INFECTION CONTROL PRACTICES AMONG CORRECTIONAL HEALTHCARE WORKERS: EFFECT OF MANAGEMENT ATTITUDES AND AVAILABILITY OF PROTECTIVE EQUIPMENT AND ENGINEERING CONTROLS

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ABSTRACT

OBJECTIVES: To determine the relation of the availability of personal protective equipment (PPE) and engineering controls to infection control (IC) practices in a prison healthcare setting, and to explore the effect on IC practices of a perceived organizational commitment to safety.

DESIGN: Cross-sectional survey.

SETTING: The study population was drawn from the 28 regional Correctional Health Care Workers Facilities in Maryland.

PARTICIPANTS: All full-time Maryland correctional healthcare workers (HCWs) were surveyed, and 225 (64%) of the 350 responded.

METHOD: A confidential, self-administered questionnaire was mailed to all correctional HCWs employed in the 28 Maryland Correctional Health Care Facilities. The questionnaire was analyzed psychometrically and validated through extensive pilot testing. It included items on three major constructs: IC practices, safety climate (defined as the perception of organizational commitment to safety), and availability of IC equipment and supplies.

RESULTS: A strong correlation was found between the availability of PPE and IC practices. Similarly, a strong correlation was found between IC practices and the presence of engineering controls. In addition, an equally strong association was seen between the adoption of IC practices and employee perception of management commitment to safety. Those employees who perceived a high level of management support for safety were more than twice as likely to adhere to recommended IC practices. IC practices were significantly more likely to be followed if PPE was always readily available. Similarly, IC practices were more likely to be followed if engineering controls were provided.

CONCLUSION: These findings suggest that ready availability of PPE and the presence of engineering controls are crucial to help ensure their use in this high-risk environment. This is especially important because correctional HCWs are potentially at risk of exposure to bloodborne pathogens such as human immunodeficiency virus and hepatitis B and C viruses. Commitment to safety was found to be highly associated with the adoption of safe work practices. There is an inherent conflict of "custody versus care" in this setting; hence, it is especially important that we understand and appreciate the relation between safety climate and IC practices. Interventions designed to improve safety climate, as well as availability of necessary IC supplies and equipment, will most likely prove effective in improving employee compliance with IC practices in this healthcare setting (*Infect Control Hosp Epidemiol* 2001;22:555-559).

Of the estimated 10.3 million US healthcare workers (HCWs), 4.5 million are hospital-based and approximately 100,000 are prison-based.[1-3] In Maryland, approximately 350 HCWs are employed full-time in the correctional system. The prevalences of bloodborne pathogens such as human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV) are higher in prison patient populations than in other patient populations, reflecting the increased risk associated with intravenous drug use.[4-9] Hence, the risk of exposure to these and other bloodborne pathogens may be greater in correctional HCWs than in other HCWs. In addition, correctional HCWs may provide medical care under conditions that could increase their risk of exposure, including substandard working conditions, inadequate staffing, limited safety equipment and supplies, and limited opportunities for training and education. These are important considerations, given that the risks of contracting HIV, HBV, or HCV following contaminated needlestick are approximately 0.3%, 10% to 30%, and 3% to 7%, respectively.[10-14] Occupational

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exposure to bloodborne pathogens continues to be a problem for HCWs.[15,16] Seroconversion in HCWs has been documented after occupational exposure to HBV-, HCV-, and HIV-contaminated needlestick.[17]

Safe work practices have been developed and implemented for HCWs, including correctional HCWs, but the efficacy of these practices and their adoption by correctional HCWs is unknown.[18-20] For these reasons, we recently evaluated the relation between infection control (IC) practices and factors that might facilitate their implementation, such as availability of personal protective equipment (PPE) and engineering controls, as well as organizational factors (referred to as "safety climate"). Recently, this has been operationalized[20] as the collective perception that employees have regarding the safety of their workplace.[19]

This study builds upon previous similar work involving other hospital-based HCWs (nurses, doctors, technicians, and phlebotomists), as well as non–hospital-based HCWs, including dentists and funeral service practitioners. These studies have shown that the adoption of safe work practices with respect to bloodborne pathogen exposure is complex and associated with a number of organizational and worker-centered factors.[21-26]

A recent analysis based on this data set indicated that compliance among correctional HCWs was less than among HCWs in other settings. Given this finding, it is important to identify correlates of compliance. The current study specifically examines the relation between the use of engineering controls, compliance with PPE, and their perceived availability. This information will help us to better understand the role these factors play with respect to safety for correctional HCWs and may help lead to the development of specific targeted interventions.

METHODS

HCW Questionnaire

A confidential, self-administered questionnaire[18] was mailed to the entire full-time Maryland correctional HCW population (n=350) employed at the 28 regional facilities throughout the state. These medium- to maximum-security correctional institutions each house 200 to 800 inmates, for a total of approximately 19,000 inmates. Both inpatient and outpatient units are present. These healthcare facilities also provide care to inmates from smaller prisons within the catchment area.[18] Employees invited to participate had direct contact either with patients or with their specimens. The survey was sent out in June 1996, and all responses were collected by September 1996. Aggressive follow-up techniques were employed to achieve a final response rate of 64% (225/350). The questionnaire is described in more detail in prior work.[18]

The study population consisted of doctors, dentists, nurses, therapists, and medical assistants. The majority of questions were answered using 4- and 5-point Likert scales.[27] The questionnaire included 30 items covering five major constructs: IC practices, availability of PPE, provision of engineering controls, perception of safety management practices at the workplace, and demographic characteristics of the employees. Whenever possible, preexisting well-defined scales were used. The final instrument underwent psychometric testing and validation procedures.[18]

Availability of PPE and Provision of Engineering Controls

Respondents were asked about the availability of the following PPE: tuberculosis respirators or masks, face shields, disposable gloves, antibacterial handwashing soap, goggles or other eye protection, waterproof gowns, sharps containers, red-bag containers, and extra (backup) street clothing in the event their clothing became heavily soiled. A 4-point Likert scale was dichotomized into "non-strict" and "strict" categories. The "strict" category was defined as "always" available. Respondents were also asked to respond "yes" or "no" as to whether they were provided an area separate from patient care for eating or taking breaks. In addition, they were asked whether they felt satisfied with the amount of time allotted for breaks. A 5-point Likert scale was used for the latter response and dichotomized into "satisfied" and "dissatisfied." The "satisfied" category consisted of "satisfied" and "very satisfied."

Safety Climate and Organizational Commitment to Safety

The questions related to various aspects of safety management and climate addressed facilitywide safety programs, workers' involvement in safety, adequacy of training on safe work practices, and physical layout and organization of the work area. Respondents also were asked about management and supervisory attitudes and involvement with respect to safety. A 5-point Likert scale was dichotomized into "agree" and "disagree." "Agree" was defined as the responses "agree" and "strongly agree." Thirteen of the questions related to various aspects of safety management and climate were factored into one large safety climate scale (alpha=0.89).

IC Practices

The questionnaire included 15 items related to various IC practices, such as the use of disposable gloves, the practice of recapping needles, waste disposal practices, and disinfectant use. A 5-point Likert scale was dichotomized into "non-strict" and "strict" adherence categories. "Strict" adherence was defined as "always" adhering to all safe work practices. Questions related to IC practices were examined individually and factored into one IC practices scale (alpha=0.84).

Statistical Analysis

Descriptive statistics were used to characterize the participants in the study. Frequency distributions and cross-tabulations were generated with covariates of interest. Bivariate association between safety climate and IC practices was assessed by means of odds ratios and regres-

TABLE 1
CHARACTERISTICS OF THE RESPONDENTS

Characteristic	% (N)
Gender, female	71.6 (154)
Age, y	
<30	12.9 (26)
31-40	25.4 (51)
41-50	36.3 (73)
51-60	14.9 (30)
>60	10.5 (21)
Marital status	
Single	21.8 (47)
Separated, divorced, or widowed	26.4 (57)
Married or living with partner	51.9 (112)
Professional license	
RN, LPN	75.7 (140)
MD, PhD	10.3 (19)
MT, RT, PT, DDS, other	10.8 (20)
Highest level of education	
High school, GED	6.5 (14)
College, vocational certificate	22.8 (49)
Associate's degree (2 y)	24.2 (52)
College graduate (4 y)	22.3 (48)
Postgraduate work (masters or doctoral)	23.7 (51)
Other	0.5 (1)
Years employed at present correctional facility, <10	96.7 (206)
Years working in correctional health care, <10	90.6 (194)

Abbreviations: DDS, doctor of dental surgery; GED, general equivalency diploma; LPN, licensed practical nurse; MD, doctor of medicine; MT, medical technologist; PhD, doctor of philosophy; PT, physical therapist; RN, registered nurse; RT, radiologic technologist.

TABLE 2
PERCENT OF TIME THAT PERSONAL PROTECTIVE EQUIPMENT WAS PERCEIVED TO BE "ALWAYS" READILY AVAILABLE

Item	% (N)
TB respirators or masks	72.7 (149)
Face shield	46.8 (96)
Disposable gloves	96.7 (199)
Antibacterial handwashing soap	70.8 (147)
Goggles or other eye protection	50.0 (103)
Waterproof gowns	29.1 (60)
Sharps containers	92.3 (192)
Red-bag containers	87.1 (182)
Extra (backup) street clothing	4.1 (10)

Abbreviation: TB, tuberculosis.

TABLE 3
ODDS OF USE OF PPE OR IC PRACTICE DEPENDING ON READY AVAILABILITY OF RESOURCE

Item	Odds Ratio	CI_{95}
TB respirators or masks	2.9	1.2-7.3
Waterproof gown	4.5	2.1-9.7
Eye protection	5.5	2.8-10.8
Dispose of material in red bag	8.7	2.9-25.8
Recap needles (if sharps container not available)	11.2	2.3-55.1
Not eating or drinking while working (if break room provided)	3.0	1.5-5.6
Eat in contaminated area (if adequate time for a break)	0.4	0.2-0.7

Abbreviations: CI_{95}, 95% confidence interval; IC, infection control; PPE, personal protective equipment; TB, tuberculosis.

sion techniques. The Cronbach alpha was determined for each of the scales.[28]

RESULTS

Demographics

The demographic findings are summarized in Table 1. Most of the respondents were female. The mean age was 44 years, and the mean length of employment was almost 4 years. Approximately half of the respondents reported a college education or higher. The majority worked 40 hours or more per week and approximately half were married or living with a partner. Approximately two thirds were nurses. The remainder were doctors, dentists, therapists, and technicians. Information pertaining to non-respondents is not available.

Availability of PPE and Provision of Engineering Controls and Their Use

As seen in Table 2, some forms of PPE and engineering controls were perceived more often than other forms as being always available. Whereas disposable gloves and sharps containers were perceived as being always available more than 92% of the time, other items such as waterproof gowns and extra street clothing were perceived as being always available less than 30% of the time.

Upon further exploring compliance behaviors and PPE availability, we found, not surprisingly, that individual PPE were significantly more likely to be used if they were readily available. For example, as illustrated in Table 3, the odds of wearing a mask if one were always available was almost 3 times greater than if one were not always available. The odds of wearing a gown if one were always available was 4.5 that of wearing one if it were not always available. Similarly, the odds ratio of using eye protection was more than 5, depending on availability. The odds of using red-bag containers was almost 9 times higher if they were perceived to be always available. Recapping of needles was 11 times more likely to occur if sharps containers were not readily available.

Finally, we found a significant relation between accessibility of a safe eating environment and eating and drinking in potentially contaminated areas. As seen in Table 3, workers were more likely to refrain from eating or drinking in inappropriate areas if provided with a separate

TABLE 4
PERCEPTION OF MANAGEMENT COMMITMENT TO SAFETY (SAFETY CLIMATE)

Perception	% (N)
Where I work, top-level contractual management gets personally involved in safety activities	28.1 (60)
Where I work, top-level security management gets personally involved in safety activities that affect me	43.4 (93)
My immediate supervisor does not show concern for my safety on the job	67.4 (144)

area for these activities. Furthermore, employees who felt that they were provided with adequate time for a break were less likely to eat in contaminated areas.

Perception of Organizational Safety Climate

For all levels of administration, from the immediate supervisor to senior management, employees did not perceive a strong organizational commitment to a safe working environment. Table 4 shows that less than one third of the HCWs agreed or strongly agreed that top-level management got personally involved in safety activities. Furthermore, less than one half of the HCWs agreed or strongly agreed that top-level security management got involved in safety activities. More than two thirds agreed or strongly agreed that their immediate supervisors did not show concern for their safety.

Infection Control

Reports of compliance with IC were found to vary. The highest levels of compliance were found to be associated with use of special caution when using scalpels. Approximately 90% of the respondents answered that they always used special caution when using scalpels, always disposed of potentially contaminated materials into a red or labeled bag for disposal as biomedical waste, or always wore gloves when drawing a patient's blood. Approximately 80% responded that they always disposed of sharps into a sharps container. The lowest levels of compliance were found to be associated with the use of disposable face masks and disposable outer garments. Less than half of the respondents indicated that they always complied with these practices.[18] Table 5 indicates that most employees, approximately 96%, reported no exposure to bloodborne pathogens during the previous 6 months.

Safety Climate and IC Practices

We found a significant relation between safety climate and IC practices when we used bivariate analysis. Correctional HCWs who perceived a strong safety climate were more than twice as likely to comply strictly with IC practices.

DISCUSSION

Adherence to recommended IC practices in healthcare settings has always been important, but it is even more important with the emergence of new and resistant pathogens. This is especially true for the correctional environment, given that the prevalence of certain bloodborne pathogens such as HIV, HBV, and HCV is higher in the prison patient population than in other patient populations. Therefore, it is critical that barriers to IC practices in this unique setting be identified and appropriate interventions implemented.

TABLE 5
EXPOSURES (IN THE PAST 6 MONTHS)

Type of Exposure	No. of Times	% (N)
Needlestick injuries	0	95.8 (204)
	1	3.7 (8)
	6	0.5 (1)
Splashes to eyes or mouth	0	95.8 (204)
	1	0.9 (2)
	2	2.3 (5)
	3	0.5 (1)
	10	0.5 (1)
Contacts with open wounds on skin	0	96.2 (205)
	1	3.3 (7)
	10	0.5 (1)
Cuts with sharp objects	0	97.2 (206)
	1	1.4 (3)
	2	0.9 (2)
	10	0.5 (1)

This study set out to examine both the relationship between availability of PPE and provision of engineering controls on IC practices, and the effect of organizational commitment to safety on IC practices. Not surprisingly, the data suggest that IC practices improve with ready availability of PPE and provision of engineering controls. For example, use of eye protection and face shields, generally poorly complied with, increased when this protective equipment was readily available. These results are particularly important in the correctional setting, because the availability and accessibility of safety equipment and supplies may be problematic due to security concerns. In addition, the data suggest that provision of both a safe eating area and adequate time for breaks significantly decreased eating and drinking in contaminated areas. It is not surprising, therefore, that the safety climate dimensions identified that significantly affected IC practices were ready availability of a variety of PPE and the provision of the engineering control measures cited above. The data also suggest that employee perception of an organizational commitment to safety has a significant impact on safe work practices. Previous work indicated that perception of top-management involvement was low.[18]

An important limitation of this study is that the data are self-reported. Healthcare workers may overestimate their levels of compliance because they may want to report socially acceptable responses. However, this may be some-

what ameliorated by the confidential nature of the study. In addition, the data derive from the perception of these correctional HCWs and may not reflect the actual programs in place.

The response rate is another potential limitation. Nonresponder bias can be a problem if a high percentage of employees fail to complete the questionnaire. People who respond may differ in important ways from those who do not. For instance, they may be more or less compliant, or they may perceive a better or worse safety climate. We do not have information about the nonresponders. We tried to maximize the responses using various methods, and achieved a final rate of 64%.

Other potential limitations include the generalizability of the data. We sampled correctional HCWs from the Maryland prisons. Our results may not be applicable to correctional HCWs in other correctional settings. Nevertheless, this study generates information on correctional HCWs, a highly understudied population of HCWs. Finally, the cross-sectional design precludes determination of causality. Although it is an efficient way to glean information in a timely manner, inferences must be drawn with caution.

Based on our data, we offer three recommendations for measures to improve IC practices. First, we suggest that senior management show visible and tangible support for safety programs. Safety should be integrated into the overall system of the organization,[19] encouraging better adherence to safe work practices. Second, all reasonable steps need to be taken to minimize hazardous tasks and make PPE readily available. Finally, engineering controls need to be provided to encourage safe eating and drinking habits.

In summary, visible and demonstrable organizational commitment to safety, the availability of PPE, and provision of engineering controls were found to be associated with the adoption of IC practices by Maryland correctional HCWs. This suggests that the institution of these measures would increase compliance and, possibly, decrease exposures.

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