughout the system.
Lack of medical expertise	Many correctional facilities struggle to recruit and retain qualified clinicians.
Patient distrust	Lack of trust is a major barrier to acceptance of and adherence to care.
Poor reimbursement	Correctional departments are usually not reimbursed for immunizations and other prevention efforts that benefit the general population.
Ongoing drug use	Proven drug treatment strategies, including methadone maintenance and buprenorphine, are not available to the majority of inmates who might benefit from them.
Ongoing sexual activity and injection drug use	Most inmates do not have access to condoms and needle exchange.

infected inmates, it may also be prudent to isolate or cohort all of those who develop zoster. Employees with active VZV infection should be medically furloughed until they are no longer contagious. Nonimmune staff should not participate in the care of inmates who have active VZV infection, unless the staff member wears a respirator. Diagnosis of chicken pox should prompt a contact investigation to identify nonimmune persons who may have been exposed. Exposed persons who do not recall a history of VZV infection should undergo serological testing, and those who lack immunity should be offered VZV vaccination. VZV immunoglobulin should be offered to non-immune pregnant and immunocompromised persons. Exposed susceptible inmates should be cohorted and medically confined to a housing unit during the time that they are at risk for developing active disease. Exposed susceptible staff should be medically furloughed during the same period [29].

### **MYCOBACTERIUM TUBERCULOSIS (MTB)**

Up to 25% of US inmates have latent tuberculosis infection (LTBI), and the incidence of active MTB infection among inmates is 6–10 times that in the nonincarcerated population [2, 30]. HIV infection, which is the strongest risk factor for progression from LTBI to active disease, is 10–20 times more prevalent among the incarcerated population than among the non-incarcerated population [1]. HIV-infected persons can progress extraordinarily rapidly from LTBI to active contagious disease [31, 32]. MTB transmission has been documented from inmates to employees, visitors, volunteers, and other inmates [30, 32–34]. Overcrowding, poor ventilation, delayed diagnosis, and failure to adhere to recognized standards for prevention, screening, and containment have all contributed to the transmission of MTB within jails and prisons and, from there, to the non-incarcerated population [30–34]. Essential MTB infection pre-

vention and control measures include early identification of persons with LTBI and active disease, prompt isolation of contagious persons, appropriate use of airborne precautions, swift performance of contact investigations, and successful completion of treatment for LTBI and active MTB infection [30].

New employees who do not have a history of either a positive PPD result or treatment for active MTB infection should undergo tuberculin skin testing (TST). Two-step testing should be used for employees who have not had a recent PPD test. Those with negative TST results should be retested at least annually (and more frequently if a case of contagious tuberculosis is identified and/or there is evidence of person-to-person transmission within the facility) [30]. Positive TST results should be managed in accordance with published guidelines [30].

Upon entry to the correctional facility, inmates who exhibit signs or symptoms of active MTB infection should be immediately masked, housed in negative-pressure respiratory isolation, and evaluated for active disease with a chest radiograph, TST (if the patient does not have a prior positive TST result), and sputum smear and culture [30]. While occupied, isolation rooms should be tested at least daily to ensure that negative pressure is maintained.

Inmates who will be incarcerated for at least 2 weeks should undergo TST unless they have a history of a prior positive TST result. Those who have a positive TST result should be evaluated for preventive therapy. Inmates with a history of LTBI or active disease should be evaluated to ensure that treatment was completed. Jail inmates are often released within hours or days, making routine TST impractical. Screening all incoming inmates for active MTB infection with a single-view chest radiograph has been demonstrated to be sensitive and cost-effective in some jails [35, 36]. Baseline chest radiographs should also

**Table 5. HIV management in correctional facilities.**

Subject	Comment
HIV testing	Implement routine opt-out HIV testing as part of health care within all correctional facilities.
Treatment	Provide appropriate antiretroviral care, treatment, and prevention services to all HIV-infected inmates.
Contact tracing	Conduct partner counseling and referral services.
Harm-reduction services	Provide proven harm-reduction measures, including education, condom distribution, and drug and alcohol treatment.
Transition to community	Develop partnerships with health departments and community-based organizations to link HIV-infected persons to housing, treatment, and prevention services in the community.

be obtained for all HIV-infected inmates, regardless of symptoms or TST results. Serologic testing for LTBI with an assay such as the QuantiFERON-TB Gold (Cellestis) is worthy of further study.

Clinicians should remain vigilant for signs and symptoms of tuberculosis and maintain a low threshold for respiratory isolation, radiographs, and sputum analysis. At least annually, all inmates who have not had a prior positive TST result should be retested, and those who have positive results should be evaluated for preventive therapy. Treatment for active MTB infection and LTBI should be administered via directly observed therapy to maximize adherence and decrease the likelihood of treatment failure.

Inmates are often abruptly summoned for court appearances and are summarily transferred or released. No patient with active MTB infection should be transported or released without the approval of the responsible physician.

Correctional facilities should establish collaborative relationships with county and state public health departments for consultation, laboratory studies, assistance with contact investigations, and to help coordinate the evaluation and treatment of community contacts and inmates who have been transferred or released (table 3) [30, 37].

## VIRAL HEPATITIS

Up to 40% of all Americans with chronic viral hepatitis have been incarcerated, and the prevalence of viral hepatitis among inmates is significantly higher than it is among the general population [2]. Any comprehensive national strategy for the prevention, early diagnosis, and treatment of viral hepatitis must include jails and prisons. Immunization of those who are nonimmune, treatment of those who are chronically infected, substance abuse treatment, and harm-reduction education in correctional facilities can benefit the general population by decreasing the costs associated with chronic viral hepatitis, reducing transmission, and decreasing recidivism [table 4].

**Hepatitis A virus.** All inmates should know their hepatitis A virus status, and nonimmune individuals should be offered

vaccination. Tracking systems to ensure completion of the vaccine series within the correctional system should be established, and procedures should be developed to facilitate completion of the second vaccine dose for those inmates who return to the community.

**Hepatitis B virus (HBV).** Because of the success of universal HBV vaccination of children and adolescents, most new cases of viral hepatitis now occur among adults [38]. Approximately 30% of persons with acute HBV infection have been incarcerated, and the prevalence of chronic HBV infection among inmates is significantly elevated, compared with the general population [2, 39]. Nonimmune inmates are at high risk for acquiring HBV infection through injection drug use or sexual activity during their incarceration or after their release, and they should, therefore, be offered vaccination for HBV [8]. Standing immunization orders should be used to facilitate the identification and immunization of at-risk inmates [38].

**Hepatitis C virus.** As many as 40% of inmates demonstrate serologic evidence of hepatitis C virus infection [39, 40]. Many inmates who are not infected remain at high risk because of ongoing injection drug use, both during incarceration and after release. Most inmates do not have access to proven harm-reduction measures, such as needle exchange, and many inmates who might benefit from substance abuse treatment do not have access to it. As a result, opportunities to treat addiction are lost, and many inmates continue harmful behaviors. Because of the absence of a vaccine, further reductions in the number of new cases of hepatitis C virus infection will depend on harm reduction education of those who are at risk for infection.

## HIV INFECTION

The prevalence of AIDS is at least 5 times greater among prisoners than it is among the general population, and HIV infection and/or AIDS remains one of the most common causes of death among inmates in the United States [1, 2]. Although up to 25% of people living with HIV infection in this country have spent time in a jail or prison, less than one-half of prison

systems and few jails routinely provide HIV testing on entry [2, 41]. Effective treatment of HIV infection in prisons has brought a reduction of ~75% in AIDS-related mortality [42]. Identification of HIV-infected inmates can prompt partner counseling and referral services, encouraging others to be tested for HIV infection and potentially hindering the spread of the virus. Nonincarcerated individuals reduce the frequency of their risk behaviors following receipt of a diagnosis of HIV infection, and inmates who are aware of their HIV-infected status may similarly reduce HIV transmission behaviors, both in prison and upon returning to their communities [43]–[45]. Antiretroviral therapy minimizes infectiousness by reducing viral load in genital secretions, thereby decreasing the risk for HIV transmission [46, 47].

HIV testing that is driven by determination of individual risk factors and high-prevalence settings fails to reach a sizeable number of HIV-infected individuals [48, 49]. The Centers for Disease Control and Prevention has recently recommended that routine, voluntary, opt-out testing for HIV infection be integrated into the routine health care of all Americans, including inmates (table 5) [50]. Programs that offer inmates routine, voluntary, opt-out testing for HIV infection have been highly successful [41, 51].

Although illegal, consensual and nonconsensual sexual activity that places inmates at high risk for HIV transmission has been well documented. Although condoms are highly effective at preventing the transmission of HIV infection and other sexually transmitted diseases, and although the Centers for Disease Control and Prevention has recommended that they be made available in correctional facilities, only 2 state prison systems and 5 local jail systems make condoms available to inmates [52, 53]. Injection drug use is a major risk factor for HIV infection, and a significant number of inmates continue to use drugs during their incarceration. There is insufficient access to substance abuse treatment in jails and prisons, and no correctional facilities in the United States offer needle exchange programs. Because of the link between HIV infection and drug use, access to drug treatment programs is an essential component of correctional HIV care and planning for release into the community.

## CONCLUSIONS

A significant and increasing percentage of the US population works or resides in correctional facilities. The prevalence of infectious diseases among incoming inmates is substantial, and the conditions that exist within our nation's jails and prisons contribute to the further amplification of contagious illnesses. Jails and prisons represent unique and challenging environments in which to implement effective infection-control strategies. Correctional facility-based immunization programs, infectious disease screening, treatment, and harm-reduction

efforts are essential components of any national strategy for the control of communicable diseases. Most jails and prisons lack infection-control expertise, creating an ideal opportunity for collaboration with local universities, public health departments, and private infection-control consultants. The inclusion of correctional public health and infection control in the curricula of clinical and public health training programs may help to raise awareness of the important role that jails and prisons play in national disease prevention and control efforts.

## Acknowledgments

*Potential conflicts of interest.* J.A.B.: no conflicts.

## References

1. Bureau of Justice Statistics, US Department of Justice. Bureau of Justice Statistics, 2005. Available at: <http://www.ojp.usdoj.gov/bjs/prisons.htm>. Accessed 31 August 2007.
2. Hammett TM, Harmon MP, Rhodes W. The burden of infectious disease among inmates of and releases from US correctional facilities, 1997. *Am J Public Health* **2002**;92:1789–94.
3. Gershon RRM, Sherman MF, Mitchell C, et al. Prevalence and risk factors for bloodborne exposure and infection in correctional health-care workers. *Infect Control Hosp Epidemiol* **2007**;28:24–30.
4. Department of Labor, Occupational Safety and Health Administration. 29 CFR Part 1910.1030. Occupational exposure to blood borne pathogens: final rule. *Federal Register* **1991**;56:64004–182.
5. Centers for Disease Control and Prevention. Updated US Public Health Services guidelines for the management of occupational exposures to HIV and recommendations for postexposure prophylaxis. *MMWR Morb Mortal Wkly Rep* **2005**;54:1–17.
6. Brewer TF, Vlahov D, Taylor E, et al. Transmission of HIV-1 within a statewide prison system. *AIDS* **1988**;2:363–7.
7. Horsburgh CR Jr, Jarvis JQ, McArthur T, et al. Seroconversion to human immunodeficiency virus in prison inmates. *Am J Public Health* **1990**;80:209–10.
8. Centers for Disease Control and Prevention. Transmission of hepatitis B virus in correctional facilities—Georgia, January 1999–June 2002. *MMWR Morb Mortal Wkly Rep* **2004**;53:678–81.
9. Mutter RC, Grimes RM, Labarthe D. Evidence of intraprisson spread of HIV infection. *Arch Intern Med* **1994**;154:793–5.
10. Turnbull PJ, Dolan KA, Stimson GV, et al. Prison decreases the prevalence of behaviours but increases the risks [abstract POC 4321]. In: Program and abstracts of the VIII International Conference on AIDS (Amsterdam). **1992**.
11. Carvell AL, Hart GJ. Risk behaviours for HIV infection among drug users in prison. *BMJ* **1990**;300:1383–4.
12. Centers for Disease Control and Prevention. Antiretroviral postexposure prophylaxis after sexual, injection-drug use, or other nonoccupational exposure to HIV in the United States. *MMWR Morb Mortal Wkly Rep* **2005**;54:1–20.
13. The Center for Food Safety and Applied Nutrition, US Food and Drug Administration. Available at <http://www.cfsan.fda.gov>. Accessed 31 August 2007.
14. The Food Safety and Inspection Service, US Department of Agriculture. Available at: <http://www.fsis.usda.gov>. Accessed 31 August 2007.
15. Walter WG, Schillinger JE. Bacterial survival in laundered fabrics. *Appl Microbiol* **1975**;29:368–73.
16. Christian RR, Manchester JT, Mellor MT. Bacteriological quality of fabrics washed at lower- than-standard temperatures in a hospital laundry facility. *Appl Environ Microbiol* **1983**;45:591–7.
17. Blaser MJ, Smith PF, Cody HJ, et al. Killing of fabric-associated bacteria



- in hospital laundry by low temperature washing. *J Infect Dis* **1984**; 149:48–57.
18. California Code of Regulations, Board of Barbering and Cosmetology. Title 16, Division 9, Article 12. Available at <http://www.barbercosmo.ca.gov/laws/art12.htm>. Accessed 31 August 2007.
  19. Centers for Disease Control and Prevention. Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Morb Mortal Wkly Rep* **2006**; 55(RR10):1–42.
  20. California Department of Health Services, Division of Communicable Disease Control, in Consultation with Licensing and Certification. Prevention and control of scabies in California long-term care facilities. Available at: <http://www.dhs.ca.gov/dcdc/disb/pdf/Scabies%20Guide.pdf>. Accessed 31 August 2007.
  21. Centers for Disease Control and Prevention. Methicillin-resistant *Staphylococcus aureus* skin or soft tissue infections in a state prison—Mississippi, 2000. *MMWR Morb Mortal Wkly Rep* **2001**; 50:919–22.
  22. Centers for Disease Control and Prevention. Public health dispatch: outbreaks of community-associated methicillin-resistant *Staphylococcus aureus* skin infections—Los Angeles County, California, 2002–2003. *MMWR Morb Mortal Wkly Rep* **2003**; 52:88.
  23. Centers for Disease Control and Prevention. Methicillin-resistant *Staphylococcus aureus* infections in correctional facilities—Georgia, California, and Texas, 2001–2003. *MMWR Morb Mortal Wkly Rep* **2003**; 52:992–6.
  24. Muto CA, Jernigan JA, Ostrowsky BE, et al. SHEA guidelines for preventing nosocomial transmission of multidrug-resistant strains of *Staphylococcus aureus* and enterococcus. *Infect Control Hosp Epidemiol* **2003**; 24:362–86.
  25. Centers for Disease Control and Prevention. Management of multi-drug-resistant organisms in healthcare settings, 2006. Available at: <http://www.cdc.gov/ncidod/dhqp/pdf/ar/mdroGuideline2006.pdf>. Accessed 31 August 2007.
  26. Stelfox HT, Bates DW, Redelmeier DA. Safety of patients isolated for infection control. *JAMA* **2003**; 290:1899–905.
  27. Simor A, Phillips E, McGeer A, et al. Randomized controlled trial of chlorhexidine gluconate for washing, intranasal mupirocin, and rifampin and doxycycline versus no treatment for the eradication of methicillin-resistant *Staphylococcus aureus* colonization. *Clin Infect Dis* **2007**; 44:78–85.
  28. Bick J. Methicillin-resistant *Staphylococcus aureus* in the correctional setting. *Infectious Diseases in Corrections Report* **2007**; 9:1–6.
  29. Bick J. Infection control of *Varicella zoster* in the correctional setting. *Infectious Diseases in Corrections Report* **2006**; 9:5–7.
  30. Centers for Disease Control and Prevention (CDC). Prevention and control of tuberculosis in correctional and detention facilities: recommendations from CDC. *MMWR Morb Mortal Wkly Rep* **2006**; 55: 1–48.
  31. Daley CL, Small PM, Schecter GF, et al. An outbreak of tuberculosis with accelerated progression among persons infected with the human immunodeficiency virus: an analysis using restriction-fragment length polymorphisms. *N Engl J Med* **1992**; 326:231–5.
  32. Centers for Disease Control and Prevention. Probable transmission of multidrug-resistant tuberculosis in a correctional facility: California. *MMWR Morb Mortal Wkly Rep* **1993**; 42:48–51.
  33. Mitchell CM, Gershon RRM, Lears MK, et al. Risk of tuberculosis in correctional healthcare workers. *J Occup Environ Med* **2005**; 47:580–6.
  34. Mohle-Boetani JC, Miguelino V, Dewsnup DH, et al. Tuberculosis outbreak in a housing unit for human immunodeficiency virus-infected patients in a correctional facility: transmission risk factors and effective outbreak control. *Clin Infect Dis* **2002**; 34:668–76.
  35. Puisis M, Feinglass J, Lidow E, et al. Radiographic screening for tuberculosis in a large urban county jail. *Public Health Rep* **1996**; 111: 330–4.
  36. Jones T, Schaffner W. Miniature chest radiograph screening for tuberculosis in jails: a cost-effectiveness analysis. *Am J Respir Crit Care Med* **2001**; 164:77–81.
  37. National Commission on Correctional Health Care. Standards for health services in jails. Available at: <http://www.ncchc.org/pubs/catalog.html> Accessed 31 August 2007.
  38. Centers for Disease Control and Prevention. A comprehensive immunization strategy to eliminate transmission of hepatitis B virus infection in the United States: recommendations of the Advisory Committee on Immunization Practices (ACIP) Part II: immunization of adults. *MMWR Morb Mortal Wkly Rep* **2006**; 55(RR16):1–25.
  39. Weinbaum C, Sabin K, Santibanez S, et al. Hepatitis B, hepatitis C, and HIV in correctional populations: a review of epidemiology and prevention. *AIDS* **2005**; 19(Suppl 3):S41–6.
  40. Ruiz JD, Molitor F, Sun RK, et al. Prevalence and correlates of hepatitis C virus infection among inmates entering the California correctional system. *West J Med* **1999**; 170:156–60.
  41. Spaulding A, Stephenson B, Macalino G, et al. Human immunodeficiency virus in correctional facilities: a review. *Clin Infect Dis* **2002**; 35:305–12.
  42. Baham J, Bick J, Giannoni D, et al. Trends in an HIV infected incarcerated population: an autopsy review [abstract 499]. In: Proceedings and abstracts of the 40th Annual Meeting of the Infectious Diseases Society of America (Chicago). Arlington, VA: Infectious Diseases Society of America, **2002**:132.
  43. Centers for Disease Control and Prevention. Adoption of protective behaviors among persons with recent HIV infection and diagnosis—Alabama, New Jersey, and Tennessee, 1997–1998. *MMWR Morb Mortal Wkly Rep* **2000**; 49:512–5.
  44. Weinhardt LS, Carey MP, Johnson BT, et al. Effects of HIV counseling and testing on sexual risk behavior: a meta-analytic review of published research, 1985–1997. *Am J Public Health* **1999**; 89:1397–405.
  45. Wolitski RJ, MacGowan RJ, Higgins DL, et al. The effects of HIV counseling and testing on risk-related practices and help-seeking behavior. *AIDS Educ Prev* **1997**; 9(3 Suppl):52–67.
  46. Quinn TC, Wawer MJ, Sewankambo MB, et al. Viral load and heterosexual transmission of human immunodeficiency virus type 1. *New Engl J Med* **2000**; 342:921–9.
  47. Chakraborty H, Sen PK, Helms RW, et al. Viral burden in genital secretions determines male to female sexual transmission of HIV-1: a probabilistic empiric model. *AIDS* **2001**; 15: 621–7.
  48. Jenkins TC, Gardner EM, Thrun MW, et al. Risk-based human immunodeficiency virus (HIV) testing fails to detect the majority of HIV-infected persons in medical care settings. *Sex Transm Dis* **2006**; 33: 329–33.
  49. Centers for Disease Control and Prevention. HIV prevalence, unrecognized infection, and HIV testing among men who have sex with men—five US cities, June 2004–April 2005. *MMWR Morb Mortal Wkly Rep* **2005**; 54:597–601.
  50. Centers for Disease Control and Prevention. Revised recommendations for HIV testing of adults, adolescents, and pregnant women in healthcare settings. *MMWR Morb Mortal Wkly Rep* **2006**; 55:1–17.
  51. Baham J, Gavin J, Mittal S, et al. The effect of various counseling and testing methods on the rate of HIV testing among male prisoners [oral presentation 90]. In: Programs and abstracts of the 11th Conference on Retroviruses and Opportunistic Infections (San Francisco). Alexandria, VA: Foundation for Retrovirology and Human Health, **2004**.
  52. National Institute of Allergy and Infectious Diseases: scientific evidence on condom effectiveness for sexually transmitted disease (STD) prevention. Available at: <http://www3.niaid.nih.gov/NR/rdonlyres/84AF59B3-F28E-4971-8297-775D1C020FE4/0/condomreport.pdf>. Accessed 31 August 2007.
  53. Wohl D. Special report: transmission of HIV within a state prison. *Infectious Diseases in Corrections Report* **2006**; 9:1–2.