Patterns and Predictors of HIV, Sexually Transmitted Infections, and *Staphylococcus Aureus* Co-Infection among New York State Prison Inmates

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ABSTRACT

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U.S. prisons are overextended, physically restrictive environments. Overcrowding in these facilities enhances the transmission of infectious, communicable diseases. At the same time, *Staphylococcus aureus (S. aureus)* colonization and infection rates are elevated in these settings. Moreover, HIV and sexually transmitted infections (STIs) are also prevalent. The purpose of this cross-sectional, correlational secondary analysis was to describe patterns of *S. aureus* co-infection with HIV and STIs in two New York State prisons and to identify risk factors for co-infection. Cultures were obtained from the anterior nares and oropharynx of a convenience sample of male (n = 383) and female (n = 373) prisoners in each facility. Descriptive and comparative statistics were used to accomplish the study aims. Overall *S. aureus* colonization rate was 53.8%. Among men, the rates of HIV-*S. aureus* and STI-*S. aureus* co-infection were 75% and 45.7%, respectively. Among women, the rates of HIV-*S. aureus* and STI-*S. aureus* co-infection were 47.4% and 59.1%, respectively. No statistically significant differences in *S. aureus* carriage rates were detected when comparing subjects with and without HIV or STIs. Multivariate logistic regression techniques were used to identify predictors of STI-*S. aureus* co-infection in women. Insufficient numbers of subjects with HIV and men with STI-*S. aureus* limited regression modeling in these groups. After adjusting for age, race/ethnicity, and educational level, only taking more (10.1 vs 8.6) showers each week was significantly associated with increased risk of co-infection (p = .04). Results of this study suggested that rates of *S.*

aureus carriage may be uniformly elevated across many risk groups in prisons. Suboptimal sample size limited interpretation of the study results.

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As a bit of a perennial student, the decision to undertake doctoral education seemed like an obvious next step for me upon completing my bachelor's degree. This journey has been the most arduous, mentally and emotionally taxing experience of my life to date. More obstacles have come my way in this process than ever before. Consequently, I have learned more about myself and have grown tremendously as an individual. For the growth and self-realization I have experienced, I have no regrets.

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I dedicate this dissertation to my family whose prayers and confidence sustained me through this journey: it was definitely a family affair. To my daughter, Trinity: this is for you because you are mommy's inspiration.

------Nowai

Prevalence and Predictors of HIV, Sexually Transmitted Infections, and *Staphylococcus Aureus* Co-Infection among New York State Prison Inmates

Chapter 1: Introduction

Background

Infection with *Staphylococcus aureus (S. aureus)*, and more specifically, methicillin-resistant *S. aureus* (MRSA) has become increasingly more prevalent in community settings. Once exclusively associated with hospital and long-term care facilities, MRSA outbreaks have been reported in diverse populations such as athletic teams, children attending daycares, and prisoners (Adcock, et al., 1998; Campbell, et al., 2004; Centers for Disease Control and Prevention, 2003a, 2003b; Herold, et al., 1998; Kazakova, et al., 2005). These populations lack the traditional risk factors for MRSA infection, including recent hospitalization and broad-spectrum antibiotic use (Lowy, 1998; Naimi, et al., 2003). Moreover, while much attention is given to the increasing rates of MRSA, methicillin-susceptible *S. aureus* (MSSA) is also a pathogen capable of causing severe disease in infected individuals (Miller, et al., 2007).

MRSA has long been a significant cause of morbidity in hospitalized patients and is becoming increasingly more widespread (Cosgrove, et al., 2003; Friedman, et al., 2002; Seybold, et al., 2006). In 1974, MRSA accounted for 2% of all healthcare-associated *S. aureus* infections (Centers for Disease Control and Prevention, 2010d) a number which reached 64% by 2003 (Klevens, et al., 2006), highlighting the exponential increase in MRSA prevalence. While MRSA continues to plague hospital settings, recent years have seen the emergence of community-associated MRSA (CA-MRSA) strains among non-hospitalized persons without established risk factors for MRSA infection. Recent research has identified a significant number of patients entering hospitals already colonized with MRSA, suggesting acquisition of MRSA in the

community setting (Hidron, et al., 2005). Among the 7% of patients identified as entering the hospital colonized with MRSA, significant risk factors for colonization included residence in alternative housing, HIV infection, history of MRSA infection/colonization, incarceration, and antimicrobial use or hospitalization in the previous 12 months.

Although the overwhelming majority of CA-MRSA cases involve treatable localized skin and soft tissue infections (SSTIs) (Crum, et al., 2006; Crum-Cianflone, et al., 2007; Naimi, et al., 2003; Ramsetty, et al., 2010), CA-MRSA infection can potentially result in more severe, invasive sequealae, including bacteremia, pneumonia, osteomyelitis, endocarditis, and septic shock (Klevens, Morrison, et al., 2007). Indeed, according to recent evidence, CA-MRSA accounts for 14% of the 19,000 deaths attributed to MRSA infection yearly in the United States (Klevens, Edwards, et al., 2007).

HIV infection has been identified as an independent risk factor for MRSA colonization and infection (Crum-Cianflone, et al., 2007), and it has emerged as a significant cause of concern in the HIV-infected population (Popovich et al., 2010). Similar to the general population, these CA-MRSA strains most frequently manifest as SSTIs, with dramatic increases in prevalence among HIV-infected individuals (Ahuja & Albrecht, 2009; Crum-Cianflone, et al., 2009; Crum-Cianflone, et al., 2007; Lee, et al., 2005; Shet, et al., 2009; Trinh, et al., 2009). Mathews et al (2005) reported a 6-fold increase in CA- MRSA SSTIs among HIV-infected persons between 2000 and 2003, while others have reported a 17-fold increase in these infections from 2003 to 2005 (Crum-Cianflone, et al., 2007). Researchers have further calculated MRSA incidence rates among persons with HIV between 9 to12 cases per 1000 person years compared to the general population rate of 1 to 2 cases per 1000 person years (Crum-Cianflone, et al., 2009; Popovich, et al., 2010), highlighting the significantly greater burden MRSA imparts on HIV-infected

individuals. Several behavioral and environmental risk factors have been identified as potential predictors of co-infection with MRSA and HIV in the community setting. Among these risk factors are advanced immunosuppression, high-risk sexual behavior, injection drug use (IDU), antibiotic use, and history of incarceration (Crum-Cianflone, et al., 2007; Lee, et al., 2005; Mathews, et al., 2005).

Similar to trends in the community, rates of MRSA infection in incarcerated populations have increased significantly in recent years. In the Texas Department of Criminal Justice, MRSA accounted for 24% and 66% of all *S. aureus* infections in 1998 and 2002 respectively (Centers for Disease Control and Prevention, 2003a). Moreover, a study of the Texas prison system revealed an incidence rate of 12 MRSA cases per 1000 person years (Baillargeon, Kelley, et al., 2004). According to this study, the greatest co-morbid risk for MRSA infection was HIV/AIDS. Furthermore, a prospective study of HIV-infected outpatients with CA-MRSA revealed that 46% of the sample had a history of incarceration (Skiest, et al., 2006).

In addition to HIV and MRSA, sexually transmitted infections (STIs) are also common in correctional facilities (Flanigan, et al, 2009; Hammett & Drachman-Jones, 2006). Following the discontinuation of routine male STI screening in a Chicago jail, the reported cases of chlamydia and gonorrhea city-wide among men declined by 33.3% and 19.5%, respectively (Broad, et al., 2009). This overall decline in STI cases may suggest that the city was unable to capture many individuals with STIs by not screening routinely in the selected jail. It follows that a substantial percentage of individuals with STIs pass through the correctional system. These data suggest that screening in the correctional setting can capture a significant proportion of individuals with STIs that may not otherwise be diagnosed in the community.

A link between STIs and MRSA has also been hypothesized in the literature. Lee and colleagues (2005) found, in univariate analysis, that high risk sexual behavior, including multiple sex partners, inconsistent condom use, and history of STI, was significantly associated with MRSA in a sample of HIV-infected men who have sex with men (MSM). Moreover, history of STI was the greatest risk factor (OR 6.4, $p = 0.007$); however, in multivariate analysis, only inconsistent condom use and having a sex partner with skin infection remained significant risk factors. While there has been no conclusive evidence, there has been speculation that MRSA may act in some ways as an STI based on its transmission mode, i.e., primarily through close physical contact. Cook et al (2007) found evidence of heterosexual transmission of MRSA in the community where individuals developed colonization and skin infections in the pubic area after sexual contact with partners infected with MRSA.

The epidemiology of MRSA, HIV and other STIs is similar in that one important route of transmission for all three infections is close physical contact, including sexual contact (Cook et al., 2007; Crum, et al., 2006; Lee, et al., 2005). Additionally, HIV in particular results in immunosuppression, increasing the likelihood of acquiring other infections. Hence, it is plausible that co-infection with MRSA, HIV and/or other STIs occurs, but the prevalence and risk factors have not been widely examined, specifically in a high risk population such as prisoners.

Problem Statement

While data demonstrating the increased rates of MRSA colonization and infection among HIV-infected persons exist, few data are available to support this trend within prison populations. No study to date has enumerated the prevalence of either MRSA or MSSA colonization and/or infection specifically among HIV-infected inmates. The concomitant

demographic and environmental risk factors of prison populations, including increased prevalence of HIV, MRSA, poor hygiene, and crowded living conditions would suggest a magnification of the MRSA and HIV co-infection rates observed in the civilian population. Moreover, as it has been demonstrated that infection with other STIs increases the risk of contracting HIV (Fleming & Wasserheit, 1999), it is reasonable to expect elevated rates of STIs within a population where HIV is highly prevalent. The research that has been conducted in the community population supports the hypothesis that prisoners experience elevated rates of HIV, STI and MRSA co-infection. However, none of these hypotheses have been evaluated and remain speculative. Examining potential risk factors in this highly susceptible population may more clearly elucidate predictors of HIV, STI, and *S. aureus* co-infection. Targeted surveillance and prevention strategies for *S. aureus* can be developed for high-risk inmates with HIV and STIs if the prevalence of co-infection with *S. aureus* identified within this group is present in the prison setting.

Significance

According to the most recent data from the U.S. Department of Justice (2010), more than 1.6 million persons were incarcerated in U.S. prisons at year-end 2009, corresponding to an imprisonment rate of 502 prisoners per 100,000 U.S. residents. Moreover, the HIV rate within New York state prisons is reported as the highest in U.S. correctional facilities at 5.8% (U.S. Department of Justice, 2009).Correctional facilities house a high concentration of individuals with multiple factors associated with MRSA, including immunosuppressive conditions and injection drug use (Baillargeon, Black, et al., 2004). Additionally, the physical layout of these facilities whereby inmates are in close physical contact increases the likelihood of transmission of MRSA within prisons. For example, in Bedford Hills and Correctional Facility, two inmates

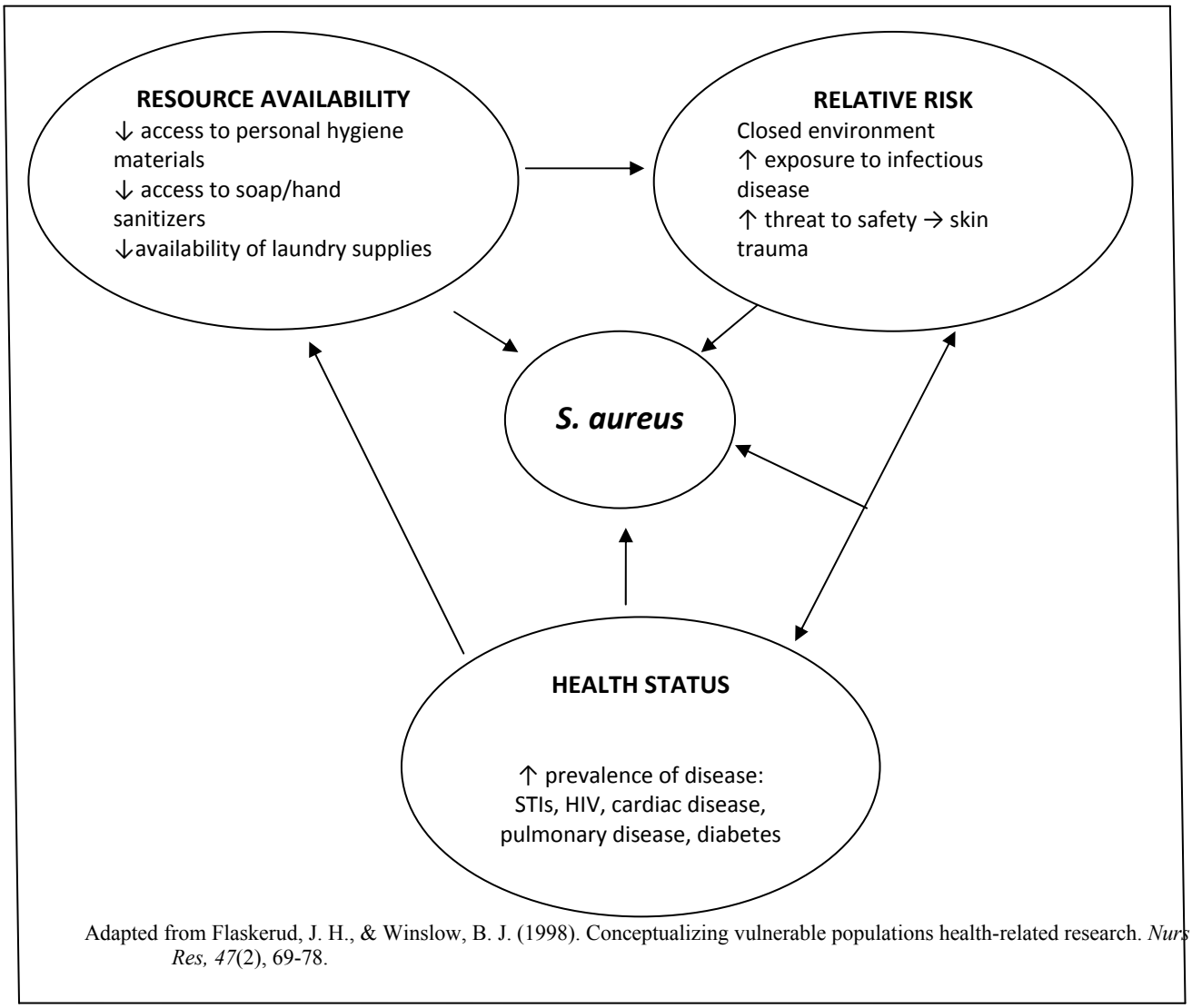
share a 10x8 feet cubicle and at Sing Sing Correctional Facility, individual inmates reside in 10x6 feet cells. Moreover, in 2008, 729,295 offenders were released from state and federal prisons into the community (U.S. Department of Justice, 2010b) and over 153,000 HIV-infected persons were released from correctional facilities in 2006 (Spaulding, et al., 2009). Inmates may acquire MRSA in prisons and, upon release, transmit the infection to individuals in the community who would not otherwise have been exposed to MRSA. This risk of prison-to community transmission is heightened if MRSA infections are not identified and effectively treated during incarceration (Okano & Blower, 2010). A community-based study in Chicago (n = 1222) revealed that the presence of HIV and history of incarceration within the previous year were significantly associated with CA-MRSA SSTI (Hota, et al., 2007). The large number of prisoners released into the community annually underscores the importance of appropriate treatment of MRSA among high-risk prisoners and the potential risk to the general public's health that is likely to result from suboptimal treatment.

Conceptual Framework

The vulnerable populations model for health-related research developed by Flaskerud & Winslow (1998) was the conceptual framework used to guide this study. This model conceptualizes relationships among resource availability, relative risk, and health status in groups considered to be vulnerable to comparatively poorer health outcomes than the general population. In this framework, the locus of responsibility for health is shared between the individual and the community in which he lives. Furthermore, the community has the greater responsibility to provide the resources, as well as access to these resources, that are conducive to favorable health outcomes. For the current study, the three concepts in the model, i.e., resource availability, relative risk, and health status were framed in the context of the prison as a

community responsible for the health of its prisoners. Specifically, colonization with *S. aureus* was identified as the primary adverse health outcome and resource availability and relative risk were examined in terms of their ability to influence this outcome. This modified model is provided in Figure 1.

Figure 1. Modified Vulnerable Populations Health-Related Research Model for Infectious Disease in Prisons



Adapted from Flaskerud, J. H., & Winslow, B. J. (1998). Conceptualizing vulnerable populations health-related research. *Nurs Res, 47*(2), 69-78.

Resource availability was conceptualized as environmental resources that promote health. In prison settings, access to resources for adequate infection control, such as alcohol-based hand sanitizers and daily showers, are limited primarily to ensure the physical safety of prisoners and

staff (Bick, 2007). As illustrated in the model, limited resources can negatively influence prisoners' relative risk of contracting infectious diseases, by increasing their exposure to and limiting their protection from these diseases. Moreover, the physical environment itself, where prisoner movement is restricted and close contact with other prisoners is common, increases the risk of acquiring *S. aureus*. The potential for injury as a result of violence is especially relevant as a source of elevated risk for *S. aureus*. If exposed, prisoners are more susceptible to contracting *S. aureus* when there is a break in the cutaneous barrier. The model also proposes that poor health status can deplete an individual's environmental and social resources by limiting access to these resources.

The relationship between health status and relative risk is a bi-directional interaction in the model, such that both concepts interact to influence each other. Health status is conceptualized as morbidity and mortality associated with specific diseases, as well as with exposure to multiple risk factors. As an example, HIV rates in prisons are markedly elevated (morbidity), which predisposes prisoners to contracting *S. aureus* as a result of an act of violence that may lead to skin trauma (relative risk). In this example, poor health status (HIV) is exacerbating the relative risk of contracting *S. aureus*, while another risk factor (violence) is acting to worsen the health status of the individual. This complex interaction between health status and relative risk was the primary relationship of interest in this study. The study examined the extent to which poor health status, operationalized as STI and HIV infection, in a high risk prison environment is associated with other negative health outcomes, i.e., *S. aureus* colonization.

Specific Aims and Hypotheses

This research aimed to expand knowledge regarding the prevalence of HIV, STI, and *S. aureus* co-infection in a prison population. Using a sample of inmates at two New York State prisons, the specific study aims and related hypotheses were to:

1. Describe the patterns of *S. aureus* (MSSA and MRSA) co-infection with HIV or STIs

   Hypothesis to be tested: The prevalence of HIV-*S. aureus* and STI-*S. aureus* co-infection will be higher than the prevalence of *S. aureus* among non-HIV infected and those without STIs.

2. Identify risk factors for *S. aureus* (MSSA and MRSA) co-infection with HIV or STIs

   Hypothesis to be tested: Risk factors for HIV-*S. aureus* and STI-*S. aureus* co-infection will be those associated with both poor hygiene practices (e.g., sharing of personal items, fewer showers) and high-risk sexual behavior (e.g., multiple sex partners, being a man who has sex with men).

The paucity of literature available in this area combined with the constellation of risk factors for HIV, STIs, and *S. aureus* present in incarcerated populations makes the proposed inquiry both timely and relevant.

This project was a secondary analysis of data from an ongoing investigation in two New York State prisons to identify patterns of *S. aureus* strain transmission within the prison, determine the factors associated with the development of clinical infections within the prison, and identify risk factors associated with colonization and/or infection with *S. aureus* at prisoner intake and at release.

Summary

The burden of HIV has been substantial over the past three decades. HIV has evolved from a disease primarily affecting MSM to a disease that has touched all demographics across the United States. Advancements in HIV treatment, specifically the advent and success of highly active antiretroviral therapy (HARRT), have transformed HIV from an acute to chronic illness and effectively extended the life expectancy of those living with the disease. Consequently, individuals infected with HIV are susceptible to a wide range of other chronic and infectious diseases by virtue of their compromised immune system. MRSA is one such infection that research suggests disproportionately affects HIV-infected individuals. The literature is replete with evidence of increasing rates of MRSA among HIV-infected persons in the community. However, prisons represent an important setting where the relationship between HIV and MRSA has yet to be studied. Moreover, there has been speculation that MRSA may behave in some ways as an STI and may be more prevalent among those individuals infected with or at risk for STIs (Cook, et al., 2007; Crum-Cianflone, et al., 2007). Additionally, due to the potential for MSSA to cause significant morbidity in afflicted individuals, it is necessary to not limit investigation of *S. aureus* to MRSA alone. Behavioral risk factors, including IDU and high-risk sexual activity as well as environmental risk factors, such as poor hygiene and closed living quarters all converge in the prison setting. This convergence of risk factors may serve to exacerbate the occurrence of HIV-*S. aureus* and STI-*S. aureus* co-infection in incarcerated populations and warrants further investigation.

Chapter 2: Review of the Literature

Introduction

This chapter will explore the epidemiology of each of the major topics of interest: HIV, STIs, and *S. aureus.* These topics will first be explored in the general, non-incarcerated population. The chapter will conclude with a discussion of how these diseases impact correctional settings.

HIV/AIDS in the United States

HIV/AIDS has had devastating effects on individuals and society at large since its inception in the 1980s. There were an estimated 1.2 million people living with HIV in the U.S. at year-end 2008 (Centers for Disease Control and Prevention, 2011b). Even more alarming is the fact that 20% of these cases were undiagnosed. Undiagnosed estimates are derived using a back-calculation approach based on the number of HIV diagnoses in a calendar year and HIV disease severity of individuals within the calendar year of diagnosis (Hall, et al., 2008). The most recent data available report an incidence of 56,300 HIV cases in 2006 (Hall, et al., 2008). At year-end 2008, there were an estimated 479,868 children and adults living with AIDS and 594,496 persons had died of AIDS in the U.S, since these data have been collected (Centers for Disease Control and Prevention, 2011a). In recent years, HIV/AIDS has affected certain demographics disproportionately, further exacerbating their propensity to poor health outcomes. Although African-Americans comprise only 12% of the total U.S. population, they accounted for 48% of persons living with HIV/AIDS in 2007 (Centers for Disease Control and Prevention, 2009b).

While HIV/AIDS remains an incurable disease, the advent of highly active antiretroviral therapy (HAART) in the mid-late 1990s has markedly reduced morbidity and mortality related to HIV/AIDS in the U.S., thereby transforming it from a more acute disease into a chronic

condition (Cambiano, et al., 2010; Hammer, et al., 2008). Strict adherence to complex HAART regimens is necessary to realize the benefits of therapy, including viral load suppression (Mannheimer, et al., 2002), increased CD4 counts (Wood, et al., 2004), and reduced risk of drug resistance (Hammer, et al., 2008). This change in disease treatment and trajectory has resulted in new challenges related to suboptimal medication adherence, which can result in increased risk of transmission of resistant strains, thereby limiting treatment options (Este & Cihlar, 2010). Nevertheless, despite prevention education and advancements in treatment of HIV, both the incidence and prevalence continue to rise in certain demographics, such as African-Americans. As HIV-infected individuals can now expect to live significantly longer lives than those infected at the onset of the epidemic, these individuals are more susceptible to contracting other debilitating infectious and chronic diseases.

Sexually Transmitted Infections in the United States

According to the Centers for Disease Control and Prevention (2009d), there are approximately 19 million new cases of STIs in the U.S. annually. Common STIs include syphilis, gonorrhea, chlamydia, and genital herpes, in addition to HIV. Of these infections, syphilis, gonorrhea, and chlamydia are categorized as notifiable diseases with federally-funded control programs. However, because most infected individuals are asymptomatic, they are never diagnosed and remain untreated. The consequences of non-treatment can be severe and include ectopic pregnancy and infertility in women and sterility in men, although this is less common. Adolescents and females are at greatest risk for contracting STIs due to their physical anatomy which makes them more susceptible to the microorganisms responsible for STIs (Centers for Disease Control and Prevention, 2009d)

Chlamydia is the most frequently reported STI in the U.S. with over 1.2 million cases reported in 2008. The infection is caused by the bacterium *Chlamydia trachomatis* and can be transmitted via vaginal, anal, or oral sex or from mother to infant during childbirth (Centers for Disease Control and Prevention, 2010a). Chlamydia rates for women have increased substantially in the past decade. In 2000, the rate of chlamydia infection among New York State women was 273.6 per 100,000 and increased to 616.7 per 100,000 by 2008. Rates of chlamydia infection in New York State remained below national levels until 2007 when they outpaced the national rates (Centers for Disease Control and Prevention, 2010b).

Gonorrhea is also a bacterial infection caused by *Neisseria gonorrhoeae*. Despite the fact that gonorrhea is a notifiable disease, the CDC estimates that only half of the cases are actually reported, primarily due to infected individuals not seeking medical care. In 2006, there were 358,366 cases of reported gonorrhea in the U.S. corresponding to a rate of 120.9 per 100,000 persons. (Centers for Disease Control and Prevention, 2008)

Unlike chlamydia and gonorrhea, genital herpes is a viral infection caused by the *Herpes simplex* virus type 2 (HSV-2). The disease is characterized by intermittent outbreaks of blisters in the genital area that break, leaving tender sores that may take several weeks to heal. The HSV-2 virus can be spread by sexual contact with an infected individual even if the person does not have an active outbreak. Approximately 16% of people ages 14 to 49 years in the U.S. are infected with HSV-2. Infection rates differ between men and women at 11% and 20%, respectively. Because genital herpes is caused by a virus, there is no curative pharmacological therapy; however, antiviral medications are available to shorten the disease course and prevent outbreaks (Centers for Disease Control and Prevention, 2010c).

There are many similarities in symptomatology and complications among the common STIs. Most infected individuals are asymptomatic or exhibit only mild, non-descript symptoms, such as vaginal discharge. Because most are asymptomatic, routine screening of sexually active persons for STIs is the most effective means to identify and provide timely treatment for these infections. Pelvic inflammatory disease is the most common complication of untreated STIs in women and can result in infertility. Moreover, the presence of an STI makes individuals more susceptible to HIV infection if exposed and also increases the ability of HIV-infected individual to transmit the disease (Fleming & Wasserheit, 1999). Table 2.1 provides a summary of prevalence rates of select STIs in the U.S.

Table 2.1

Estimated Rates of Chlamydia, Gonorrhea, and Syphilis in the U.S and Correctional Facilities, 2008

Disease	**Men (%)**		**Women (%)**	
	U.S.[a]	**Corrections**	**U.S.[a]**	**Corrections**
Chlamydia	0.21	7[b]	0.58	8.5[b]
Gonorrhea	0.10	1.4[b]	0.12	2.6[b]
Syphilis	0.02	2.3[c]	0.008	7.5[c]

[a] Source: CDC (2009c). *Sexually Transmitted Disease Morbidity 1984 - 2008 by Gender.*
[b] Source: CDC (2009d). *Sexually Transmitted Diseases Surveillance, 2008.*
[c] Source: Kahn, et al., (2006). Overview of sexually transmitted diseases. In M. Puisis (Ed.), *Clinical practice in correctional medicine* (2nd ed., pp. 175-181). Philadelphia: Mosby Elsevier.

MRSA in the United States

Healthcare-associated MRSA (HA-MRSA). MRSA has been endemic in U.S. hospitals for several decades. The first cases of MRSA in hospitals were reported in the 1960s (Barrett, et al., 1968). Clinically, MRSA presents several treatment challenges including resistance to all beta-lactam antibiotics (Naimi, et al., 2003) and the ability to lie dormant for unpredictable

lengths of time in colonized persons (Chambers & DeLeo, 2009). Common sites of MRSA infection in healthcare settings include the blood, respiratory tract, and urinary tract (Klevens, Morrison, et al., 2007).

HA-MRSA infections are associated with significant morbidity and mortality as they affect the most vulnerable patients who are already battling a host of other acute and chronic ailments. There are an estimated 126,000 hospitalizations attributed to MRSA annually (Kuehnert, et al., 2005) and a survey of over 1200 U.S. hospitals found an overall MRSA prevalence rate of 46.3 per 1000 inpatients (Jarvis, et al., 2007). In addition to the human costs, fiscal costs associated with MRSA have been substantial, estimated at $3.2 to $4.2 million annually primarily due to the prolonged hospitalization required as a result of the infection (U.S. Outcomes Research Group, 2005). Cosgrove and colleagues (2005) examined differences in mortality, length of stay, and hospital charges between patients with MRSA and MSSA bloodstream infections. They reported a median attributable length of stay of 2 days and a median attributable hospital charge of $6,916 in the MRSA patients, both of which were significantly higher than MSSA.

Community-associated MRSA (CA-MRSA). MRSA was associated exclusively with hospital and long-term care facilities for many years until the emergence of MRSA infection among healthy community-dwelling individuals. The first cases of CA-MRSA in the U.S. have been traced back to the early 1990s among children with no traditional risk factors for MRSA in Chicago (Herold, et al., 1998). Since then, outbreaks have been reported in such diverse populations as athletes (Begier, et al., 2004; Centers for Disease Control and Prevention, 2003b; Kazakova, et al., 2005), MSM (Diep, et al., 2008), military personnel (Aiello, et al.,

2006), children attending daycares (Adcock et al., 1998), and prisoners (Aiello, et al., 2006; Centers for Disease Control and Prevention, 2003a, 2003c).

Colonization with MRSA is increasingly problematic in the community. Data collected from a nationally representative sample of non-institutionalized persons (n = 9,622) for the National Health and Nutrition Examination Survey (NHANES) from 2001-2002 estimated a 0.8% prevalence (2.3 million persons) of nasal MRSA colonization (Kuehnert, et al., 2006). The prevalence of nasal MRSA colonization increased significantly to 1.5% in the subsequent years 2003-2004 according to the NHANES sample (n = 9,004) for those years (Gorwtiz, et al., 2008). Genotypes typically associated with CA-MRSA strains accounted for the majority of the strains isolated. From 2001-2004, colonization with specific CA-MRSA genotypes increased from 7% to 24.2% as would be expected with the rise in MRSA colonization in the community setting (Tenover, et al., 2008).

MRSA preferentially colonizes the anterior nares (Cenizal, et al., 2008), although colonization also occurs in other body sites, including the skin, throat, vagina, and gastrointestinal tract (Boyce, et al., 2005; Eveillard, et al., 2006; Nilsson & Ripa, 2006**)**. Colonization with MRSA is often a prerequisite to infection, although most colonized individuals do not progress to infection (Miller, et al., 2003).

Rates of MRSA clinical infections have also risen significantly in recent years. A study of military medical facilities estimated an incidence of 154.7 CA-MRSA infections per 100,000 persons in 2004 (Crum, et al., 2006). Results further suggested that many of the MRSA infections identified resulted from intrafamilial spread, reinforcing the significant role of close contact in the transmission of MRSA. Treatment recommendations for CA-MRSA infections vary, depending on the site of the infection and clinical presentation. Surgical incision and

drainage, without adjunct antimicrobial therapy, is recommended as first-line therapy for cutaneous abscesses depending on the number and size of lesions and the presence of other medical co-morbidities (Lee, et al., 2004).

Comparison of HA- and CA- MRSA. Community-associated MRSA is distinguished from HA-MRSA both epidemiologically and microbiologically. Individuals infected with CA-MRSA lack the traditional risk factors associated with HA-MRSA, e.g., long-term antibiotic use, recent hospitalization or surgery, residence in a long-term care facility, dialysis, and indwelling percutaneous medical devices and catheters (Brumfitt & Hamilton-Miller, 1989; Lowy, 1998). Community-associated MRSA is more likely to manifest as a skin and soft tissue infection (SSTI), whereas HA-MRSA tends to infect sites such as the blood, lungs, and urinary tract (Naimi, et al., 2003).

Healthcare-associated and community-acquired MRSA exhibit distinct genotypes, with the USA-100 and USA-200 clones more often isolated in HA-MRSA samples (McDougal, et al., 2003) and the USA-300 and USA-400 clones most often associated with CA-MRSA (Diep, et al., 2008; Tenover, et al., 2006). Although the USA-300 clone was first isolated from CA-MRSA samples and still predominates in community-dwelling individuals, researchers have found that this clone is infiltrating healthcare facilities and becoming a cause of HA-MRSA infections (Gonzalez, et al., 2006; Liu, et al., 2008; Maree, et al., 2007; Popovich, et al., 2008; Seybold, et al., 2006; Skov & Jensen, 2009).

Antibiotic susceptibility profiles also vary, with CA-MRSA strains exhibiting susceptibility to a wider range of antibiotics than HA-MRSA (Chambers & DeLeo, 2009; Naimi, et al., 2003). Results from a study examining differences between CA- and HA-MRSA in Minnesota revealed CA-MRSA strains to be significantly more susceptible to ciprofloxacin,

clindamycin, erythromycin, and gentamicin compared to HA-MRSA strains. More than 90% of both CA-MRSA and HA-MRSA strains were susceptible to rifampin, tetracycline, vancomycin, and trimethoprim/sulfamethoxazole (TMP/SMZ) (Naimi, et al., 2003). In HIV-infected persons with MRSA, antibiotic therapy has been shown to be further complicated by resistance to many of the drugs commonly prescribed for non-HIV-infected persons with MRSA (Krucke, et al., 2009). Over 90% of MRSA cultured from abscesses were resistant to cefazolin and erythromycin; 54.8% were resistant to ciprofloxacin and 35.4% were resistant to clindamycin. No resistance to rifampin, vancomycin, or TMP/SMZ was identified, although vancomycin resistant strains have been reported (Tenover, et al., 2001).

HIV and MRSA: Risk Factors for Co-Infection

The literature suggests that HIV-infected individuals are colonized and infected with MRSA at higher rates than the general population. Cenizal and colleagues (2008) estimated a 10% prevalence of MRSA among HIV-infected ambulatory patients, representing an exponential increase compared to the general population prevalence of 1.5% (Gorwitz, et al., 2008). Similarly, Hidron et al (2005) found that HIV-infected persons entering an urban hospital were significantly more likely to be colonized with MRSA compared to HIV-negative persons (17% vs. 6%; OR = 3.2; $p < 0.001$).

Research identifying the microbiological link between CA-MRSA and HIV has been limited to date and primarily retrospective in nature. Several factors, including immunodeficiency, high-risk sexual behaviors, injection drug use (IDU), and widespread use of antibiotics, have been hypothesized to contribute to the increased rates of CA-MRSA infection among HIV-infected persons (Crum-Cianflone, et al., 2007; Lee, et al., 2005; Mathews, et al.,

2005). However, to date, there has been no consensus as to the underlying factors contributing to the increased rates of CA-MRSA in the HIV population.

Immunosuppression, the hallmark of HIV disease, has been hypothesized to contribute to the increased rates of MRSA among HIV-infected persons. However, conflicting data exist in the literature regarding if and how the degree of immunosuppression in HIV-infected individuals contributes to subsequent MRSA infection. Crum-Cianflone et al (2009) identified a significant risk for MRSA infection in an HIV-infected sample with lower CD4 counts, a finding that has been supported by others in the literature (Cenizal, et al., 2008; Mathews, et al., 2005; Ramsetty, et al., 2010). However, Trinh et al (2009) found that advanced HIV status, as evidenced by CD4 count <50 cells/mm^3, was not associated with MRSA infection in a small HIV-infected sample (n = 43). Moreover, a study by Shet et al (2009) revealed significantly higher rates of MRSA colonization and infection among non-immunosuppressed HIV-infected patients when compared to those not infected with HIV, suggesting that the presence of HIV, regardless of its stage, is a significant risk factor for contracting MRSA. Given the improvement in immune status associated with strict adherence to HAART, some researchers suggest that better management of HIV may mitigate the risk of MRSA infection in this population (Ramsetty, et al., 2010; Crum-Cianflone, et al., 2009) although empirical data to support this claim are lacking.

High-risk sexual behavior has also been implicated in the increased rates of co-infection with MRSA observed among HIV-infected persons. Several studies have suggested that MSM have significantly elevated risks of contracting MRSA (Lee et al, 2005; Mathews et al, 2005; Diep et al, 2008). High-risk sexual behavior, including having multiple sex partners and inconsistent condom use, was associated with increased risk of CA-MRSA SSTI in a sample of HIV-infected MSM (Lee et al., 2005). A population-based study conducted by Diep et al (2008)

revealed incidences of USA-300 MRSA infection to be 26 and 170 cases per 100,000 in the San Francisco general population and MSM, respectively. Interestingly, although both HIV infection and being a MSM were risk factors for multidrug-resistant USA300 infection, the influence of being an MSM persisted as an independent predictor of HIV status. This independent influence of being an MSM led the authors to hypothesize that the potential skin trauma associated with sexual activity in this population may exert the greatest influence in contracting MRSA.

Injection drug use is prevalent among HIV-infected individuals who also carry MRSA. Mathews et al (2005) reported that 23% of their HIV-MRSA co-infected sample had a history of IDU. Men who have sex with men and injection drug users were more likely to be infected with CA-MRSA compared to individuals with neither risk factor (adjusted hazard ratio = 5.0; p = 0.008), although the individual influence of IDU was not reported. The sharing of dirty syringes among injection drug users may be the primary mechanism whereby MRSA is transmitted between HIV-infected individuals in this particular population.

Researchers have also reported conflicting data regarding the role of antibiotic use in MRSA among HIV-infected persons. The Centers for Disease Control and Prevention (2009a) recommend the use of TMP/SMZ to prevent opportunistic infections, namely pneumocystis pneumonia, in HIV-infected persons. Lee et al (2005) found that use of TMP/SMZ was protective against CA-MRSA SSTI among HIV-infected MSM. Additionally, Cenizal et al (2008) demonstrated that current use of TMP/SMZ was protective for MRSA colonization among a sample of HIV-infected ambulatory patients. Similarly, Trinh et al (2009) found current or recent use of antibiotics to be associated with a low rate of MRSA colonization in an HIV-infected sample. These findings are contrary to results reported in the general population, in which antibiotic use is associated with greater risk of MRSA infection (Hidron, et al., 2005).

However, they are consistent with the supposition that prophylactic antibiotic use reduces the risk of developing opportunistic infections in this population. Nevertheless, other studies have revealed increased risk of MRSA colonization and infection among HIV-infected individuals who received antibiotics prior to MRSA infection (Shet, et al., 2009; Skiest, et al., 2006). Crum-Cianflone and colleagues (2007) found recent use of beta-lactam antibiotics to be predictive of CA-MRSA in their HIV-infected sample. A study of ambulatory HIV clinic patients identified treatment with clindamycin in the previous 12 months as an independent risk factor for MRSA USA-300 infection (Diep, et al., 2008).

Infections in United States Prisons

There are an estimated 2.3 million persons incarcerated in U.S. jails and prisons, more than in any other country (U.S. Department of Justice, 2010a). Moreover, rates of certain health conditions, including HIV/AIDS, substance abuse, and mental illness have been found to be considerably higher in prison than the general population (Feliner & Abramsky, 2003; Hammett, et al., 2001; Pollack, et al., 1999). Research suggests that many high-risk behaviors in which inmates engage prior to incarceration, including unprotected sex and IDU, persist in correctional facilities (Hammett, 2006). Despite the fact that sexual contact is prohibited in jails and prisons, a survey of inmates in one state estimated that up to 44% of inmates have sexual contact with other inmates (Krebs, 2002). The risk of contracting infectious diseases may be further amplified due to the absence of preventive mechanisms such as condoms and clean needles (Mahon, 1996; Swartz, et al., 2004).

HIV. Prisons and jails house a significant proportion of the HIV-infected population in the U.S. It was recently estimated that approximately 17% of all HIV-infected persons and 12% of persons living with AIDS in the U.S. come into contact with the corrections system annually

(Spaulding, et al., 2009). Consequently, U.S. prisons and jails report substantially higher proportions of HIV-infected persons compared to the general population. The U.S. Department of Justice (2009) reported that at year-end 2008, 1.5% of state and federal prisoners were infected with HIV compared to 0.47% in the civilian population. In New York, the total number of HIV-infected prisoners decreased from 2007 to 2008; nevertheless, the state reported the largest percent of HIV-infected prisoners at 5.8%. Moreover, the rate of AIDS among prisoners (0.41%) is more than double the rate in the general population (0.17%).

Sexually transmitted infections. Sexually transmitted infections represent a significant burden of disease in correctional facilities. A recent review of the literature conducted by Hammett (2009) highlighted the disproportionate burden of STIs within U.S. prisons and jails. Table 2.1 provides a summary of selected STI prevalence rates in correctional facilities discussed in that review.

Individuals entering jails and prisons account for a substantial proportion of the overall reported cases of several STIs. Upon discontinuation of routine STI screening at a male Chicago jail, the number of reported cases of chlamydia and gonorrhea among men in the city decreased from 40.6% to 5.1% and 16.3% to 1.9%, respectively (Broad, et al., 2009). These data underscore the fact that universal screening for STIs in jails captures a significant proportion of infected persons that may otherwise remain undiagnosed. Many of the individuals entering these facilities have their first interaction with primary health care as a result of being incarcerated. Consequently, incarceration provides an opportunity for medical screening and intervention in an otherwise hard to reach population. Mandatory and voluntary screening programs for common STIs, such as chlamydia and gonorrhea, in correctional facilities identify many cases of previously undiagnosed and untreated infections (Mertz, et al., 2002).

MRSA. While outbreaks of MRSA in prisons have been reported across the country in Georgia, California, and Texas (Centers for Disease Control and Prevention, 2003a), there is evidence to suggest that MRSA may be endemic in prison populations (Lowy, et al., 2007). Lowy and colleagues (2007) studied *S. aureus* colonization and infection in New York State prisons. Among isolates of clinical infection and colonization, 48.3% (29/60) and 10.5% (13/124) of the *S. aureus* positive samples were MRSA positive, respectively ($p < 0.001$).

The restrictive nature of prisons limits inmate and staff access to many basic infection-prevention supplies, including certain bath soaps, alcohol-based hand sanitizer, and clean laundry (Aiello, et al., 2006; Bick, 2007). Prisons frequently operate above capacity and lack the facilities to isolate infected individuals or consistently provide personal protective equipment for staff. Furthermore, the often abrupt transfer and discharge of inmates has been suggested as a barrier to effective diagnosis and treatment of infections, including MRSA (Bick, 2007).

Risk factors for MRSA infection identified during outbreaks in correctional facilities are primarily associated with poor hygiene and inadequate infection-control practices. An investigation of a 2001 MRSA outbreak in a Georgia detention center identified prolonged incarceration (>36 days) and outdoor work duty as independent risk factors for MRSA infection. A second investigation during 2002 at a Georgia prison identified previous antimicrobial use, self-draining of boils, skin laceration, washing clothes by hand, sharing soap, and arrival at the prison after 2001 as risk factors for MRSA infection. In 2001, the Los Angeles County jail system observed inadequate infection-control measures in the clinic area after an outbreak of MRSA was identified from a series of suspected spider bites. Finally, in 2001 the Texas Department of Criminal Justice identified previous skin infections and recent close contact with an MRSA-infected inmate as risk factors for MRSA infection in the system's largest intake

facility. Following each of these outbreaks, administrators in these facilities implemented new guidelines targeted at improving infection control practices of both inmates and staff. Measures taken within the various facilities included routine surveillance for skin lesions, culturing of all draining skin lesions, standardized wound treatment recommendations with non- beta-lactam antimicrobials, hygiene education for inmates, and more frequent laundry changes for inmates. Implementation of these guidelines led to varying levels of success from non-significant decreases in the incidence of MRSA to near eradication of MRSA infections in these facilities (Centers for Disease Control and Prevention, 2003a; Wootton, et al., 2004).

Summary

The burden of MRSA on HIV-infected persons in the community has been studied. Research has revealed elevated rates of MRSA among HIV-infected persons and several risk factors for these elevated rates have been suggested, including high-risk sexual behavior. While the impact of MRSA on HIV-infected persons has been examined in the community, the burden of neither MRSA nor MSSA on HIV-infected prisoners has been documented. Many of the risk factors identified in the community converge in the prison setting, increasing the likelihood of co-infection. However, neither the HIV- nor broader STI-infected populations have been studied and warrant further investigation. The aim of this study was to help fill this knowledge gap.

Chapter 3: Methodology

Specific Aims

Using a sample of inmates at two New York State prisons, the specific study aims were to:

1. Describe the patterns of *S. aureus* (MSSA and MRSA) co-infection with HIV or STIs
2. Identify risk factors for *S. aureus* (MSSA and MRSA) co-infection with HIV or STIs

Study subjects were a convenience sample comprised of a subset of inmates who participated in a larger study of *S. aureus* transmission in New York State prisons as described below.

Research Design

The study was a secondary analysis of data from a larger cross-sectional study described below, using descriptive and correlational analyses.

Parent Study

This study was part of a larger study (Risk Factors for Spread of *Staphylococcus aureus* in Prisons, National Institutes of Health, National Institute of Allergy and Infectious Diseases #1R01AI082536-01A1; Lowy and Larson, Principal Investigators) to develop a comprehensive understanding of the risk factors and transmission dynamics of *S. aureus* in New York State prisons. Specific aims of the larger study are to: 1) identify patterns of *S. aureus* strain transmission within the prison; 2) determine the factors associated with the development of clinical *S. aureus* infections within the prison and; 3) identify risk factors associated with colonization and/or infection with *S. aureus* at prisoner intake and at release. The investigators

anticipate the information gained from their study will be used to design interventions to reduce the risk of *S. aureus* infection within the prison population. All data were collected and managed by two trained research assistants (RAs) and a study coordinator employed by the parent study. One RA was a female with a baccalaureate in biology and the other RA was a male with baccalaureate degrees in special education and social psychology. Both RAs had previous experience interviewing vulnerable populations.

Setting and Sample

The overall study population for the dissertation was dictated by the parent study. Participants were recruited from two New York State prisons: Sing Sing Correctional Facility (Sing Sing) and Bedford Hills Correctional Facility (Bedford Hills). Sing Sing is a maximum security facility which houses approximately 1731 male prisoners. Approximately 30-50 inmates are admitted to the facility weekly and 59 are released monthly. The average length of incarceration is 21 months. Inmates from

Bedford Hills is the only maximum security female facility in the state and houses approximately 745 prisoners. This facility serves as a reception center for female inmates who are awaiting transfer to other correctional facilities where they will carry out their sentences or who have been sentenced to a maximum security facility. Approximately 20-30 inmates are admitted to the facility weekly and 29 are released monthly. The average length of incarceration is 38 months. The majority of prisoners in both facilities are African-American and convicted for violent or drug-related crimes. Table 3.1 provides a summary of the demographic characteristics of each facility.

Table 3.1
Prisoner Characteristics at Sing Sing and Bedford Hills Correctional Facilities

Characteristic	**Sing Sing**	**Bedford Hills**
Number of inmates	1731	745
Number of new inmates/week	30-50	20-30
Number of inmates released/month	59	29
Ethnic status (%)		
African-American	55	50
Hispanic	31	22
White	11	27
Age (years)		
16-20	23	28
21-29	356	208
30-39	534	191
40-49	521	208
50-59	221	81
60+	76	29
Average length of incarceration (months)	21	38
Prior arrest record (%)		
No prior arrest	17	37
No prior conviction	6.5	7.5
Prior conviction	16	17
Prior jail term	17.5	21
Crime group (%)		
Violent felony	80	65
Drug felony	12	10

Note: Data current as of March 2011

Recruitment

Eligibility criteria to be included in the study were: inmate at Bedford Hills or Sing Sing prison with the ability to provide informed consent; at least 16 years of age; a sentence of at least one-year; new prisoner undergoing the initial intake process. Prisoners on death row and in isolation facilities were excluded due to security reasons and because they have minimal contact with other prisoners.

The RAs visited each facility for 4-6 hours/day for two days each week. Potential participants were approached by the RAs during the prisoner intake process. During the intake process, inmates at Bedford Hills were approached by the RAs as they awaited their initial

medical screening. Inmates at Sing Sing were approached in the State Shop, the facility's general processing center. Each facility provided the RAs with a list of individuals currently being processed for intake. The RAs then invited each individual prisoner into a private room where an informational pamphlet providing an overview of MRSA and describing the study was given. The RAs then explained the study, with its associated risks and benefits, to prisoners expressing interest. The RAs answered any questions the prisoners had and written informed consent was obtained from all who agreed to participate.

Data Collection Procedures

Data were collected from November 2009 to January 2011 via interviews, medical record review, and biological cultures. Study interviews took place in individual exam rooms during inmates' initial processing into each facility. Correction officers accompanied prisoners to the interview, but were not present in the interviewing room to maintain participant confidentiality.

After the prisoner agreed to participate and provided informed consent, s/he was assigned a unique study number that was associated with all study-related forms and biological cultures obtained. Research assistants obtained separate cultures from each participant's anterior nares, oropharynx, and any other visible or participant-reported site of infection or open wound. Cultures were obtained by gently rotating a pre-moistened culturette in both anterior nares or the posterior pharynx and then placing the swab in transport media. Each culture was labeled with the participant's study number and site of culture. The RAs then conducted a structured interview using a standardized interview questionnaire. Additionally, the RAs obtained data from the participant's Department of Correctional Services (DOCS) medical records using an extraction form developed for the study.

All women at Bedford Hills are tested for syphilis, gonorrhea, chlamydia, and given PAP smears at intake. All men at Sing Sing are tested for syphilis at intake. Inmates at both facilities are offered voluntary HIV testing. Results from these tests are available in the medical record.

Microbiological and Molecular Epidemiological Techniques

Microbiological culturing was performed in the laboratory of the principal investigator of the parent study (Lowy) at Columbia University Medical Center. Each swab was incubated in 6% NaCl supplemented Tryptic Soy Broth (Becton Dickinson) at 35˚C overnight in order to enrich *S. aureus* selection before being plated onto Mannitol Salt agar (Becton Dickinson) and incubated at 37˚C for 48 hours. Individual positive colonies were then streaked onto sheep blood agar (5% on trypticase soy agar) before being confirmed as *S. aureus* with the latex coagulase test Staphaurex (Remel, KS) (Lowy, et al., 2007). Positive samples were *spa*-typed and compared using the Ridom Staph Type software (Ridom GmbH, Wuerzburg, Germany) (Harmsen, et al., 2003; Koreen, et al., 2004). Positive methicillin-resistant isolates were Staphylococcal Chromosomal Cassette (SCC) *mec* typed as previously described (Boye, Bartels, Andersen, Moller, & Westh, 2007; International Working Group on the Classification of Staphylococcal Cassette Chromosome Elements, 2009; Oliveira & de Lencastre, 2002). Parameters for the Based Upon Repeat Pattern (BURP) clustering within the Ridom StaphType software using standards determined elsewhere (Mellmann, et al., 2008; Weniger, et al. 2006) were used to further characterize the isolates. Positive samples were also examined by pulsed field gel electrophoresis (PFGE) via *Sma*I digest (Hallin, et al., 2007).

Consideration of Human Subjects

The parent study was approved by the Institutional Review Board (IRB) of Columbia University Medical Center and the Office of Program Planning, Research, and Evaluation in the

New York State DOCS. A certificate of confidentiality was obtained from National Institutes of Health to protect identifiable research information from forced disclosure. The student investigator was added as personnel to the IRB protocol for the larger study and became an integral part of the study team, attending weekly team meetings and actively participating in the development and testing of data collection instruments, methods, and the database.

Study Variables and Instruments

Variables. Demographic data collected included age, race/ethnicity, gender, highest level of education, recent residence, and history of injection drug use. Additional information regarding medical history was obtained, including HIV status, history of STIs, history of skin conditions, and antibiotic use among others. The primary outcome variables were STI-*S. aureus* and HIV-*S. aureus* co-infection. Colonization with *S. aureus* (MSSA and/or MRSA) in either the anterior nares or oropharynx was considered positive. Table 3.2 summarizes study variables of interest.

Table 3.2

Study Variables, Source of Data, and Levels of Data

Variable	**Data Source**	**Operationalization**	**Measurement**	**Level of Data**
Age	Interview	Years	Years	Continuous
Race/Ethnicity[a]	Interview	Latino or Hispanic; Black/African American/African descent; White; Asian/Pacific Islander; other	y, n, dk, ref, other	Categorical
Sex	Interview	Site of recruitment	BH = female; SS = male	Categorical
Education[b]	Interview	Highest level of education completed	< HS; HS/ GED; some college; college grad;	Categorical
Previous residence	Interview	Most recent residence	Jail, prison, other	Categorical
General health[c]	Interview	General state of health	Poor, fair, good, excellent, ref	Categorical
Chronic disease[d]	Interview	Presence of diabetes, cancer, cardiovascular, pulmonary, kidney, liver, or other disease	y, n, dk, ref	Categorical
HIV status	Interview, Chart	HIV-positive	y, n, dk, ref	Categorical
Sexually Transmitted Infection	Chart	Herpes; syphilis; gonorrhea; chlamydia; HPV; other	y, n	Categorical
Sexual activity	Interview	Sexually active in previous six months	y, n	Categorical
Sexual partners[e]	Interview	Number of male and female partners in previous six months	Numeric	Continuous
Showers	Interview	Number of showers taken weekly	Numeric	Continuous

Table 3.2 *cont'd*

Variable	Data Source	Operationalization	Measurement	Level of Data
Personal item use	Interview	Share any personal items	y, n, dk, ref	Categorical
Shaving	Interview	Shave any body part	y, n, dk, ref	Categorical
Chronic skin conditions[d]	Interview	Psoriasis; eczema; acne; other	y, n, dk, ref	Categorical
S. aureus history[d]	Interview	Previous *S. aureus* infection	y, n, dk, ref	Categorical
Antibiotic use[d]	Interview	Antibiotic use in previous six months	y, n, dk, ref	Categorical
Injection drug use	Interview	Current or past use	y, n, dk, ref	Categorical
S. aureus colonization	Nasal and oropharyngeal culture	Positive culture	y, n	Categorical

Note: y= yes; n=no; dk=don't know; ref= refused; BH = Bedford Hills; SS = Sing Sing; HS = high school; GED = general educational development; All categorical data was dummy coded as 0 (absence) or 1 (presence) of condition unless otherwise noted.

[a] Responses dichotomized to Black, non-Black

[b] Responses dichotomized to less than high school, high school graduate or more

[c] Responses dichotomized to fair/poor, excellent/good

[d] A response of 'don't know' was coded as 'no'

[e] Responses used to create new variable reflecting multiple sex partners(i.e., response of >1) and men who have sex with men (i.e., male subject who responded as ≥1 male partner)

Interview questionnaire. The questionnaire was initially developed from previous community-based surveys of MRSA colonization and from preliminary interviews obtained during a prevalence survey of MRSA colonization in prisoners (Lowy, et. al., 2007). It was further pilot tested from November to December 2009 using the first 17 interviews at Sing Sing and the first 35 interviews at Bedford Hills. The final questionnaire contained 51 items in the following 14 categories: demographics, education, housing history, occupation during incarceration, exercise during incarceration, hygiene during incarceration, chronic or ongoing medical condition(s) or infections, skin problems and staphylococcal infections, antibiotic use,

tattoos and piercings, sexual relationships, substance use, group activities during incarceration, and history of fighting. Participants were asked to recall responses to items anytime in the past and/or within the previous six months. The questionnaire was administered by the interviewer reading each question to the participants and recording their responses. The interview took an average of 15 minutes to complete.

Medical record extraction form. The medical record data extraction form was developed from an extensive literature review for two purposes: (a) as a reliability check for available data which were also self-reported by inmates, and (b) to obtain additional health-related information of relevance to potential *S. aureus*, STI, and/or HIV infection. Data were extracted from the DOCS medical record for each participant, including the problem list, medical screening reception form, immunization form, medical history, treatment and medication records, health provider order sheet, and physical examination form.

The form was also pilot tested from November to December 2009 using the first 17 chart reviews at Sing Sing and the first 35 chart reviews at Bedford Hills. It was modified to better reflect the information available in the medical records and the sequence of the questions were arranged to be consistent with the organization of the medical records, both of which facilitate an efficient and accurate process of data extraction. The final form contained 33 items in the following 10 categories: chronic or ongoing medical condition(s) or infections, skin conditions, venereal diseases, dental problems, tattoos and needle marks, antibiotic use, skin problems and *Staphylococcus* infections, bodily injuries, substance use, and sexual activity. Both study instruments are provided as appendices.

Data Management

Participants' consent, interview, and medical record extraction forms were kept in locked files in a locked office allocated for the study. All data were entered into an encrypted database designed for the study. Each member of the study team had a unique username and password to access the database. Participant names were not entered into the database. Upon completion of the parent study, all documents containing personal identifying information will be destroyed.

Power Analysis

An a priori power analysis was performed under the following assumptions: 1) prevalence rates for *S. aureus*, HIV, and STIs of 25%, 6%, and 10%, respectively; 2) a detectable odds ratio of 2-3; 3) a Chi-square two-sided test of significance with $\alpha = .05$. The prevalence rates used are based on the review of the literature for *S. aureus* , HIV, and STIs. The target total enrollment for the larger study was 910. Given this fixed sample size, the calculated power to detect an odds ratio of 3 for MRSA-HIV and MRSA-STI co-infection is 0.8 and 0.9, respectively. Table 3.3 summarizes the calculations performed. The study was notably underpowered to detect an odds ratio of 2 or less, given the target enrollment for the larger study.

Table 3.3
A Priori Power Analysis Calculations

$n_{total\ sample}$	n_{hiv}	n_{sti}	Detectable OR	$Power_{hiv}$	$Power_{sti}$
910[a]	55	91	2	0.59	0.78
910[a]	55	91	3	0.96	0.99
1411[b]	85	141	2	0.80	-
946[b]	57	94	2	-	0.80

Note: OR = Odds ratio; STI = sexually transmitted infection; The values calculated are for a two-sided χ^2 test, $\alpha = .05$, assuming prevalence of *S. aureus*, HIV, and STI of 25%, 6%, and 10%, respectively.
[a] Value represents the targeted enrollment for the larger study.
[b] Value represents the total sample needed to detect an OR of 2

Data Analysis

All data were analyzed using SPSS version 18 (Chicago, IL). Statistical significance was set at $\alpha < 0.05$. Data for variables of interest as outlined in Table 3.2 were transferred from the

larger study's database into an SPSS file. To maintain confidentiality, publicly available DOCS inmate identification numbers were not exported from the secure database. Preliminary analysis of the data revealed more positive responses to key risk factor questions (e.g., drug use and sexual activity) during the interview when compared to the medical record review; therefore, only responses from the interview were used for these variables. Because the interview did not include questions about STIs, information pertaining to STIs, including culture data for the women, was obtained from the medical record review.

The parent study utilizes two independent samples (men at Sing Sing and women at Bedford Hills), which differ in several ways aside from the differences in gender. Inmates from Sing Sing are almost exclusively transferred from other prisons, whereas inmates from Bedford Hills tend to be transferred from jails. The difference in most recent prior residence is noteworthy given variations in facility operation, layout, and inmate length of stay between prisons and jails. In general, the jail population is more transient than the prison, with greater, faster turnover and jails tend to be more overcrowded. Consequently, data from the two prisons were not combined for analysis as the differences between the facilities could potentially be related to *S. aureus* transmission and obscure comparisons.

Demographics. Descriptive statistics, including frequencies, percentages, mean, and standard deviation, were used to describe the demographic characteristics of the sample. Categorical variables were dummy coded as not present (0) versus present (1) to facilitate interpretation of study results. To determine statistically significant differences between selected groups e.g., by gender, HIV, and STI status, for categorical variables, chi-square tests were performed for those variables with individual cell values of at least five and Fisher's exact tests were performed for variables with individual cell values less than five. Mean, standard deviation,

and range for continuous variables were calculated and two-sided, independent sample t-tests were used to determine statistically significant differences between selected groups. Levene's test was used to assess equality of variances between groups. Chi-square and t-tests were used for categorical and continuous data, respectively to compare age and education of the sample to the overall population of each facility and to the overall New York State prison population. Neither facility- nor state-level aggregate data were available for other demographic and inmate history data.

Specific Aim One. The first study aim was to describe the pattern of *S. aureus* (MSSA and MRSA) co-infection with HIV or STIs. Frequencies and percentages were used to determine the individual prevalence of HIV, STIs, and *S. aureus* in the study population. New variables were then created to identify subjects co-infected with HIV-*S. aureus* and STI-*S. aureus*. Chi-square or Fisher's exact tests were computed to examine differences in *S. aureus* rates between HIV-infected individuals and those uninfected as well as those with and without STIs in each prison independently.

Specific Aim Two. The second study aim was to identify risk factors for *S. aureus* (MSSA and MRSA) co-infection with HIV and/or STIs. A small sample of HIV-infected subjects ($n = 27$) and even fewer subjects co-infected with *S. aureus* ($n = 15$) prohibited the fitting of a regression model to determine risk factors for HIV-*S. aureus* co-infection. Consequently, only a descriptive report of HIV-*S. aureus* co-infection was possible. Similarly, the small sample of men co-infected with STI-*S. aureus* ($n = 16$) prevented the fitting of a regression model to determine risk factors for STI-*S. aureus* co-infection in this group. Therefore, a model to identify risk factors for STI-*S aureus* co-infection was only fit for women. Potential predictor variables, as outlined previously, were selected based on previous literature

describing risk factors for *S. aureus* colonization. Chi-square, Fisher's exact, and t-tests were used as appropriate in univariate analyses to assist in determining possible risk factors to enter into the multivariate model. Potential predictor variables were and entered into a binary logistic regression model based on theoretical plausibility. Multicollinearity among independent variables was assessed using tolerance values and variance inflation factors. Tolerance values <0.1 and variance inflation factors >2.5 suggested high correlation among the predictor variables. The model was controlled for traditional demographic variables including age, race/ethnicity, and education. Adjusted odds ratios with 95% confidence intervals were calculated for each potential predictor entered into the model. Those variables found to be statistically significant were included in the final model. Statistical significance was set at $\alpha < 0.05$ to assess the probability that the independent variables in the model were not associated with the outcome variable.

Chapter 4: Results

Introduction

The aim of this study was to estimate the rates of HIV-*S. aureus* and STI-*S. aureus* co-infection and to examine risk factors for co-infection in a prison population. This chapter will present statistical results of the study guided by the study's specific aims.

Demographic Findings

The final sample consisted of 373 women from Bedford Hills and 383 men from Sing Sing. Of all inmates approached to participate in the study, 86% at Bedford Hills and 79% at Sing Sing agreed to be subjects for an overall participation rate of 81%. The mean age of the total sample was 34.4 years and was similar between subjects at the two prisons. Men prisoners were significantly more likely to be Black than women ($p = .01$). Nearly 50% of the sample had not completed high school, which was similar among men and women. Chronic diseases were prevalent in subjects in both facilities with nearly 75% of the sample reporting having one or more chronic illnesses, with pulmonary disease being the most frequently reported (28.7%). Men and women differed significantly on several variables; women were more likely to report a history of HIV/AIDS, STI, previous *S. aureus* infection, injection drug use, and having multiple sex partners ($p < .05$). Approximately 20% of the sample reported having a chronic skin condition, but only 4% reported having a *S. aureus* infection in the past. Hygiene practices also differed, with women reporting taking more showers per week and sharing more personal items while men reported more shaving. Table 4.1 summarizes demographic characteristics of the sample, comparing men and women.

Table 4.1

Demographic, Clinical, and Behavioral Characteristics of Inmates at Sing Sing and Bedford Hills Correctional Facilities (n=756)

Characteristic	**Total sample (*n*=756)**	**Sing Sing (*n*=383)**	**Bedford Hills (n=373)**	***p*[a]**
Mean age ± SD, range (years)	34.4 ± 10.1, 16-64	33.7 ± 9.5, 17-64	35.0 ±10.7, 16-61	.07[b]
Race/ethnicity, n (%)				.01
Black	354 (46.8)	197 (51.4)	157 (42.1)	
non-Black	402 (53.2)	186 (48.6)	216 (57.9)	
Education level completed, n (%)				.36
Less than high school				
High school graduate or more	340 (45.0) 416 (55.0)	166 (43.3) 217 (56.7)	174 (46.6) 199 (53.4)	
Previous residence, n (%)				<.001
Jail	368 (48.7)	12 (3.1)	356 (95.4)	
Prison	384 (50.8)	368 (96.0)	16 (4.3)	
Other	4 (0.5)	3 (0.8)	1 (0.3)	
General health, n (%)				.14
Excellent or good	606 (80.7)	313 (82.8)	293 (78.6)	
Fair or poor	145 (19.3)	65 (17.2)	80 (21.4)	
Chronic disease, n (%)				
Diabetes	36(4.8)	9 (2.3)	27 (7.2)	.002
Cardiovascular	110 (14.6)	49 (12.8)	61 (16.4)	.16
Pulmonary	217 (28.7)	91 (23.8)	126 (33.8)	.002
Kidney	11 (1.5)	6 (1.6)	5 (1.3)	.79
Liver	51 (6.7)	24 (6.3)	27 (7.2)	.60
Cancer	9 (1.2)	0	9 (2.4)	.002[c]
Other[d]	120 (15.9)	52 (13.6)	68 (18.2)	.08
HIV/AIDS, n (%)	27 (3.6)	8 (2.1)	19 (5.1)	.03
STI, n (%)	123(16.3)	35 (9.1)	88 (23.6)	<.001
Syphilis	33 (4.4)	9 (2.3)	24 (6.4)	.006
Gonorrhea	24 (3.2)	6 (1.6)	18 (4.8)	.01
HPV	19 (2.5)	5 (1.3)	14 (3.8)	.03
Chlamydia	42 (5.6)	13 (3.4)	29 (7.8)	.009
Herpes	13 (1.7)	4 (1.0)	9 (2.4)	.17[c]
Other	21 (2.8)	2 (0.5)	19 (5.1)	<.001[c]
Chronic skin condition, n (%)	148 (19.6)	71 (18.5)	77 (20.6)	.47
Past *S. aureus* infection, n (%)	30 (4.0)	7 (1.8)	23 (6.2)	.002
Systemic antibiotics, n (%)[e]	217 (28.7)	71 (18.5)	146 (39.1)	<.001
Injection drug use, n (%)	65 (8.6)	20 (5.2)	45 (12.1)	.001
Sexually active, n (%)[e]	266 (35.2)	77(20.1)	189 (50.7)	<.001
Multiple sex partners, n (%)[e]	61 (8.1)	23 (6.0)	38 (10.2)	.035

Table 4.1 *cont'd*

Characteristic	**Total sample (*n*=756)**	**Sing Sing (*n*=383)**	**Bedford Hills (n=373)**	***p*[a]**
Men who have sex with men, n (%)[e]	11 (1.5)	11 (2.9)	--	--
High risk sexual activity, n (%)[e,f]	70 (9.3)	32 (8.4)	38 (10.2)	.38
Average showers per week, mean ± SD, range	7.0 ± 4.0 0-21	5.1 ± 3.2 0-21	8.8 ± 4.0 1-21	<.001[b]
Share personal items, n (%)[g]	100 (13.2)	33 (8.6)	67 (18.0)	<.001
Shave any body part, n (%)	529 (70.0)	320 (83.6)	209 (56.0)	<.001
Arms	53 (7.0)	15 (3.9)	38 (10.2)	.001
Legs	160 (21.2)	7 (1.8)	153 (41.0)	<.001
Torso	27 (3.6)	20 (5.2)	7 (1.9)	.01
Crotch	189 (25)	78 (20.4)	111 (29.8)	.003
Face	316 (41.8)	304 (79.4)	12 (3.2)	<.001
` Underarms	251 (33.2)	88 (23.0)	163 (43.7)	<.001
Head	33 (4.4)	32 (8.4)	1 (0.3)	<.001[c]
Other	6 (0.8)	6 (1.6)	0 (0)	.03[c]

Note. SD = standard deviation. STI = sexually transmitted infection. HPV = human papilloma virus. *S. aureus* = *Staphylococcus aureus*.
[a] Two-sided χ^2 unless otherwise noted
[b] Two-sided t-test
[c] Fisher's exact test
[d] Other chronic diseases included neurologic, endocrine, musculoskeletal, optic, gastrointestinal, hematologic, and psychological diseases.
[e] Participants were asked if they engaged in this activity in the previous six months.
[f] High-risk sexual activity constituted having multiple sex partners and/or being a man who has sex with men.
[g] Personal items included towels, clothes, soap, razors, combs/brushes, deodorant, and nail clippers.

Compared to the entire Sing Sing and Bedford Hills populations, this sample was generally younger as illustrated in Table 4.2. High school completion status was similar between subjects from Sing Sing and all men in New York State Department of Corrections (DOCS) (p = .86). This sample of women from Bedford Hills was less likely to have completed high school when compared to all women in DOCS (p = .007).

Table 4.2.

Age and High School Completion Status of a Sample from Bedford Hills and Sing Sing Correctional Facilities Compared to New York State Department of Corrections Population

	Sing Sing sample (n = 383)	**Sing Sing (*n* = 1711)**	**DOCS total male (n = 54,205)**	**Bedford Hills sample (n = 373)**	**Bedford Hills (*n* = 745)**	**DOCS total female (n = 2256)**
Age (years), n (%)[a]						
16-29	154 (40.2)	359 (21.9)		145 (38.9)	236 (31.7)	
30-49	204 (53.2)	1055 (51.4)	-	192 (51.5)	399 (53.5)	-
50+	25 (6.5)	297 (17.2)		36 (9.6)	110 (14.8)	
Completed high school, n (%)	217 (55.0)	-	30,951[b] (57.0)	174 (47.0)	-	1222[c] (54.0)

Note. DOCS = Depart of Correctional Services. Totals for each facility and DOCS data current as of March 2011.
[a] χ^2 test comparing Sing Sing sample/total and Bedford Hills sample/total, $p < .05$
[b] χ^2 test comparing Sing Sing sample to DOCS male total for high school completion, $p = .86$.
[c] χ^2test comparing Bedford Hills sample to DOCS female total for high school completion, $p = .007$

The prevalence of HIV/AIDS in the sample was 3.6%. Among women, compared to non-HIV-infected subjects, HIV-infected subjects were more likely to be Black and to have not graduated from high school ($p < .05$). Reports of injection drug use among HIV-infected male subjects (25%) were approximately five times those without HIV (4.8%). No significant differences in sexual activity history were found between HIV-infected and uninfected male subjects. However, female HIV-infected subjects were more likely to report a history of STI ($p = .01$). Tables 4.3 and 4.4 summarize demographic characteristics of HIV-infected male and female subjects respectively.

Table 4.3

*Demographic, Clinical, and Behavioral Characteristics of HIV- and non-HIV-infected Inmates at Sing Sing Correctional Facility (*n=*383)*

Characteristic	**HIV (*n* = 8)**	**non-HIV (*n* = 375)**	***p*[a]**
Mean age ± SD, range (years)	39.0 ± 12.4, 24-56	33.6 ± 9.4, 17-64	.11[b]
Race/ethnicity, n (%)			.49
Black	3 (37.5)	194 (51.7)	
non-Black	5 (62.5)	181 (48.3)	
Education level completed, n (%)			.30
Less than high school	5 (62.5)	161 (42.9)	
High school graduate or more	3 (37.5)	214 (57.1)	
General health, n (%)			.03
Excellent or good	4 (50.0)	309 (83.5)	
Fair or poor	4 (50.0)	61 (16.5)	
Chronic disease, n (%)			
Diabetes	1 (12.5)	8 (2.1)	.18
Cardiovascular	1 (12.5)	48 (12.8)	1.00
Pulmonary	1 (12.5)	90 (24.0)	.69
Kidney	0	6 (1.6)	1.00
Liver	3 (37.5)	21 (5.6)	.01
Cancer	0	0	-
Other[c]	0	52 (13.9)	.61
STI, n (%)	0	35 (9.3)	1.00
Chronic skin condition, n (%)[d]	2 (25.0)	69 (18.4)	.65
Past *S. aureus* infection, n (%)	0	7 (1.9)	1.00
Systemic antibiotics, n (%)[e]	2 (25.0)	69 (18.4)	.65
Injection drug use, n (%)	2 (25.0)	18 (4.8)	.06
Sexually active, n (%)[e]	2 (25.0)	75 (20.0)	.66
Multiple sex partners, n (%)[e]	1 (12.5)	22 (5.9)	.39
Men who have sex with men, n (%)	1 (12.5)	10 (2.7)	.21
High risk sexual activity, n (%)[e,f]	1 (12.5)	31 (8.3)	.51
Average showers per week, mean ± SD, range	6.1± 6.3, 2-21	5.1 ± 3.1, 0-21	.66[b]
Share personal items, n (%)[g]	2 (25.0)	31 (8.3)	.15
Shave any body part, n (%)	7 (87.5)	313 (83.5)	.76[h]

Note. SD = standard deviation. STI = sexually transmitted infection. *S. aureus* = *Staphylococcus aureus*.
[a] Fisher's exact test unless otherwise noted
[b] Two-sided t-test
[c] Other chronic diseases included neurologic, endocrine, musculoskeletal, optic, gastrointestinal, hematologic, and psychological diseases.
[d] Chronic skin conditions included eczema, psoriasis, acne, dermatitis, impetigo, and vitiligo
[e] Participants were asked if they engaged in this activity in the previous six months.
[f] High-risk sexual activity constituted having multiple sex partners and/or being a man who has sex with men.
[g] Personal items included towels, clothes, soap, razors, combs/brushes, deodorant, and nail clippers.
[h] Two-sided χ^2 test

Table 4.4

*Demographic, Clinical, and Behavioral Characteristics of HIV- and non-HIV-infected Inmates at Bedford Hills Correctional Facility (*n=*373)*

Characteristic	**HIV (*n* = 19)**	**non-HIV (*n* = 354)**	***p*[a]**
Mean age ± SD, range (years)	39.4 ± 11.9, 19-61	34.8 ± 10.6, 16-60	.07[b]
Race/ethnicity, n (%)			.004
Black	14 (73.7)	143 (40.4)	
non-Black	5 (26.3)	211 (59.6)	
Education level completed, n (%)			.02
Less than high school	14 (73.7)	160 (45.2)	
High school graduate or more	5 (26.3)	194 (54.8)	
General health, n (%)			.09
Excellent or good	12 (63.2)	281 (79.4)	
Fair or poor	7 (36.8)	73 (20.6)	
Chronic disease, n (%)			
Diabetes	1 (5.3)	26 (7.3)	1.00[c]
Cardiovascular	3 (15.8)	58 (16.4)	1.00[c]
Pulmonary	6 (31.6)	120 (33.9)	.84
Kidney	0	5 (1.4)	1.00[c]
Liver	6 (31.6)	21 (5.9)	<.001
Cancer	2 (10.5)	7 (2.0)	.07[c]
Other[d]	2 (10.5)	66 (18.6)	.55[c]
STI, n (%)	9 (47.4)	79 (22.3)	.01
Chronic skin condition, n (%)[e]	6 (31.6)	71 (20.1)	.23
Past *S. aureus* infection, n (%)	2 (10.5)	21 (5.9)	.33[c]
Systemic antibiotics, n (%)[f]	6 (31.6)	140 (39.5)	.49
Injection drug use, n (%)	5 (26.3)	40 (11.3)	.05
Sexually active, n (%)[f]	5 (26.3)	184 (52.0)	.03
Multiple sex partners, n (%)[f]	1 (5.3)	37 (10.5)	.71[c]
Average showers per week, mean ± SD, range	8.2 ± 4.5, 2-21	8.8 ± 3.9, 1-21	.47[b]
Share personal items, n (%)[g]	5 (26.3)	62 (17.5)	.15
Shave any body part, n (%)	7 (36.8)	202 (57.1)	.08

Note. SD = standard deviation. STI = sexually transmitted infection. *S. aureus* = *Staphylococcus aureus*.
[a] Two-sided χ^2 test unless otherwise noted
[b] Two-sided t-test
[c] Fisher's exact test
[d] Other chronic diseases included neurologic, endocrine, musculoskeletal, optic, gastrointestinal, hematologic, and psychological diseases.
[e] Chronic skin conditions included eczema, psoriasis, acne, dermatitis, impetigo, and vitiligo
[f] Participants were asked if they engaged in this activity in the previous six months.
[g] Personal items included towels, clothes, soap, razors, combs/brushes, deodorant, and nail clippers.

The overall prevalence of STIs was 16.3%, which differed significantly between men (9.1%) and women (23.6%). Although females comprised 50% of the total sample, they accounted for the majority of those with STIs (71.5%). Both male ($p = .65$) and female subjects ($p = .53$) with and without STIs were equally likely to report being sexually active in the previous six months; however, women with STIs were more likely to report having multiple sex partners in the same time frame ($p = .01$). No men who have sex with men (MSM) reported a history of STI. Both men and women with STIs were more likely to report the use of antibiotics in the previous six months ($p < .05$), Tables 4.5 and 4.6 compare demographic, clinical, and behavioral characteristics of male and female subjects with and without STIs.

Table 4.5

*Demographic, Clinical, and Behavioral Characteristics of Inmates with and without STIs at Sing Sing Correctional Facility (*n=*383)*

Characteristic	**STI (*n*=35)**	**non-STI (*n*=348)**	***p*[a]**
Mean age ± SD,	33.5 ± 11.2	33.7 ± 9.3	.88[b]
range (years)	21-63	17-64	
Race/ethnicity, n (%)			.08
Black	23 (65.7)	174 (50.0)	
non-Black	12 (34.3)	174 (50.0)	
Education level completed, n (%)			.68
Less than high school	14 (40.0)	196 (56.3)	
High school graduate or more	21 (60.0)	152 (43.7)	
General health, n (%)			.81
Excellent or good	27 (84.4)	286 (82.7)	
Fair or poor	5 (15.6)	80 (17.3)	
HIV/AIDS, n (%)	0	8 (2.3)	1.00[c]
Chronic disease, n (%)			
Diabetes	0	9 (2.6)	1.00[c]
Cardiovascular	5 (14.3)	44 (12.6)	.78
Pulmonary	7 (20.0)	84 (24.1)	.58
Kidney	1 (2.9)	5 (1.4)	.44[c]
Liver	2 (5.7)	22 (6.3)	1.00[c]
Cancer	0	0	--
Other[d]	10 (28.6)	42 (12.1)	.01
Chronic skin condition, n (%)[e]	13 (37.1)	58 (16.7)	.003
Past *S. aureus* infection, n (%)	0	7 (2.0)	1.00[c]
Systemic antibiotics, n (%)[f]	11 (31.4)	60 (17.2)	.04
Injection drug use, n (%)	2 (5.7)	18 (5.2)	.70[c]
Sexually active, n (%)[f]	6 (17.1)	71 (20.4)	.65
Multiple sex partners, n (%)[f]	1 (2.9)	22 (6.3)	.71[c]
Men who have sex with men, n (%)[f]	0 (0)	11 (3.2)	.61[c]
High risk sexual activity, n (%)[f,g]	1 (2.9)	31 (8.9)	.34[c]
Average showers per week,	5.11 ± 3.3	5.1 ± 3.2	.97[b]
mean ± SD, range	2-14	0-21	
Share personal items, n (%)[h]	6 (17.1)	27 (7.8)	.06
Shave any body part, n (%)	32 (91.4)	288 (82.8)	.19

Note. SD = standard deviation. STI = sexually transmitted infection. *S. aureus* = *Staphylococcus aureus*.
[a] Two-sided χ^2 test unless otherwise noted
[b] Two-sided t-test
[c] Fisher's exact test
[d] Other chronic diseases included neurologic, endocrine, musculoskeletal, optic, gastrointestinal, hematologic, and psychological diseases.
[e] Chronic skin conditions included eczema, psoriasis, acne, dermatitis, impetigo, and vitiligo
[f] Participants were asked if they engaged in this activity in the previous six months.
[g] High-risk sexual activity constituted having multiple sex partners and/or being a man who has sex with men.
[h] Personal items included towels, clothes, soap, razors, combs/brushes, deodorant, and nail clippers.

Table 4.6

*Demographic, Clinical, and Behavioral Characteristics of Inmates with and without STIs at Bedford Hills Correctional Facility (*n*=373)*

Characteristic	**STI (*n*=88)**	**non-STI (*n*=285)**	***p*[a]**
Mean age ± SD, range (years)	35.8 ± 10.4 18-61	34.8 ± 10.8 16-60	.45[b]
Race/ethnicity, n (%)			<.001
Black	52 (59.1)	105 (36.8)	
non-Black	36 (40.9)	180 (63.2)	
Education level completed, n (%)			.03
Less than high school	50 (56.8)	124 (43.5)	
High school graduate or more	38 (43.2)	161 (56.5)	
General health, n (%)			.22
Excellent or good	65 (73.9)	228 (80.0)	
Fair or poor	23 (26.1)	57 (20.0)	
HIV/AIDS, n (%)	9 (10.2)	10 (3.5)	.01
Chronic disease, n (%)			
Diabetes	7 (8.0)	20 (7.0)	.77
Cardiovascular	16 (18.2)	45 (15.8)	.60
Pulmonary	30 (34.1)	96 (33.7)	.94
Kidney	1 (1.1)	4 (1.4)	1.00[c]
Liver	9 (10.2)	18 (6.3)	.22
Cancer	1 (1.1)	8 (2.8)	.69[c]
Other[d]	21 (23.9)	47 (16.5)	.12
Chronic skin condition, n (%)[e]	22 (25.0)	55 (19.3)	.25
Past *S. aureus* infection, n (%)	4 (4.5)	19 (6.7)	.62[c]
Systemic antibiotics, n (%)[f]	44 (50.0)	102 (35.8)	.02
Injection drug use, n (%)	13 (14.8)	32 (11.2)	.37
Sexually active, n (%)[f]	42 (47.7)	147 (51.6)	.53
Multiple sex partners, n (%)[f]	16 (18.2)	22 (7.7)	.01
Average showers per week, mean ± SD, range	9.6 ± 3.9 3-21	8.6± 3.9 1-21	.05[b]
Share personal items, n (%)[h]	23 (26.1)	44 (15.4)	.02
Shave any body part, n (%)	32 (91.4)	288 (82.8)	.19

Note. SD = standard deviation. STI = sexually transmitted infection. *S. aureus* = *Staphylococcus aureus*.
[a] Two-sided χ^2 test unless otherwise noted
[b] Two-sided t-test
[c] Fisher's exact test
[d] Other chronic diseases included neurologic, endocrine, musculoskeletal, optic, gastrointestinal, hematologic, and psychological diseases.
[e] Chronic skin conditions included eczema, psoriasis, acne, dermatitis, impetigo, and vitiligo
[f] Participants were asked if they engaged in this activity in the previous six months.
[g] High-risk sexual activity constituted having multiple sex partners and/or being a man who has sex with men.
[h] Personal items included towels, clothes, soap, razors, combs/brushes, deodorant, and nail clippers.

Aim 1: Patterns of *S. aureus* co-infection with HIV or STIs

The first study aim was to describe the patterns of *S. aureus* (MSSA and MRSA) co-infection with HIV or STIs. *S. aureus* carriage rates were high in this population. 53.8% of the total sample was colonized with *S. aureus* in the anterior nares and/or the throat with no significant differences detected between the two prisons ($p = .32$). The MRSA colonization rate for the total sample was 8.5% ($n = 64$). Differences in MSSA and MRSA carriage between subjects from the two prisons were noted. Men were significantly more likely to carry MSSA strains ($p < 0.01$) and women were more likely to carry MRSA strains ($p < 0.01$) as illustrated in Table 4.7.

Table 4.7

Staphylococcus aureus *Profile of Inmates at Sing Sing and Bedford Hills Correctional Facilities (*n=*756)*

S. aureus	**Total (*n* = 756)**	**Sing Sing (*n* = 383)**	**Bedford Hills (*n* = 373)**	***p****
Any *S. aureus,* n (%)	407 (53.8)	213 (55.6)	194 (52.0)	.32
MSSA, n	350	196	154	
Proportion of total sample (%)	350/756 (46.3)	196/383 (51.2)	154/373 (41.3)	.006
Proportion of *S. aureus* (%)	350/407 (86.0)	196/213 (92.0)	154/194 (79.4)	
MRSA, n	64	21	43	
Proportion of total sample (%)	64/756 (8.5)	21/383 (5.5)	43/373 (11.5)	.003
Proportion of *S. aureus* (%)	64/407 (15.7)	21/213 (9.9)	43/194 (22.2)	

Note. MSSA= Methicillin-susceptible *Staphylococcus aureus.* MRSA= Methicillin-resistant *Staphylococcus aureus.* Frequencies represent *S. aureus* carriage in the nares and/or throat. Values calculated for MSSA + MRSA may add up to more than 100% due to individuals colonized with both MSSA and MRSA in the nares and throat ($n = 7$).

* Two-sided χ^2 test

Among HIV-infected men, 6/8 (75%) had a culture positive for *S. aureus* in either the nares and/or throat as described in Table 4.8. *S. aureus* carriage was similar between HIV-infected and uninfected subjects ($p = .27$) in this group. All men colonized with *S. aureus* carried a methicillin-susceptible strain. Among HIV-infected women, 9/19 (47.4%) had a culture positive for *S. aureus* as illustrated in Table 4.9. A greater proportion of HIV-infected women were colonized with MRSA (21.1%) compared to subjects without HIV (11%), but this difference was not statistically significant ($p = .26$).

Table 4.8

Staphylococcus aureus *Profile of Inmates Co-Infected with HIV at Sing Sing Correctional Facility (*n *=383)*

S. aureus	**HIV (*n* = 8)**	**non-HIV (*n* = 375)**	**OR (95% CI)**	***p*[a]**
Any *S. aureus*, n (%)	6 (75.0)	207 (55.2)	2.4 (.49 - 12.2)	.27
MSSA, n	6	190		
Proportion of total sample (%)	6/8 (75.0)	190/375 (50.7)	2.9 (.58-14.7)	.17
Proportion of *S. aureus* (%)	6/6 (100.0)	190/207 (91.2)		
MRSA, n	0	21	---	
Proportion of total sample (%)	0/8 (0)	21/375 (5.6)		1.00[b]
Proportion of *S. aureus* (%)	0/6 (0)	21/207 (10.1)		

Note. OR= Odds ratio. CI= Confidence Interval. MSSA= Methicillin-susceptible *Staphylococcus aureus.* MRSA= Methicillin-resistant *Staphylococcus aureus.* Frequencies represent *S. aureus* carriage in the nares and/or throat. Values calculated for MSSA + MRSA may add up to more than 100% due to individuals colonized with both MSSA and MRSA in the nares and throat ($n = 4$).

[a] Two-sided χ^2 test unless otherwise noted

[b] Fisher's exact test

Table 4.9

Staphylococcus aureus *Profile of Inmates Co-Infected with HIV at Bedford Hills Correctional Facility (*n *=373)*

S. aureus	**HIV (*n* = 19)**	**non-HIV (*n* = 354)**	**OR (95% CI)**	***p*[a]**
Any *S. aureus*, n (%)	9 (47.4)	185 (52.3)	.82 (.33-2.1)	.68
MSSA, n	5	149		
Proportion of total sample (%)	5/19 (26.3)	149/354 (42.1)	.49 (.17-1.4)	.17
Proportion of *S. aureus* (%)	5/9 (55.6)	149/185 (80.5)		
MRSA, n	4	39	2.2 (.68-6.8)	
Proportion of total sample (%)	4/19 (21.1)	39/354 (11.0)		.26[b]
Proportion of *S. aureus* (%)	4/9 (44.4)	39/185 (21.1)		

Note. OR= Odds ratio. CI= Confidence Interval. MSSA= Methicillin-susceptible *Staphylococcus aureus.* MRSA= Methicillin-resistant *Staphylococcus aureus.* Frequencies represent *S. aureus* carriage in the nares and/or throat. Values calculated for MSSA + MRSA may add up to more than 100% due to individuals colonized with both MSSA and MRSA in the nares and throat (*n* = 3).

[a] Two-sided χ^2 test unless otherwise noted

[b] Fisher's exact test

Of the 123 subjects with a history of STI, 68 (55.3%) were also colonized with *S. aureus.* No statistically significant differences in *S. aureus* carriage were found between male ($p = .22$) or female ($p = .13$) subjects with and without STIs. Among subjects positive for *S. aureus*, MSSA colonization predominated among those with STIs and those without STIs. More than 80% of *S. aureus* positive samples in men with and without STIs were methicillin-susceptible. Statistically significant differences in MRSA colonization were noted between female subjects with and without STIs. Women with STIs were greater than two times more likely to be colonized with MRSA than those without STIs (OR 2.1, $p = .03$). The *S. aureus* profiles of men and women with STIs are illustrated in Tables 4.10 and 4.11, respectively.

Table 4.10

Staphylococcus aureus *Profile of Inmates Co-Infected with STIs at Sing Sing Correctional Facility (*n=*383)*

S. aureus	**STI (*n* = 35)**	**non- STI (*n* = 348)**	**OR (95% CI)**	***p*[a]**
Any *S. aureus*, n (%)	16 (45.7)	197 (56.6)	.65 (.32 - 1.30)	.22
MSSA, n	13	183		
Proportion of total sample (%)	13/35 (37.1)	183/348 (52.6)	.53 (.26-1.09)	.08
Proportion of *S. aureus* (%)	13/16 (81.3)	183/197 (92.9)		
MRSA, n	3	18		
Proportion of total sample (%)	3/35 (8.6)	18/348 (5.2)	1.72 (.48-6.15)	.43[b]
Proportion of *S. aureus* (%)	3/16 (18.8)	8/197 (9.14)		

Note. OR= Odds ratio. CI= Confidence Interval. STI= sexually transmitted infection. MSSA= Methicillin-susceptible *Staphylococcus aureus.* MRSA= Methicillin-resistant *Staphylococcus aureus* Frequencies represent *S. aureus* carriage in the nares and/or throat. Values calculated for MSSA + MRSA may add up to more than 100% due to individuals colonized with both MSSA and MRSA in the nares and throat (*n*=4).

[a] Two-sided χ^2 test

[b] Fisher's exact test

Table 4.11

Staphylococcus aureus *Profile of Inmates Co-Infected with STIs at Bedford Hills Correctional Facility (*n=*373)*

S. aureus	**STI (*n* = 88)**	**non- STI (*n* = 285)**	**OR (95% CI)**	***p****
Any *S. aureus*, n (%)	52 (59.1)	142 (49.8)	1.46 (.90 – 2.36)	.13
MSSA, n	37	117		
Proportion of total sample (%)	37/88 (42.0)	117/285 (41.1)	1.04 (.64 – 1.69)	.87
Proportion of *S. aureus* (%)	37/52 (65.4)	117/142 (82.4)		
MRSA, n	16	27		
Proportion of total sample (%)	16/88 (18.2)	27/285 (9.5)	2.12 (1.09-4.16)	.03
Proportion of *S. aureus* (%)	19/68 (27.9)	45/339 (13.3)		

Note. OR= Odds ratio. CI= Confidence Interval. STI= sexually transmitted infection. MSSA= Methicillin-susceptible *Staphylococcus aureus.* MRSA= Methicillin-resistant *Staphylococcus aureus* Frequencies represent *S. aureus* carriage in the nares and/or throat. Values calculated for MSSA + MRSA may add up to more than 100% due to individuals colonized with both MSSA and MRSA in the nares and throat (*n*=3).

* Two-sided χ^2 test

Aim 2: Risk factors for *S. aureus* co-infection with HIV or STIs

The second study aim was to identify risk factors for *S. aureus* co-infection with HIV or STIs. The small sample of subjects with HIV-*S. aureus* co-infection (*n* = 15) prevented the fitting of a regression model to determine risk factors for co-infection in this group. Because there were significant differences between men and women on several variables of interest, the two prison populations were analyzed separately as noted previously. The small sample of men co-infected with STI-*S. aureus* (*n* = 16) prevented the fitting of a regression model to determine risk factors for STI-*S. aureus* co-infection in this group. Therefore, a model to identify risk factors for STI-*S aureus* co-infection was only fit for women. Demographic characteristics of men co-infected with STI-*S. aureus* are described in Table 4.12.

Table 4.12

*Demographic, Clinical, and Behavioral Characteristics of Men Co-Infected with STI-*S. aureus *at Sing Sing Correctional Facility (*n=*383)*

Characteristic	**STI-*S. aureus* (*n* = 16)**	**No STI-*S. aureus* (*n* = 367)**	***p*[a]**
Mean age ± SD, range (years)	31.7 ± 6.1 16-45	33.8 ± 9.6 17-64	.21[b]
Race/ethnicity, n (%)			.37
Black	10 (62.5)	187 (51.0)	
non-Black	187 (51.0)	180 (49.0)	
Education level completed, n (%)			.63
Less than high school	6 (37.5)	160 (43.6)	
High school graduate or more	10 (62.5)	207 (56.4)	
Previous residence, n (%)			.72
Jail	1 (6.3)	11 (3.0)	
Prison	15 (93.8)	353 (96.2)	
Other	0 (0)	3 (0.8)	
General health, n (%)			1.00[c]
Excellent or good	13 (86.7)	300 (82.6)	
Fair or poor	2 (13.3)	69 (17.4)	
HIV/AIDS, n (%)	0 (0)	8 (2.2)	1.00[c]
Chronic skin condition, n (%)[d]	5 (31.3)	66 (18.0)	.18
Past *S. aureus* infection, n (%)	0(0)	7 (1.9)	1.00[c]
Systemic antibiotics, n (%)[e]	5 (31.3)	66 (18.0)	.18
Injection drug use, n (%)	0 (0)	20 (5.4)	1.00[c]
Sexually active, n (%)[e]	5 (31.3)	72 (19.6)	.26
Multiple sex partners, n (%)[e]	1 (6.3)	22 (6.0)	1.00[c]
Average showers per week, mean ± SD, range	4.1± 1.8 2-7	5.2 ± 3.2 0-21	.17[b]
Share personal items, n (%)[f]	2 (12.5)	31 (8.4)	.64[c]
Shave any body part, n (%)	16 (100.0)	304 (82.8)	.07

Note. SD = standard deviation. STI= sexually transmitted infection. *S. aureus* = *Staphylococcus aureus*.
[a] Two-sided χ^2 test unless otherwise noted
[b] Two-sided t-test
[c] Fisher's exact test
[d] Chronic skin conditions included eczema, psoriasis, acne, dermatitis, impetigo, and vitiligo
[e] Participants were asked if they engaged in this activity in the previous six months.
[f] Personal items included towels, clothes, soap, razors, combs/brushes, deodorant, and nail clippers.

A total of 52 women were co-infected with STI-*S. aureus*. Compared to women who were not co-infected, these women were more likely to be Black and to have not graduated from high school ($p < .05$). Most reported their health as excellent or good (73.1%). More than 50% reported being sexually active in the previous six months, but only 15.4% reported having

multiple sex partners during the same time period. Half of the women co-infected with STI-*S. aureus* reported recent antibiotic use and 4% reported having a previous *S. aureus* infection. Co-infected women also reported taking more showers per week ($p = .02$) and sharing more personal items ($p = .07$). Crude odds ratios with associated p values from univariate analyses comparing demographic characteristics between women co-infected with STI-*S. aureus* and those not co-infected are presented in Table 4.13.

Variables were selected as potential predictors for multivariate analyses based on previous literature and associated theoretical plausibility. Given the sample size of approximately 50, a conservative approach was taken, and four variables were selected for use in the building of a logistic regression model. Variables included were HIV status, systemic antibiotic use, number of showers taken each week, and sharing of personal items. Collinearity among the selected predictor variables was assessed and neither tolerance values < 0.1 nor variance inflation factors > 2.5 was detected, providing no evidence of collinearity. These variables were entered together into a binary logistic regression model with STI-*S. aureus* co-infection as the outcome variable. The regression was then adjusted for age, race/ethnicity, and education level. After controlling for demographic variables, only average number of showers retained statistical significance in the model, such that reporting taking more showers each week was associated with an increased risk of having STI-*S. aureus* co-infection (adjusted OR = 1.08, $p = 0.04$). The Hosmer and Lemeshow's test was used to assess goodness of fit of this model and was found to be adequate ($p = .18$). Results of the regression analysis are provided in Table 4.14.

Table 4.13

*Comparison of Women Co-Infected and Not Co-Infected with STI-*S. aureus *at Bedford Hills Correctional Facility (*n*=373)*

Characteristic	**STI-*S. aureus* (*n* = 52)**	**No STI-*S. aureus* (*n* = 321)**	**OR (95% CI)**	***p*[a]**
Mean age ± SD, range (years)	33.3 ± 9.6 18-61	35.3 ± 10.9 16-60	--	.22[b]
Race/ethnicity, n (%)			1.9	.03
Black	29 (55.8)	128 (39.9)	(1.05-3.43)	
non-Black	23 (44.2)	193 (60.1)		
Education level completed, n (%)			.41	.004
Less than high school	34 (65.4)	140 (43.6)	(.22-.76)	
High school graduate or more	18 (34.6)	181 (56.4)		
Previous residence, n (%)			--	.91
Jail	50 (96.2)	306 (95.3)		
Prison	2 (3.8)	14 (4.4)		
Other	0 (0)	1 (0.3)		
General health, n (%)			.70	.30
Excellent or good	38 (73.1)	255 (79.4)	(.36-1.37)	
Fair or poor	14 (26.9)	66 (20.6)		
HIV/AIDS, n (%)	5 (9.6)	14 (4.4)	2.3 (.80- 6.78)	.11
Chronic disease, n (%)				
Diabetes	5 (9.6)	22 (6.9)	1.45 (.52- 4.00)	.48
Cardiovascular	8 (15.4)	53 (16.6)	.92 (.41-2.06)	.84
Pulmonary	16 (30.8)	110 (34.3)	.85 (.45-1.61)	.62
Kidney	0 (0)	5 (1.6)	--	1.00[c]
Liver	6 (11.5)	21 (6.5)	1.86 (.71-4.86)	.20
Cancer	1 (1.9)	8 (2.5)	.77 (.09-6.26)	1.00[c]
Other[d]	12 (23.1)	56 (17.4)	1.42 (.70-2.88)	.33
Chronic skin condition, n (%)[e]	9 (17.3)	68 (21.2)	.78 (.36- 1.68)	.52
Past *S. aureus* infection, n (%)	2 (3.8)	21 (6.5)	.57 (.01-2.51)	.76[c]
Systemic antibiotics, n (%)[f]	26 (50.0)	120 (37.4)	1.68 (.93-3.02)	.08
Injection drug use, n (%)	7 (13.5)	38 (11.8)	1.16 (.49- 2.75)	.74

Table 4.13 *cont'd*

Characteristic	**STI-*S. aureus* (*n* = 52)**	**No STI-*S. aureus* (*n* = 321)**	**OR (95% CI)**	***p*[a]**
Sexually active, n (%)[f]	27 (51.9)	162 (50.5)	1.06 (.59-1.91)	.85
Multiple sex partners, n (%)[f]	8 (15.4)	30 (9.3)	1.76 (.76- 4.09)	.18
Average showers per week, mean ± SD, range	10.1 ± 4.1 3-21	8.64 ± 3.9 1-21	--	.02[b]
Share personal items, n (%)[g]	14 (26.9)	53 (16.5)	1.86 (.94-3.68)	.07
Shave any body part, n (%)	28 (53.8)	181 (56.4)	.90 (.50-1.63)	.73
Arms	3(5.8)	35 (10.9)	.50 (.15-1.69)	.33[c]
Legs	18 (34.6)	135 (42.1)	.73 (.40-1.35)	.31
Torso	0 (0)	7 (2.2)	--	.60[c]
Crotch	19 (36.5)	92 (28.7)	1.43 (.78-2.65)	.25
Face	2 (3.8)	10 (3.1)	1.24 (.27-5.85)	.68[c]
Underarms	22 (42.3)	141 (43.9)	.94 (.52-1.70)	.83
Head	1 (1.9)	0 (0)	--	.14[c]

Note. OR = odds ratio. CI = confidence interval. SD = standard deviation. STI= sexually transmitted infection. *S. aureus* = *Staphylococcus aureus*.

[a] Two-sided χ^2 test unless otherwise noted

[b] Two-sided t-test

[c] Fisher's exact test

[d] Other chronic diseases included neurologic, endocrine, musculoskeletal, optic, gastrointestinal, hematologic, and psychological diseases.

[e] Chronic skin conditions included eczema, psoriasis, acne, dermatitis, impetigo, and vitiligo

[f] Participants were asked if they engaged in this activity in the previous six months.

[g] Personal items included towels, clothes, soap, razors, combs/brushes, deodorant, and nail clippers.

Table 4.14.

*Multivariate Logistic Regression Results for STI-*S. aureus *Co-Infection Among Women at Bedford Hills Correctional Facility (*n=*373)*

	STI-*S. aureus* (n=52)	**No STI-*S. aureus* (n=321)**	**Unadjusted OR (95% CI)**	***p***	**Adjusted OR (95% CI)**	***p***
HIV/AIDS, n (%)	5 (9.6)	14 (4.4)	2.44 (.80-7.43)	.12	1.95 (.61-6.15)	.26
Systemic antibiotics, n (%)	26 (50.0)	120 (37.4)	1.55 (.85-2.83)	.16	1.70 (.92-3.17)	.09
Average showers per week, mean ± SD, range	10.1	8.64	1.10 (1.02-1.18)	.01	1.08 (1.00-1.16)	.04
Share personal items, n (%)	14 (26.9)	53 (16.5)	1.78 (.88-3.58)	.11	1.75 (.86-3.58)	.12

Note: OR= Odds ratio. CI= confidence interval. STI= sexually transmitted infection. *S. aureus*= *Staphylococcus aureus.* Adjusted OR was adjusted for age, race/ethnicity, and education level

Summary

In this sample of inmates at Bedford Hills (n = 373) and Sing Sing (n = 383) prisons, *S. aureus* carriage was high (53.8%). Among men, co-infection of *S. aureus* with HIV and STIs was 75% and 45.7%, respectively. Among women, co-infection of *S. aureus* with HIV and STIs was 47.4% and 59.1%, respectively. Multivariate analysis revealed that reporting taking more showers each week was significantly associated with increased risk of having STI-*S. aureus* co-infection in women.

Chapter 5: Discussion and Implications

Introduction

STIs and HIV and have been identified as predictors of *S. aureus* infection in community and incarcerated populations, respectively (Hota, et al., 2007; Lee, et al., 2005). However, no literature to date has specifically enumerated the occurrence of *S. aureus* co-infection with HIV or STIs in this setting. Thus, the aims of this study were to describe the patterns of *S. aureus* co-infection with HIV or STIs and to identify risk factors for co-infection in two New York State prisons. This chapter will outline and discuss the results of the investigation. Limitations of the study, clinical and policy implications, and proposals for future research are also discussed.

Demographic Findings

This cross-sectional, descriptive, correlational secondary analysis consisted of a convenience sample of 373 women from Bedford Hills and 383 men from Sing Sing Correctional Facilities in New York. The prevalence of HIV/AIDS in the sample was 3.6% and women were more likely to be HIV-infected than men. The HIV prevalence rate was lower than the 5.8% reported for New York State prisons by the U.S. Department of Justice (2009). According to Kahn and colleagues (2006), the prevalence of selected STIs in correctional facilities ranged from 1.4 – 7% in men and 2.6 – 8.5% in women. Rates of STIs in this sample were elevated at 9.1% for men and 23.6% for women. All women entering prisons in New York are screened for syphilis, gonorrhea, chlamydia, and given PAP smears, which likely accounts for the high rates of STIs in women found in this sample. Men, however, are only routinely screened for syphilis; this routine screening may explain why syphilis was the second most frequently reported STI among men (26% of all STIs).

Aim 1. Patterns of *S. aureus* Co-infection with HIV or STIs

The first aim of this study was to describe the patterns of *S. aureus* co-infection with HIV or STIs in two prison populations. Results of this study revealed elevated rates of nasal and throat *S. aureus* carriage in both prisons (53.8%), which was similar between Sing Sing (55.6%) and Bedford Hills (52%). Previous research in the same prisons reported a *S. aureus* nasal colonization rate of 25.5% (Lowy, et al., 2007). However, researchers in the previous study cultured only the nares, whereas the current study cultured both the nares and throat. Further analyses examining site of *S. aureus* colonization revealed that 26%, 41%, and 33% of the sample was colonized in the nares only, throat only, and at both sites respectively. This finding of 26% nasal colonization is consistent with the previous research. Moreover, the high throat colonization rate supports recent findings identifying the throat as an important reservoir for *S. aureus* colonization and a potential area for continued study and intervention as throat culture may enhance *S. aureus* detection (Hamdan-Partida, et al., 2010; Lee, et al., 2011; Marshall & Spelman, 2007; Nilsson & Ripa, 2006).

Of all *S. aureus* isolates, 15.7% were methicillin resistant. Significant differences in methicillin resistance patterns were identified between male and female subjects. Women were more likely to be colonized with a methicillin resistant strain and men were more likely to be colonized with a methicillin susceptible strain. A similar trend was identified in the Texas prison system where women were nearly twice as likely as men to develop MRSA infections (Baillargeon, et al., 2004) as well as in a Mississippi prison during a MRSA outbreak (Centers for Disease Control and Prevention, 2001). Using a nationally representative sample of non-institutionalized persons, Kuehnert and colleagues (2006) also found a positive association between female sex and nasal MRSA carriage. Clear explanations for the increased rates of

MRSA among females are lacking in the current literature. In the current study, differences in MRSA carriage rates may be further obscured by the fact that women and men entering these facilities come from very different settings i.e., other jails vs. prisons. It is possible that the differences in previous residence may be mediating the apparent gender differences. Moreover, higher antibiotic use by women in the current sample may help to explain some of the elevation in MRSA in this group; however, the study design limits examination of this speculation as information regarding the temporal relationship between antibiotic use and MRSA colonization was not obtained.

Among HIV-infected men, 6/8 (75%) had a culture positive for *S. aureus* in either the nares and/or throat, but no significant differences were found between HIV-infected and uninfected subjects. Of men positive for *S. aureus,* none carried a MRSA strain. *S. aureus* carriage rates were also similar between HIV-infected and uninfected women. Although MRSA carriage rates among HIV women was high (21.1%), no significant difference was found in comparison to those not infected with HIV (11%). Therefore, the hypothesis that rates of *S. aureus* colonization would be higher in the HIV-infected compared to those not infected with HIV was not supported. The small HIV-infected sample size may be partially responsible for this finding as there was not sufficient power to detect differences between the two groups. Although MRSA carriage rates among HIV-infected subjects was high, no significant difference was found in comparison to those not infected with HIV. Interpretation of this non-significant result is likely limited due to the small number of HIV-infected subjects with MRSA ($n = 4$). The effect of the small sample is evident in the wide 95% confidence interval (0.68-6.8) for the odds ratio. A larger prison study ($n = 4663$) reported a nearly three-fold increase in the likelihood of having MRSA among HIV-infected inmates ($n = 234$) (Baillargeon, et al., 2004) while a smaller study

(n = 162) found no increase in MRSA risk among HIV-infected inmates (n = 8) (Maree et al., 2010). While other study-specific factors may be involved, some of the inconsistency in results across these studies can reasonably be attributed to differences in sample size.

No statistically significant differences in *S. aureus* carriage were identified between men with and without STIs in this sample. However, a greater proportion of men with STIs were colonized with an MRSA strain. Rates of *S. aureus* colonization were similar between female subjects with and without STIs at 59.1% and 49.8%, respectively. However, women with STIs were significantly more likely to be colonized with MRSA compared to those without STIs. Several factors may be acting to influence these findings. Again, the differences in gender and previous residence are evident, although it is not possible in the current study to determine which factor is exerting the true influence. Additionally, as 45% of those with STIs reported recent antibiotic use, it is possible that some of these individuals were prescribed antibiotics to treat an STI, which subsequently made them more susceptible to developing MRSA. Temporality could not be established because reliable data as to when a specific antibiotic was prescribed was not available. Research relating STI and *S. aureus* is limited and focuses on sexual risk behavior in HIV-infected individuals. Lee, et al (2005) found multiple sex partners and recent STI to be significantly associated with MRSA skin infection in univariate analysis among community-dwelling, HIV-infected men who have sex with men (MSM); however, neither retained significance in multivariate analysis. No studies linking STIs and *S. aureus* in a prison or jail setting were identified in the literature.

While the hypothesis that *S. aureus* rates among subjects with STIs would be higher than rates among those without STIs was not supported, it is clinically important that, among women, differences in MRSA rates were noted between the two groups. Assessment of specific antibiotic

use may prove useful in further evaluating the likely role of sound antimicrobial stewardship in preventing MRSA spread within the community as well as in closed settings, such as prisons and jails. The Federal Bureau of Prisons (2011) recommends first-line use of TMP-SMX for mild-moderate cases of MRSA SSTIs in prison settings.

Statistically significant differences in *S. aureus* carriage rates between subjects with and without HIV-infection or STIs was not supported by the data. However, several others findings are noteworthy. The data suggest that rates of *S. aureus* colonization may be uniformly elevated in corrections settings. The 41% throat colonization rate, when combined with mounting evidence of the role of throat colonization in *S. aureus* identification, may have important implications in future *S. aureus* surveillance studies. Furthermore, risk factors for STIs and HIV, e.g., high-risk sexual activity and injection drug use (IDU), are common in prison populations, even among those without STIs and HIV. It is plausible that the prevalence of these behaviors across groups made it difficult to detect increased risk of *S. aureus* specifically among subjects with STIs and HIV.

Aim 2. Risk factors for *S. aureus* co-infection with HIV or STIs

The second study aim was to identify risk factors for *S. aureus* co-infection with HIV or STIs in the two prisons. Limited sample size prohibited the fitting of regression models to identify risk factors for HIV-*S. aureus* (n = 15) and STI-*S. aureus* in men (n = 16).Therefore, a risk model was only fit for women co-infected with STI-*S. aureus.*

In multivariate analysis, controlling for age, race/ethnicity, and education level, average number of showers taken each week was significantly associated with STI-*S. aureus* co-infection. Subjects who reported taking more showers each week were more likely to be co-infected with STI-*S. aureus.* While it was expected that showering practices would be a risk

factor for co-infection, the direction of the association is inconsistent with previous literature. In multivariate analysis, Maree and colleagues (2010) found daily showering to be protective against MRSA colonization in a corrections setting. Indeed, numerous investigations have identified inadequate hygiene, including limited access to showering, as a facilitator of MRSA spread in prisons (Aiello, et al., 2006; Bick, 2007; Centers for Disease Control and Prevention, 2001; Centers for Disease Control and Prevention, 2003a, 2003c). Given the current sample, it is possible that women may take more showers as a result of their STI symptoms, e.g., vaginal discharge. This hypothesis may be even more reasonable if indeed these women acquire MRSA as a result of antibiotic use to treat STIs. If this were the case, we would expect elevated MRSA rates to persist in the presence of adequate hygiene practices, such as frequent showering. This possibility, however, is speculative as we were not able to analyze such a hypothesis with the data collected. Further investigation in this area is warranted to accurately examine and explain this relationship.

Relationship of Findings Conceptual framework

The vulnerable populations model for health-related research developed by Flaskerud & Winslow (1998) was the conceptual framework used to guide this study. The model conceptualizes relationships between resource availability, relative rids, and health status in groups considered to be vulnerable to comparatively poorer health outcomes than the general population. The model was modified for the particular case of *S. aureus,* STIs, and HIV in prisons and the current inquiry aimed to address the relationship between relative risk and health status. Specifically, the study examined the extent to which poor health status, operationalized as STI and HIV infection, in a high risk prison environment is associated with other negative health outcomes, i.e., *S. aureus* colonization. The data suggested that individuals with STI and HIV

experienced high rates of *S. aureus* colonization. However, these individuals' *increased* vulnerability for carrying *S. aureus* compared to other prisoners was not supported by the data as evidenced by non-significant differences in *S. aureus* carriage between subjects with and without STIs and HIV.

Study Limitations

There were several noteworthy limitations to this study that must be considered when interpreting and applying the results. These limitations include threats to validity, generalizability, and inadequate power.

The cross-sectional nature of this study limits interpretation of the results. Because causality cannot be inferred based on the associations identified, the temporal direction of the relationships is unknown. Antibiotic use was common in the STI sample; however, it was not known whether antibiotic use preceded the STI diagnosis.

There are also limitations related to internal validity as a result of using a self-report interview. Recall bias was a concern in asking participants to remember activities within a certain time frame, such as in the past six months. It is also possible that some participants failed to report certain behaviors, such as IDU, due to social desirability. If underreporting of risk factors occurred frequently, then it may be that the observed results were conservative estimates. We attempted to reduce recall bias by including a medical record review as additional method of validation for the interview responses. However, this process proved useful primarily in obtaining laboratory results for STIs since inconsistent collection of self-report items, e.g., sexual history, by prison staff prohibited use of the medical record as a reliability check for participants' self-report.

Non-random, convenience sampling was used, which threatened generalizability. Because no data were collected for those prisoners who refused to participate, it is not certain that they were similar to those who participated. Moreover, only two prisons in New York State were sampled. Our sample was generally younger than the populations in both facilities. The sample from Bedford Hills was less educated than the overall female population of state prisons. However, in the comparative analyses, we adjusted the model for these variables to control for these differences.

An a priori power analysis was conducted and noted that this secondary analysis was underpowered to detect differences in *S. aureus* colonization between groups of subjects with HIV and STIs (Table 3.3). Interim data from the parent study found a higher than expected *S. aureus* carriage rate (~50%); consequently, the targeted total sample size was reduced from 910 to 800. Upon completion of the analysis, an a posteriori power analysis was conducted to determine the true power of this secondary analysis. Given the following sample sizes: n_{total}=756, n_{HIV} = 27, n_{STI} = 123, prevalence$_{S.\ aureus}$ = 0.5, the calculated power for HIV = .058 and for STI = 0.075. The severely limited power greatly hindered the ability to detect differences as the chi-square statistic used to analyze the categorical data is heavily influenced by sample size. Low statistical power increases the likelihood of finding statistically non-significant results. Interpretation of such results is inconclusive because it is possible that a difference between measured groups existed, but was not detected, i.e., a type II error occurred. Sufficient numbers of subjects with and without the variables of interest were not obtained in this study. In this secondary analysis, it was not possible to control the power obtained since the total sample size was dictated by the aims of the parent study.

Implications

This study revealed high levels of *S. aureus* carriage in two New York State prisons. Several implications for practice, policy, and future research emerged in light of these findings and the aims of the study.

Practice implications. The literature suggests that nurses working in corrections are often conflicted in their dual roles as custodians and caregivers (Watson, et al., 2004). This conflict may manifest most clearly in the case of maintaining adequate infection prevention strategies in prisons.

Nurses can play a critical role in the early identification and treatment of *S. aureus* infections in prison settings. The threshold for suspicion for *S. aureus* infection should be lowered in this setting with markedly high rates of carriage. As the gatekeeper to health services, it is primarily the nurse's duty to be vigilant in identifying potential infections and referring inmates to appropriate medical staff to ensure timely treatment, thereby minimizing the risk of transmission.

Creative strategies that maximize infection prevention measures and minimize threats to safety require collaborative efforts to engage staff, policymakers, as well as prisoners. Previous interventions to reduce MRSA transmission in prisons involved an educational component for prisoners (Centers for Disease Control and Prevention, 2003a). Patient education is an essential nursing function and should not be neglected, regardless of the population being served. Nurses can take advantage of their frequent contact with inmates to develop educational sessions surrounding infection control and realistic hygiene strategies that can be implemented in the restricted prison setting. Despite its challenges, practicing nursing in prisons provides an

excellent opportunity for nurses to engage in their roles as advocates for staff and inmates to potentially make tangible impacts on health outcomes.

Policy implications. Any policy relating to the provision of healthcare must be informed by sound, clinically-relevant research. Prisoners have a constitutional mandate guaranteeing healthcare services (Estelle v. Gamble, 1976), and are considered a vulnerable research population. Therefore, it may be difficult for outside researchers to access correctional facilities. Researchers have documented the ethical and regulatory challenges inherent in prison research, as well as approaches that can be taken to overcome these challenges (Byrne, 2005; Brewer-Smith, 2008). An interdisciplinary, collaborative approach to research and policy recommendations in which all vested interests, e.g., prison administrators, staff, and prisoners are key players is essential (Byrne, 2005). Moreover, the primary role of prisons is containment and security; therefore, maintaining safety is of paramount importance. As a result, current practices in correctional facilities restrict access to critical supplies necessary to prevent transmission of infections, such as bleach for laundering and alcohol-based hand sanitizers. Such supplies are considered potential safety hazards as they can readily be used to cause injury to other inmates and staff (Bick, 2007). These considerations must be taken into account by researchers when making policy recommendations to administrators who must maintain balance in preventing the spread of disease and lessening the potential for harm to staff and inmates. The Federal Bureau of Prisons (2011) provides guidelines for the management of MRSA in prison settings, which outlines practical steps to be taken to prevent, identify, and treat MRSA in these settings.

Colonization with *S. aureus,* and MRSA specifically, is often a precursor to clinical infection, although most colonized individuals do not progress to infection (Miller, et al., 2003). Neither routine screening nor nasal decolonization for *S. aureus* has been found effective in

preventing *S. aureus* infection and is not recommended in healthcare settings (Gorwitz, et al., 2006). Therefore, a universal screening program may not be the most effective way to curb the spread of *S. aureus* despite the high carriage rates in prisons. Instead, prison administrators and infection control staff should be committed to implementing and enforcing measures that reduce the risk of *S. aureus* transmission. In response to MRSA outbreaks, correctional facilities across the country have had success in reducing the incidence of MRSA. This success has been due, in part, to implementing non-clinical changes, such as hygiene education and more frequent laundry changes for inmates (Centers for Disease Control and Prevention, 2003a; Wootton, et al., 2004). If consistent implementation of these changes results in a decline in *S. aureus* carriage rates, the cost-effectiveness of the changes should also be assessed to ensure a reasonable allocation of resources. Although cost should not be the primary driving factor in studious infection control policies, it is a necessary consideration when fiscal and human resources are limited.

This study's results also support the institution of routine screening for STIs for men upon entering the corrections system. Women tend to have higher rates of STIs, primarily because they seek care for symptoms, whereas men with STIs are often asymptomatic although they remain infectious (Centers for Disease Control and Prevention, 2009c). For some men in the community who have frequent contact with the criminal justice system, correctional facilities serve as their only source of primary care. Therefore, diagnosis and treatment for STIs upon entry to the system would serve as both a corrections and public health initiative by capturing an otherwise hard to reach population for health interventions.

Future research implications. This study addressed the co-infection status of inmates newly entering two prison facilities. Consequently, the results are not reflective of specific prison-level factors that may impact co-infection rates. However, as over 95% of

respondents reported their most recent residence as another correctional facility, it may still be that facility-level dynamics are influencing *S. aureus* colonization rates among prisoners with HIV or STIs. Studies examining colonization rates in prisoners upon discharge from their current facility will shed light on potential facility-specific factors that may facilitate or impede transmission of *S. aureus.* Intervention studies, targeting amendable risk factors within the prisons can then be individually crafted based on prison-specific factors. Social networking analyses examining prisoner contacts and location within the prison may identify deficiencies in infection control practices that are contributing to the persistently elevated rates of *S. aureus.* It should be noted, however, that the often abrupt transfer of inmates between facilities may limit the feasibility of following specific inmates over time. Federal guidelines do, however, recommend that inmates who have been identified with MRSA not be transferred to other facilities until they have completed their course of treatment (Bureau of Prisons, 2011).

A complex interaction across the community, individuals who come into contact with correctional facilities, and the physical facilities themselves exists. Some researchers suggest simply that individuals acquire MRSA in prisons and transmit it back into the community upon release (Skiest, et al., 2006). Okano and Blower (2010), however, offer a more sophisticated model of *S. aureus* transmission within the Los Angeles County Jail and back into the surrounding community. Their model accounts for the increased likelihood of MRSA spread within prisons due to overcrowding, which increases the frequency of an infected person contacting other inmates and transmitting MRSA. In this way, the jail acts as an "amplification zone" for MRSA spread since the infected inmate arriving in the prison would not likely have had close contact with as many individuals had he not been incarcerated. Network modeling techniques, which identify individual and spatial contacts over time, could be used to further

investigate the proposed interactions in this model which could be useful in managing the spread of *S. aureus* in both correctional settings and the community.

Future research into *S. aureus* colonization patterns among prisoners with HIV and STIs should build on results of the current study by addressing the methodological flaws to improve rigor and strengthen the validity of any observed findings. A major limitation of the current inquiry was inadequate sample size of subjects with HIV or STIs, which limited power. A primary analysis, adequately powered to study similar aims as the current investigation could be undertaken. Future inquiries should also attempt to access more objective patient data. This may be challenging for newly arriving inmates, as we found that much of the history provided in the medical record at intake is based on the inmate's self-report. However, treatment records are more complete when the inmate is seen in the prison's medical facility for care. Therefore, a prevalence study, limited to inmates who have been in the same facility for at least six months, could provide richer medical data.

Conclusion

Results of this cross-sectional, correlational secondary analysis revealed markedly elevated rates of *S. aureus* carriage in the two prisons studied. Previous research has examined HIV as in independent predictor of *S. aureus* in prisons, but has not examined the risk factors associated with co-infection as an outcome. This was the first study to specifically examine the prevalence and risk factors for HIV-*S. aureus* and STI-*S. aureus* co-infection in prisons in a non-outbreak setting. Although not statistically significant, co-infection with HIV or STIs among those colonized with *S. aureus* was high. Prisons represent a restrictive environment, where individuals are frequently in close physical contact, thereby increasing the likelihood of *S. aureus* transmission. A better baseline understanding of risk for colonization in this setting is

needed to identify transmission dynamics and more clearly elucidate opportunities for prevention and intervention. Despite methodological weaknesses, the study is relevant prisons and prisoners in attempting to identify and control the spread of infectious disease and provides a basis for more rigorous inquiry into *S. aureus* prevalence and transmission in prisons.

References

Adcock, P. M., Pastor, P., Medley, F., Patterson, J. E., & Murphy, T. V. (1998). Methicillin-resistant Staphylococcus aureus in two child care centers. *J Infect Dis, 178*(2), 577-580.

Ahuja, D., & Albrecht, H. (2009). HIV and community-acquired MRSA. *AIDS Clin Care, 21*(3), 21-23.

Aiello, A. E., Lowy, F. D., Wright, L. N., & Larson, E. L. (2006). Methicillin-resistant Staphylococcus aureus among US prisoners and military personnel: review and recommendations for future studies. *Lancet Infect Dis, 6*(6), 335-341.

Baillargeon, J., Black, S. A., Leach, C. T., Jenson, H., Pulvino, J., Bradshaw, P., et al. (2004). The infectious disease profile of Texas prison inmates. *Prev Med, 38*(5), 607-612.

Baillargeon, J., Kelley, M. F., Leach, C. T., Baillargeon, G., & Pollock, B. H. (2004). Methicillin-resistant Staphylococcus aureus infection in the Texas prison system. *Clin Infect Dis, 38*(9), e92-95.

Barrett, F. F., McGehee, R. F., Jr., & Finland, M. (1968). Methicillin-resistant Staphylococcus aureus at Boston City Hospital. Bacteriologic and epidemiologic observations. *N Engl J Med, 279*(9), 441-448.

Begier, E. M., Frenette, K., Barrett, N. L., Mshar, P., Petit, S., Boxrud, D. J., et al. (2004). A high-morbidity outbreak of methicillin-resistant Staphylococcus aureus among players on a college football team, facilitated by cosmetic body shaving and turf burns. *Clin Infect Dis, 39*(10), 1446-1453.

Bick, J. A. (2007). Infection control in jails and prisons. *Clin Infect Dis, 45*(8), 1047-1055.

Boyce, J. M., Havill, N. L., & Maria, B. (2005). Frequency and possible infection control implications of gastrointestinal colonization with methicillin-resistant Staphylococcus aureus. *J Clin Microbiol, 43*(12), 5992-5995.

Boye, K., Bartels, M. D., Andersen, I. S., Moller, J. A., & Westh, H. (2007). A new multiplex PCR for easy screening of methicillin-resistant Staphylococcus aureus SCCmec types I-V. *Clin Microbiol Infect, 13*(7), 725-727.

Brewer-Smyth, K. (2008). Ethical, regulatory, and investigator considerations in prison research. *Advances in Nursing Science, 31*(2), 119-127.

Broad, J., Cox, T., Rodriguez, S., Mansour, M., Mennella, C., Murphy-Swallow, D., et al. (2009). The impact of discontinuation of male STD screening services at a large urban county jail: Chicago, 2002-2004. *Sex Transm Dis, 36*(2 Suppl), S49-52.

Brumfitt, W., & Hamilton-Miller, J. (1989). Methicillin-resistant Staphylococcus aureus. *N Engl J Med, 320*(18), 1188-1196.

Byrne, M.W. (2005). Conducting research as a visiting scientist in a women's prison. *Journal of Professional Nursing, 21*(4), 223-230.

Cambiano, V., Lampe, F. C., Rodger, A. J., Smith, C. J., Geretti, A. M., Lodwick, R. K., et al. (2010). Long-term trends in adherence to antiretroviral therapy from start of HAART. *AIDS, 24*(8), 1153-1162.

Campbell, K. M., Vaughn, A. F., Russell, K. L., Smith, B., Jimenez, D. L., Barrozo, C. P., et al. (2004). Risk factors for community-associated methicillin-resistant Staphylococcus aureus infections in an outbreak of disease among military trainees in San Diego, California, in 2002. *J Clin Microbiol, 42*(9), 4050-4053.

Cenizal, M. J., Hardy, R. D., Anderson, M., Katz, K., & Skiest, D. J. (2008). Prevalence of and risk factors for methicillin-resistant Staphylococcus aureus (MRSA) nasal colonization in HIV-infected ambulatory patients. *J Acquir Immune Defic Syndr, 48*(5), 567-571.

Centers for Disease Control and Prevention (2010a). *Chlamydia Fact Sheet.* Retrieved from http://www.cdc.gov/std/chlamydia/STDFACT-Chlamydia.htm

Centers for Disease Control and Prevention (2010b). *Chlamydia Profiles, 2008.* Retrieved from http://www.cdc.gov/std/chlamydia2008/stateA.htm

Centers for Disease Control and Prevention (2011a). *Diagnoses of HIV Infection and AIDS in the United States and Dependent Areas, 2009. HIV Surveillance Report,* Volume 21. Retrieved from http://www.cdc.gov/hiv/surveillance/resources/reports/2008report/

Centers for Disease Control and Prevention (2010c). *Genital Herpes Fact Sheet.* Retrieved from http://www.cdc.gov/std/Herpes/STDFact-Herpes.htm.

Centers for Disease Control and Prevention (2008). *Gonorrhea Fact Sheet.* Retrieved from http://www.cdc.gov/std/Gonorrhea/STDFact-gonorrhea.htm.

Centers for Disease Control and Prevention (2009a). Guidelines for Prevention and Treatment of Opportunistic Infections in HIV-Infected Adults and Adolescents. *Morbidity & Mortality Weekly Report, 58*(RR04), 1-198.

Centers for Disease Control and Prevention (2009b). *HIV/AIDS Surveillance Report, 2007*, Vol. 19. Retrieved from http://www.cdc.gov/hiv/topics/surveillance/resources/reports/.

Centers for Disease Control and Prevention (2011b). HIV Surveillance – United States, 1981-2008. *Morbidity & Mortality Weekly Report, 60*(21), 689-693.

Centers for Disease Control and Prevention (2003a). Methicillin-resistant Staphylococcus *aureus* infection in correctional facilities- Georgia, California, and Texas, 2001-2003. *Morbidity & Mortality Weekly Report, 52*(41), 992-996.

Centers for Disease Control and Prevention (2003b). Methicillin-resistant *Staphylococcus aureus* infections among competitive sports participants – Colorado, Indiana, Pennsylvania, and Los Angeles County, 2000-2003. *Morbidity & Mortality Weekly Report, 52*(33)*,* 793-795.

Centers for Disease Control and Prevention (2003c). Methicillin-resistant *Staphylococcus aureus* skin or soft tissue infections in a state prison---Mississippi, 2000. *Morbidity & Mortality Weekly Report, 50*(42), 919-922.

Centers for Disease Control and Prevention (2010d). *Overview of Healthcare-associated MRSA*. Retrieved from http://www.cdc.gov/ncidod/dhqp/ar_mrsa.html.

Centers for Disease Control and Prevention (2009d). *Sexually Transmitted Disease Morbidity 1984 - 2008 by Gender*, CDC WONDER On-line Database, November 2009.

Centers for Disease Control and Prevention (2009d). *Sexually Transmitted Disease Surveillance, 2008*. Atlanta, GA: U.S. Department of Health and Human Services.

Chambers, H. F., & Deleo, F. R. (2009). Waves of resistance: Staphylococcus aureus in the antibiotic era. *Nat Rev Microbiol, 7*(9), 629-641.

Cook, H. A., Furuya, E. Y., Larson, E., Vasquez, G., & Lowy, F. D. (2007). Heterosexual transmission of community-associated methicillin-resistant Staphylococcus aureus. *Clin Infect Dis, 44*(3), 410-413.

Cosgrove, S. E., Qi, Y., Kaye, K. S., Harbarth, S., Karchmer, A. W., & Carmeli, Y. (2005). The impact of methicillin resistance in Staphylococcus aureus bacteremia on patient outcomes: mortality, length of stay, and hospital charges. *Infect Control Hosp Epidemiol, 26*(2), 166-174.

Cosgrove, S. E., Sakoulas, G., Perencevich, E. N., Schwaber, M. J., Karchmer, A. W., & Carmeli, Y. (2003). Comparison of Mortality Associated with Methicillin-Resistant and Methicillin-Susceptible Staphylococcus aureus Bacteremia: A Meta-Analysis. *Clinical Infectious Diseases, 36*(1), 53-59.Crum, N. F., Lee, R. U., Thornton, S. A., Stine, O. C., Wallace, M. R., Barrozo, C., et al. (2006). Fifteen-year study of the changing epidemiology of methicillin-resistant Staphylococcus aureus. *Am J Med, 119*(11), 943-951.

Crum-Cianflone, N. F., Burgi, A. A., & Hale, B. R. (2007). Increasing rates of community-acquired methicillin-resistant Staphylococcus aureus infections among HIV-infected persons. *Int J STD AIDS, 18*(8), 521-526.

Crum-Cianflone, N., Weekes, J., & Bavaro, M. (2009). Recurrent community-associated methicillin-resistant Staphylococcus aureus infections among HIV-infected persons: incidence and risk factors. *AIDS Patient Care STDS, 23*(7), 499-502.

Diekema, D. J., BootsMiller, B. J., Vaughn, T. E., Woolson, R. F., Yankey, J. W., Ernst, E. J., et al. (2004). Antimicrobial resistance trends and outbreak frequency in United States hospitals. *Clin Infect Dis, 38*(1), 78-85.

Diep, B. A., Chambers, H. F., Graber, C. J., Szumowski, J. D., Miller, L. G., Han, L. L., et al. (2008). Emergence of multidrug-resistant, community-associated, methicillin-resistant Staphylococcus aureus clone USA300 in men who have sex with men. *Ann Intern Med, 148*(4), 249-257.

Este, J. A., & Cihlar, T. (2010). Current status and challenges of antiretroviral research and therapy. *Antiviral Res, 85*(1), 25-33.

Estelle v. Gamble, 429 U.S. 97 (1976).

Eveillard, M., de Lassence, A., Lancien, E., Barnaud, G., Ricard, J. D., & Joly-Guillou, M. L. (2006). Evaluation of a strategy of screening multiple anatomical sites for methicillin-resistant Staphylococcus aureus at admission to a teaching hospital. *Infect Control Hosp Epidemiol, 27*(2), 181-184.

Federal Bureau of Prisons (2011). Clinical Practice Guidelines: Management of MRSA infections. Retrieved from http://www.bop.gov/news/PDFs/mrsa.pdf.

Feliner, J., & Abramsky, S. (2003). Ill-Equipped: US Prisons and Offenders With Mental Illness. *Huamn Rights Watch*.

Flanigan, T. P., Zaller, N., Taylor, L., Beckwith, C., Kuester, L., Rich, J., et al. (2009). HIV and infectious disease care in jails and prisons: breaking down the walls with the help of academic medicine. *Trans Am Clin Climatol Assoc, 120*, 73-83.

Flaskerud, J. H., & Winslow, B. J. (1998). Conceptualizing vulnerable populations health-related research. *Nurs Res, 47*(2), 69-78.

Fleming, D. T., & Wasserheit, J. N. (1999). From epidemiological synergy to public health policy and practice: the contribution of other sexually transmitted diseases to sexual transmission of HIV infection. *Sex Transm Infect, 75*(1), 3-17.

Friedman, N. D., Kaye, K. S., Stout, J. E., McGarry, S. A., Trivette, S. L., Briggs, J. P., et al. (2002). Health care--associated bloodstream infections in adults: a reason to change the accepted definition of community-acquired infections. *Ann Intern Med, 137*(10), 791-797.

Gonzalez, B. E., Rueda, A. M., Shelburne, S. A., 3rd, Musher, D. M., Hamill, R. J., & Hulten, K. G. (2006). Community-associated strains of methicillin-resistant Staphylococccus aureus as the cause of healthcare-associated infection. *Infect Control Hosp Epidemiol, 27*(10), 1051-1056.

Gorwitz, R. J., Kruszon-Moran, D., McAllister, S. K., McQuillan, G., McDougal, L. K., Fosheim, G. E., et al. (2008). Changes in the prevalence of nasal colonization with Staphylococcus aureus in the United States, 2001-2004. *J Infect Dis, 197*(9), 1226-1234.

Hall, H. I., Song, R., Rhodes, P., Prejean, J., An, Q., Lee, L. M., et al. (2008). Estimation of HIV incidence in the United States. *JAMA, 300*(5), 520-529.

Hallin, M., Deplano, A., Denis, O., De Mendonca, R., De Ryck, R., & Struelens, M. J. (2007). Validation of pulsed-field gel electrophoresis and spa typing for long-term, nationwide epidemiological surveillance studies of Staphylococcus aureus infections. *J Clin Microbiol, 45*(1), 127-133.

Hamdan-Partida, A., T. Sainz-Espunes, et al. (2010). "Characterization and persistence of Staphylococcus aureus strains isolated from the anterior nares and throats of healthy carriers in a Mexican community." *J Clin Microbiol, 48*(5), 1701-1705.

Hammer, S. M., Eron, J. J., Jr., Reiss, P., Schooley, R. T., Thompson, M. A., Walmsley, S., et al. (2008). Antiretroviral treatment of adult HIV infection: 2008 recommendations of the International AIDS Society-USA panel. *JAMA, 300*(5), 555-570.

Hammett, T., Roberts, C., & Kennedy, S. (2001). Health-related issues in prisoner reentry. *Crime Delinquency, 47*(3), 390-409.

Hammett, T. M. (2006). HIV/AIDS and other infectious diseases among correctional inmates: transmission, burden, and an appropriate response. *Am J Public Health, 96*(6), 974-978.

Hammett, T. M. (2009). Sexually transmitted diseases and incarceration. *Curr Opin Infect Dis, 22*(1), 77-81.

Hammett, T. M., & Drachman-Jones, A. (2006). HIV/AIDS, sexually transmitted diseases, and incarceration among women: national and southern perspectives. *Sex Transm Dis, 33*(7 Suppl), S17-22.

Hammett, T. M., Harmon, M. P., & Rhodes, W. (2002). The burden of infectious disease among inmates of and releases from US correctional facilities, 1997. *Am J Public Health, 92*(11), 1789-1794.

Harmsen, D., Claus, H., Witte, W., Rothganger, J., Turnwald, D., & Vogel, U. (2003). Typing of methicillin-resistant Staphylococcus aureus in a university hospital setting by using novel software for spa repeat determination and database management. *J Clin Microbiol, 41*(12), 5442-5448.

Herold, B. C., Immergluck, L. C., Maranan, M. C., Lauderdale, D. S., Gaskin, R. E., Boyle-Vavra, S., et al. (1998). Community-acquired methicillin-resistant Staphylococcus aureus in children with no identified predisposing risk. *JAMA, 279*(8), 593-598.

Hidron, A. I., Kourbatova, E. V., Halvosa, J. S., Terrell, B. J., McDougal, L. K., Tenover, F. C., et al. (2005). Risk factors for colonization with methicillin-resistant Staphylococcus aureus (MRSA) in patients admitted to an urban hospital: emergence of community-associated MRSA nasal carriage. *Clin Infect Dis, 41*(2), 159-166.

Hota, B., Ellenbogen, C., Hayden, M. K., Aroutcheva, A., Rice, T. W., & Weinstein, R. A. (2007). Community-associated methicillin-resistant Staphylococcus aureus skin and soft tissue infections at a public hospital: do public housing and incarceration amplify transmission? *Arch Intern Med, 167*(10), 1026-1033.

International Working Group on the Classification of Staphylococcal Cassette Chromosome Elements (2009). Classification of staphylococcal cassette chromosome mec (SCCmec): guidelines for reporting novel SCCmec elements. *Antimicrob Agents Chemother, 53*(12), 4961-4967.

Jarvis, W. R., Schlosser, J., Chinn, R. Y., Tweeten, S., & Jackson, M. (2007). National prevalence of methicillin-resistant Staphylococcus aureus in inpatients at US health care facilities, 2006. *Am J Infect Control, 35*(10), 631-637.

Kahn, R. H., Joesoef, R., Aynalem, G., Puisis, M., Raba, J. M., & Kerndt, P. R. (2006). Overview of sexually transmitted diseases. In M. Puisis (Ed.), *Clinical practice in correctional medicine* (2nd ed., pp. 175-181). Philadelphia: Mosby Elsevier.

Kazakova, S. V., Hageman, J. C., Matava, M., Srinivasan, A., Phelan, L., Garfinkel, B., et al. (2005). A clone of methicillin-resistant Staphylococcus aureus among professional football players. *N Engl J Med, 352*(5), 468-475.

Klevens, R. M., Edwards, J. R., Richards, C. L., Jr., Horan, T. C., Gaynes, R. P., Pollock, D. A., et al. (2007). Estimating health care-associated infections and deaths in U.S. hospitals, 2002. *Public Health Rep, 122*(2), 160-166.

Klevens, R. M., Edwards, J. R., Tenover, F. C., McDonald, L. C., Horan, T., & Gaynes, R. (2006). Changes in the epidemiology of methicillin-resistant Staphylococcus aureus in intensive care units in US hospitals, 1992-2003. *Clin Infect Dis, 42*(3), 389-391.

Klevens, R. M., Morrison, M. A., Nadle, J., Petit, S., Gershman, K., Ray, S., et al. (2007). Invasive Methicillin-Resistant Staphylococcus aureus Infections in the United States. *JAMA, 298*(15), 1763-1771.

Koreen, L., Ramaswamy, S. V., Graviss, E. A., Naidich, S., Musser, J. M., & Kreiswirth, B. N. (2004). spa typing method for discriminating among Staphylococcus aureus isolates: implications for use of a single marker to detect genetic micro- and macrovariation. *J Clin Microbiol, 42*(2), 792-799.

Krebs, C. P. (2002). High-Risk HIV Transmission Behavior in Prison and the Prison Subculture. *The Prison Journal, 82*(1), 19-49.

Krucke, G. W., Grimes, D. E., Grimes, R. M., & Dang, T. D. (2009). Antibiotic resistance in Staphylococcus aureus-containing cutaneous abscesses of patients with HIV. *Am J Emerg Med, 27*(3), 344-347.

Kuehnert, M. J., Hill, H. A., Kupronis, B. A., Tokars, J. I., Solomon, S. L., & Jernigan, D. B. (Writer) (2005). Methicillin-resistant--Staphylococcus aureus Hospitalizations, United States [Article], *Emerging Infectious Diseases*: Centers for Disease Control & Prevention (CDC).

Kuehnert, M. J., Kruszon-Moran, D., Hill, H. A., McQuillan, G., McAllister, S. K., Fosheim, G., et al. (2006). Prevalence of Staphylococcus aureus nasal colonization in the United States, 2001-2002. *J Infect Dis, 193*(2), 172-179.

Lee, C. J., S. Sankaran, et al. (2011). Staphylococcus aureus oropharyngeal carriage in a prison population. *Clin Infect Dis, 52*(6), 775-778.

Lee, M. C., Rios, A. M., Aten, M. F., Mejias, A., Cavuoti, D., McCracken, G. H., Jr., et al. (2004). Management and outcome of children with skin and soft tissue abscesses caused by community-acquired methicillin-resistant Staphylococcus aureus. *Pediatr Infect Dis J, 23*(2), 123-127.

Lee, N. E., Taylor, M. M., Bancroft, E., Ruane, P. J., Morgan, M., McCoy, L., et al. (2005). Risk factors for community-associated methicillin-resistant Staphylococcus aureus skin infections among HIV-positive men who have sex with men. *Clin Infect Dis, 40*(10), 1529-1534.

Liu, C., Graber, C. J., Karr, M., Diep, B. A., Basuino, L., Schwartz, B. S., et al. (2008). A population-based study of the incidence and molecular epidemiology of methicillin-resistant Staphylococcus aureus disease in San Francisco, 2004-2005. *Clin Infect Dis, 46*(11), 1637-1646.

Lowy, F. D. (1998). Staphylococcus aureus infections. *N Engl J Med, 339*(8), 520-532.

Lowy, F. D., Aiello, A. E., Bhat, M., Johnson-Lawrence, V. D., Lee, M. H., Burrell, E., et al. (2007). Staphylococcus aureus colonization and infection in New York State prisons. *J Infect Dis, 196*(6), 911-918.

Mahon, N. (1996). New York inmates' HIV risk behaviors: the implications for prevention policy and programs. *Am J Public Health, 86*(9), 1211-1215.

Mannheimer, S., Friedland, G., Matts, J., Child, C., & Chesney, M. (2002). The consistency of adherence to antiretroviral therapy predicts biologic outcomes for human immunodeficiency virus-infected persons in clinical trials. *Clin Infect Dis, 34*(8), 1115-1121.

Maree, C. L., Daum, R. S., Boyle-Vavra, S., Matayoshi, K., & Miller, L. G. (2007). Community-associated methicillin-resistant Staphylococcus aureus isolates causing healthcare-associated infections. *Emerg Infect Dis, 13*(2), 236-242.

Marshall, C. and D. Spelman (2007). "Re: is throat screening necessary to detect methicillin-resistant Staphylococcus aureus colonization in patients upon admission to an intensive care unit?" *J Clin Microbiol, 45*(11), 3855.

Mathews, W. C., Caperna, J. C., Barber, R. E., Torriani, F. J., Miller, L. G., May, S., et al. (2005). Incidence of and risk factors for clinically significant methicillin-resistant Staphylococcus aureus infection in a cohort of HIV-infected adults. *J Acquir Immune Defic Syndr, 40*(2), 155-160.

McDougal, L. K., Steward, C. D., Killgore, G. E., Chaitram, J. M., McAllister, S. K., & Tenover, F. C. (2003). Pulsed-field gel electrophoresis typing of oxacillin-resistant Staphylococcus aureus isolates from the United States: establishing a national database. *J Clin Microbiol, 41*(11), 5113-5120.

Mellmann, A., T. Weniger, et al. (2008). Characterization of clonal relatedness among the natural population of Staphylococcus aureus strains by using spa sequence typing and the BURP (based upon repeat patterns) algorithm. *J Clin Microbiol, 46*(8), 2805-2808.

Mertz, K. J., Voigt, R. A., Hutchins, K., & Levine, W. C. (2002). Findings from STD screening of adolescents and adults entering corrections facilities: implications for STD control strategies. *Sex Transm Dis, 29*(12), 834-839.

Miller, M., Cespedes, C., Vavagiakis, P., Klein, R. S., & Lowy, F. D. (2003). Staphylococcus aureus colonization in a community sample of HIV-infected and HIV-uninfected drug users. *Eur J Clin Microbiol Infect Dis, 22*(8), 463-469.

Miller, L. G., F. Perdreau-Remington, et al. (2007). Clinical and epidemiologic characteristics cannot distinguish community-associated methicillin-resistant Staphylococcus aureus infection from methicillin-susceptible S. aureus infection: a prospective investigation. *Clin Infect Dis, 44*(4): 471-482.

Naimi, T. S., LeDell, K. H., Como-Sabetti, K., Borchardt, S. M., Boxrud, D. J., Etienne, J., et al. (2003). Comparison of community- and health care-associated methicillin-resistant Staphylococcus aureus infection. *JAMA, 290*(22), 2976-2984.

Nilsson, P., & Ripa, T. (2006). Staphylococcus aureus throat colonization is more frequent than colonization in the anterior nares. *J Clin Microbiol, 44*(9), 3334-3339.

Okano, J. T., & Blower, S. (2010). Are correctional facilities amplifying the epidemic of community-acquired methicillin-resistant Staphylococcus aureus? *Nat Rev Micro, 8*(1), 82-83.

Oliveira, D. C., & de Lencastre, H. (2002). Multiplex PCR strategy for rapid identification of structural types and variants of the mec element in methicillin-resistant Staphylococcus aureus. *Antimicrob Agents Chemother, 46*(7), 2155-2161.

Pollack, H., Khoshnood, K., & Altice, F. (1999). Health care delivery strategies for criminal offenders. *J Health Care Finance, 26*(1), 63-77.

Popovich, K. J., Weinstein, R. A., Aroutcheva, A., Rice, T., & Hota, B. (2010). Community-associated methicillin-resistant Staphylococcus aureus and HIV: intersecting epidemics. *Clin Infect Dis, 50*(7), 979-987.

Popovich, K. J., Weinstein, R. A., & Hota, B. (2008). Are community-associated methicillin-resistant Staphylococcus aureus (MRSA) strains replacing traditional nosocomial MRSA strains? *Clin Infect Dis, 46*(6), 787-794.

Ramsetty, S. K., Stuart, L. L., Blake, R. T., Parsons, C. H., & Salgado, C. D. (2010). Risks for methicillin-resistant Staphylococcus aureus colonization or infection among patients with HIV infection. *HIV Med*.

Seybold, U., Kourbatova, E. V., Johnson, J. G., Halvosa, S. J., Wang, Y. F., King, M. D., et al. (2006). Emergence of community-associated methicillin-resistant Staphylococcus aureus USA300 genotype as a major cause of health care-associated blood stream infections. *Clin Infect Dis, 42*(5), 647-656.

Shet, A., Mathema, B., Mediavilla, J. R., Kishii, K., Mehandru, S., Jeane-Pierre, P., et al. (2009). Colonization and subsequent skin and soft tissue infection due to methicillin-resistant Staphylococcus aureus in a cohort of otherwise healthy adults infected with HIV type 1. *J Infect Dis, 200*(1), 88-93.

Skiest, D., Brown, K., Hester, J., Moore, T., Crosby, C., Mussa, H. R., et al. (2006). Community-onset methicillin-resistant Staphylococcus aureus in an urban HIV clinic. *HIV Med, 7*(6), 361-368.

Skov, R. L., & Jensen, K. S. (2009). Community-associated meticillin-resistant Staphylococcus aureus as a cause of hospital-acquired infections. *J Hosp Infect, 73*(4), 364-370.

Spaulding, A. C., Seals, R. M., Page, M. J., Brzozowski, A. K., Rhodes, W., & Hammett, T. M. (2009). HIV/AIDS among inmates of and releases from US correctional facilities, 2006: declining share of epidemic but persistent public health opportunity. *PLoS One, 4*(11), e7558.

Swartz, J. A., Lurigio, A. J., & Weiner, D. A. (2004). Correlates of HIV-risk behavior among prison inmates: implications for tailored AIDS prevention programming. *The Prison Journal, 84*(4), 486-504.

Tenover, F. C., Biddle, J.W., & Lancaster, M.V. (2001). Increasing resistance to vancomycin and other glycopeptides in Staphylococcus aureus. *Emerg Infect Dis, 7*(2), 327-332.

Tenover, F. C., McAllister, S., Fosheim, G., McDougal, L. K., Carey, R. B., Limbago, B., et al. (2008). Characterization of Staphylococcus aureus isolates from nasal cultures collected from individuals in the United States in 2001 to 2004. *J Clin Microbiol, 46*(9), 2837-2841.

Tenover, F. C., McDougal, L. K., Goering, R. V., Killgore, G., Projan, S. J., Patel, J. B., et al. (2006). Characterization of a strain of community-associated methicillin-resistant Staphylococcus aureus widely disseminated in the United States. *J Clin Microbiol, 44*(1), 108-118.

Trinh, T. T., Short, W. R., & Mermel, L. A. (2009). Community-associated methicillin-resistant Staphylococcus aureus skin and soft-tissue infection in HIV-infected patients. *J Int Assoc Physicians AIDS Care (Chic Ill), 8*(3), 176-180.

U.S. Department of Justice, Bureau of Justice Statistics (2010a). *Correctional Populations in the United States, 2009.* Retrieved from http://bjs.ojp.usdoj.gov/content/pub/pdf/cpus09.pdf

U.S. Department of Justice, Bureau of Justice Statistics (2009). *HIV in Prisons*, *2007-2008.* Retrieved from http://bjs.ojp.usdoj.gov/content/pub/pdf/hivp08.pdf.

U.S. Department of Justice, Bureau of Justice Statistics (2010b). *Prisoners in 2009*. Retrieved from http://bjs.ojp.usdoj.gov/content/pub/pdf/p09.pdf.

U.S. Outcomes Research Group (2005). MRSA Infections Cost U.S. Hospitals $3.2 Billion to $4.2 Billion Annually. International Society for Pharmacoeconomics and Outcomes Research Annual Conference.

Watson, R., A. Stimpson, et al. (2004). Prison health care: a review of the literature. *Int J Nurs Stud, 41*(2), 119-28.

Weniger, T., C. Berssenbrugge, et al. (2006). Comparison of BURP (Based Upon Repeat Patterns) algorithm with different typing methods to infer the clonal relatedness of *Staphylococcus aureus. International Journal of Medical Microbiology, 296,* 70.

Wood, E., Hogg, R. S., Yip, B., Harrigan, P. R., O'Shaughnessy, M. V., & Montaner, J. S. (2004). The impact of adherence on CD4 cell count responses among HIV-infected patients. *J Acquir Immune Defic Syndr, 35*(3), 261-268.

Wootton, S. H., Arnold, K., Hill, H. A., McAllister, S., Ray, M., Kellum, M., et al. (2004). Intervention to reduce the incidence of methicillin-resistant Staphylococcus aureus skin infections in a correctional facility in Georgia. *Infect Control Hosp Epidemiol, 25*(5), 402-407.

APPENDIX A.

INTERVIEW QUESTIONNAIRE

☐☐☐☐ Subject ID

10

Groups

In the past 6 months, have you belonged to any groups in prison? ○ Yes ○ No ○ DK ○ Ref

Type of Group	Name	Activity
○ Religious ○ Ethnic ○ Social ○ Hobby ○ Sports ○ Gang ○ Other_____	_____	_____ _____
○ Religious ○ Ethnic ○ Social ○ Hobby ○ Sports ○ Gang ○ Other_____	_____	_____ _____
○ Religious ○ Ethnic ○ Social ○ Hobby ○ Sports ○ Gang ○ Other_____	_____	_____ _____
○ Religious ○ Ethnic ○ Social ○ Hobby ○ Sports ○ Gang ○ Other_____	_____	_____ _____

In how many physical fights have you been involved during the last month? ☐☐☐

How many times have you had to go to the infirmary because of a fight in the past 6 months? ☐☐☐

NOTES:

APPENDIX B.

MEDICAL RECORD EXTRACTION FORM