Compliance with universal precautions among health care workers at three regional hospitals

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Objective: To assess and characterize self-reported levels of compliance with universal precautions among hospital-based health care workers and to determine correlates of compliance.
Design: Confidential questionnaire survey of 1716 hospital-based health care workers.
Participants: Participants were recruited from three geographically distinct hospitals. A stratified convenience sample of physicians, nurses, technicians, and phlebotomists working in emergency, surgery, critical care, and laboratory departments was selected from employment lists to receive the survey instrument. All participants had direct contact with either patients or patient specimens.
Results: For this study, overall compliance was defined as "always" or "often" adhering to the desired protective behavior. Eleven different items composed the overall compliance scale. Compliance rates varied among the 11 items, from extremely high for certain activities (e.g., glove use, 97%; disposal of sharps, 95%) to low for others (e.g., wearing protective outer clothing, 62%; wearing eye protection, 63%). Compliance was strongly correlated with several key factors: (1) perceived organizational commitment to safety, (2) perceived conflict of interest between workers' need to protect themselves and their need to provide medical care to patients; (3) risk-taking personality; (4) perception of risk; (5) knowledge regarding routes of HIV transmission; and (6) training in universal precautions. Compliance rates were associated with some demographic characteristics: female workers had higher overall compliance scores than did male workers (25% of female and 19% of male respondents circled "always" or "often" on each of the 11 items, $p < 0.05$); and overall compliance scores were highest for nurses, intermediate for technicians, and lowest for physicians. Overall compliance scores were higher for the mid-Atlantic respondents (28%) than for those from the Southwest (20%) or Midwest (20%, $p = 0.001$).
Conclusions: This study supports earlier findings regarding several compliance correlates (perception of risk, knowledge of universal precautions), but it also identifies important new variables, such as the organizational safety climate and perceived conflict of interest. Several modifiable variables were identified, and intervention programs that address as many of these factors as possible will probably succeed in facilitating employee compliance. (AJIC Am J Infect Control 1995;23:225-36)

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Why do some health care workers (HCWs) fail to comply with recommendations and regulations pertaining to exposure to blood-borne pathogens? Although previous studies have documented the rates of noncompliance with universal precautions (UP), factors correlated with unsafe work practices have not been fully explored.[1-16]

A recent review of the literature demonstrated low rates of compliance with UP practices, both before and after enactment of the Occupational Safety and Health Administration standard, across various health care professions, with particularly poor compliance observed with respect to some barrier protections (e.g., protective eyewear) and the recapping of contaminated needles.[17] Similarly poor compliance with some barrier protections and with recapping was also recently reported in a nationwide survey.[18]

This problem with noncompliance is significant, because more than 6 million HCWs are at risk in this country and there is a 0.3% risk of infection with HIV after percutaneous exposure to HIV-contaminated blood.[19-25] In addition, the cumulative lifetime risk for high-risk subsets of HCWs, such as emergency medical service personnel, surgeons, and trauma teams, may be as high as 1% to 2%.[26-28]

Some of the 120 (both documented, $n = 39$, and possible, $n = 81$) HIV infections in HCWs reported by the Centers for Disease Control and Prevention (CDC) could have been prevented by strict compliance with safe work practices and use of engineering controls.[29] Several of these infections resulted from the unsafe work practices of coworkers.[29] The risk of hepatitis B infection after a known exposure is about 30% (roughly 100 times the transmission risk of HIV).[30] Approximately 10,000 acute cases of hepatitis B infection are reported among HCWs each year, resulting in an estimated 400 hospitalizations and 150 deaths. These infections are preventable by vaccination.[30-32] The risk of infection with hepatitis C virus is apparently lower, with a 6% to 10% infection rate after exposure.[33]

To address the issues of noncompliance and preventable exposure, the National Institute for Occupational Safety and Health, in conjunction with The Educational Resource Centers, Inc., initiated this multicenter research study to investigate the underlying causes of poor compliance and to develop strategies to overcome barriers to compliance with safe work practices. We took a multidisciplinary approach to the problem, viewing it epidemiologically and psychosocially, as well as from the standpoints of organizational and safety management.

To date, public health efforts to decrease the potential for blood-borne pathogen exposure among HCWs have focused on safe work practices. As early as 1985, the CDC encouraged the adoption of blood and body fluid precautions for all patients, regardless of serostatus.[34] Eventually these recommendations developed into a set of safe work practices (UP), now required under the Occupational Safety and Health Administration blood-borne pathogens standard.[35-37] Even though these well-defined UP practices have been shown to decrease risk of exposure, compliance, especially with respect to some barrier protection, remains an issue.[38,39]

Efforts led by Jagger and the CDC to reduce exposure by promoting the concept of "engineering out" some of the inherent risks have met with some success.[30,36,40-45] The use of sharps containers and innovatively redesigned needled devices appears to have helped. Although certain types of needlestick injuries (e.g., intravenous-related needlesticks) have decreased since the introduction of engineering controls, the number of other sharps-related injuries has either increased or stayed the same.[46,47] These data, however, could be the result of reporting bias.

The purpose of this study was to assess and characterize current rates of compliance among hospital-based HCWs who are at risk for blood-borne pathogen exposure. Employees were recruited from hospitals affiliated with three Educational Resource Centers representing patient populations having high, moderate, and low prevalences of blood-borne infections. In addition, this study used a theoretic model that provided a conceptual framework for identifying both individual and organizational factors correlated with compliance and noncompliance.

METHODS

Sample population

The employees invited to participate in this study were all HCWs employed by three Joint Commission on the Accreditation of Healthcare Organizations–accredited acute care hospitals. All were large (approximately 1000 beds) and geographically distinct. The mid-Atlantic hospital had a high prevalence rate of blood-borne infection, the southwestern hospital had a moderate rate, and the midwestern hospital had a low rate. Employees believed to have direct patient care or specimen contact were stratified by department

and randomly selected from lists of employees working in critical care, emergency, laboratory, surgery, or phlebotomy departments. A total of 3000 employees (1000 per site) were sent a number-coded, confidential, self-administered questionnaire. Extensive follow-up procedures were employed to improve the overall response rate. After elimination of questionnaires with missing data, a total of 1716 usable questionnaires remained, for a final response rate of 57%.

Questionnaire development and administration

In general, the adoption of preventive health behaviors is complex, and many different factors appear to play roles in any individual's adoption of precautionary behaviors.

Although several preventive health theories helped us develop our study model, they were limited in providing a useful framework for studying self-protective behavior within the caregiving context. For HCWs, taking care of patients' needs may take precedence over their need to protect themselves from blood exposure. The two needs may, at times, seem contradictory. A new study model (Fig. 1) was developed to take into account the unique circumstances surrounding the adoption of safe work practices in the health care setting. The new study model is based in part on DeJoy's organizational model,[48] as well as other educational, organizational, and preventive behavior models developed by Green and associates,[49] Murphy and coworkers,[50] and Weinstein.[51]

The study model guided the development of our questionnaire, which was designed to focus on three major conceptual areas, all of which were hypothesized to play significant roles as barriers to compliance behaviors: (1) sociodemographic and individual factors, (2) psychosocial factors, and (3) organizational factors. Whenever possible, existing well-defined scales were used. Additional input from HCWs was obtained through focus groups, and the final study instrument underwent extensive pilot testing and psychometric analysis. Unless otherwise noted, all response scales were based on a 4- or 5-point Likert scale (strongly agree, agree, disagree, strongly disagree). Wherever necessary, responses to items were reverse scored so that the direction of the responses to multiitem scales was consistent. All scales underwent factor analysis and were evaluated for internal consistency and reliability. Each mailing packet contained, in addition to the questionnaire, an institutional cover letter, a consent form, and a prepaid, preaddressed return envelope. All procedures were reviewed and approved by each institution's committee on human volunteers.

Questionnaire topics

Compliance with UP. A 5-point Likert scale was used to assess the outcome measure, compliance with UP, by means of an 11-item scale ($\alpha = 0.65$) previously developed and used to study other HCW populations. Because fewer than 25% of all respondents reported that they "always" complied with every item and because we recognize that HCWs rarely do always strictly comply, we defined compliance for the purposes of analysis as "always" or "often" adhering to the desired protective behavior. Workers who circled either of these two responses were classified as compliant. The other three categories—"sometimes," "rarely," and "never"—were collapsed and defined as noncompliant responses. High scores represented high levels of compliance.

The items measured how often workers followed specific recommended work practices, such as proper disposal of sharps, proper care and use of needles, and use of barrier protection (gloves, eye protection, protective outer clothing). Other work practices that were examined included eating or drinking in potentially contaminated areas.

Demographic and individual factors. Data were collected regarding age, sex, education, occupation, tenure in the health care field, tenure in the present occupation, number of hours worked, shift worked, hours worked on second jobs, and employment status. Knowledge was measured by means of questions from the CDC National Center for Health Statistics AIDS Awareness Test, including questions related to (1) alternate modes of transmission of HIV, (2) routes of transmission of blood-borne pathogens in the health care setting, and (3) various aspects of UP.[52]

Psychosocial factors. Data were obtained regarding the following factors: (1) HCW attitudes toward patients with HIV infection or AIDS, (2) HCW belief in the efficacy of preventive actions (e.g., effectiveness of UP practices), (3) HCW perception of personal risk of infection, (4) HCW fear related to HIV and AIDS, (5) risk-taking personality profile, and (6) perceived conflict of interest between the need for self-protection and the need to provide optimal patient care.

Attitudes related to tolerance toward patients with HIV infection or AIDS were measured with an 11-item scale adapted from Schrum and colleagues.[53] The scale was found to be highly

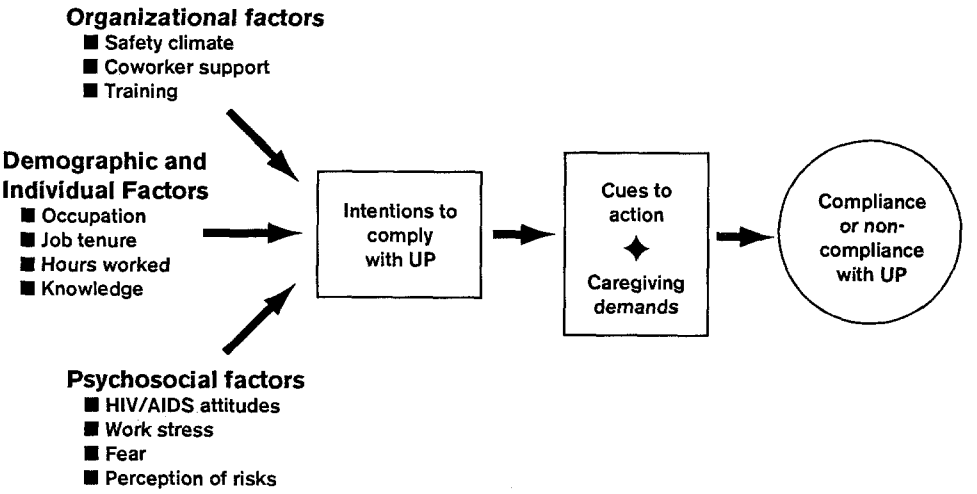

Fig. 1. Study model: compliance with UP.

reliable, with a high degree of internal consistency as measured by Cronbach's α (α = 0.83).[54] The scale is continuous; the higher the score, the more tolerant the respondent. Tolerant responses were defined as "strongly agree" or "agree" responses to statements such as "Our profession has a responsibility to treat patients with AIDS."

Efficacy of prevention was measured with a three-item scale (α = 0.63): (1) "I can reduce my risk of occupational HIV infection by complying with UP," (2) "If UP is followed with every patient, my risk of HIV/AIDS will be very low," and (3) "If I wear undamaged (intact) disposable gloves, my hands will be protected from skin contamination with HIV." Fear and perception of risk were each measured by a single item: "I frequently worry about acquiring HIV/AIDS because of my work," and "My risk of becoming infected with HIV through my work is low," respectively. The risk-taking personality profile was assessed with use of a six-item National Institute for Occupational Safety and Health scale (α = 0.74) (e.g., "I prefer an exciting, unpredictable life," "I enjoy taking risks in life,").[55] Perceived conflict of interest was measured by a new four-item scale (α = 0.72) (e.g., "I can't always follow UP because my patient's needs come first"). Work stress was measured with the use of a well-characterized inventory scale for work-related stress (α = 0.74).[56]

Organizational management factors. The overall organizational management support for safety (safety climate) was measured by means of a newly developed 13-item scale (α = 0.88) that assessed the respondents' perceptions of the extent of their hospital's commitment to safety in general and to UP in particular. Questions addressed whether the hospital had workplace safety committees, safety manuals and written procedures, safety specialists on staff, policies related to supervision, accountability regarding safety, policies related to reporting of safety violations, and safety training programs. Several questions were used to measure the accessibility and availability of protective equipment and engineering controls.

Statistical analysis

The association between the outcome measure (compliance) and the independent variables (e.g., sociodemographic, psychosocial, and organizational factors) was assessed by means of odds ratios; 95% confidence intervals were obtained for all odds ratios, crude and adjusted. A χ^2 analysis was conducted for compliance factors. Multiple logistic regression models were developed to control for confounders and to test interactions formally.

RESULTS

Response rate

The overall response rate was 57%, with a total of 1746 questionnaires returned, 1716 of which were complete. Of these, 902 came from nurses, 247 from medical technologists, 39 from phlebotomists, and 322 from physicians. The remaining 206 respondents were seven dentists, 11 autopsy

technicians, 53 nurses aides, 64 nurse practitioners, 24 clinical assistants, 18 laboratory scientists, and 29 others.

Demographics

The demographic findings are summarized in Table 1. Most respondents were female nurses. Certain demographic characteristics of respondents varied considerably among the three sites. For example, the mid-Atlantic respondents were significantly more likely ($p < 0.001$) to be female (86.6%) than were respondents from the southwestern (58%) or midwestern sites (80%). Nurses accounted for a larger proportion of the mid-Atlantic sample (61%) than of the other two samples (southwest, 34%; midwest, 51%) and the southwestern institution inexplicably had significantly more physicians represented ($p < 0.001$) than did the other two sites. Significantly more respondents from the southwestern site reported working 40 or more hours per week ($p < 0.0001$).

The mean duration that respondents had worked at their present jobs was 6.1 years and respondents had been in the health care field for a mean of 11 years. More than 80% of respondents reported an undergraduate education or higher. Most workers were employed full-time, working 40 to 50 hours a week; 20% worked more than 50 hours a week.

Compliance behaviors

The percentage of HCWs who reported compliance with UP was calculated by region and overall (Table 2). The highest levels of compliance reported were for wearing gloves, disposing of sharps, and appropriately disposing of contaminated waste. The lowest levels of compliance were related to needle recapping, wearing of protective eyewear and outer clothing, and cleaning up spills.

Overall compliance varied among the three sites. The mid-Atlantic site, where prevalence of blood-borne infection is high, consistently had the highest compliance rates: 28% ($n = 216$) of mid-Atlantic workers were compliant on *all* 11 items, whereas 20% ($n = 68$) of southwestern workers and 20% ($n = 119$) of midwestern workers complied with all items. Overall compliance for the three combined sites was only 23.7% for the entire 11-item scale.

Significant differences between the three sites were noted for the following items: handwashing after glove removal ($p < 0.001$), glove use ($p = 0.007$), wearing of protective face masks ($p < 0.001$), contaminated waste disposal, spill cleanup ($p < 0.001$), eating and drinking in potentially contaminated areas ($p < 0.05$), precautions with sharps ($p = 0.005$), and recapping of needles ($p < 0.001$).

Factors correlated with compliance: Univariate models

Factors correlated with compliance as determined with univariate models are listed in Table 3. Factors fell into the following categories: sociodemographic and individual factors, psychosocial factors, and organizational management factors.

Sociodemographic and individual factors. Overall compliance scale scores were higher for female HCWs (25%) than for male HCWs (19%), but the differences were not found to be significant after adjustment for profession. Compliance rates were highest among nurses (26.5%) and lowest among physicians (16.2%, $p = 0.0001$). Compliance rates were lower for employees with higher levels of education than for workers with fewer than 16 years of education ($p = 0.001$). Compliance was lower among employees working more than 50 hours per week (17%) than among those working fewer than 50 hours per week (25%, $p = 0.002$). Compliance scores were higher for employees reporting higher scores on a set of questions dealing with alternate modes of transmission of HIV (27%; ways in which HIV is not likely to be transmitted) than for those with lower knowledge scores (22%, $p = 0.009$). Most workers were extremely knowledgeable about UP, but this knowledge was not associated with compliance. Compliance was higher (25%) among employees reporting a low conflict of interest between the need to protect themselves and the need to provide patient care than among those with a high conflict (10%, $p < 0.0001$). Compliance was lower (16%) among respondents scoring high on a risk-taking personality scale (e.g., "I enjoy taking risks in life") than among respondents less inclined toward risk taking (25%, $p = 0.001$). Overall, compliance was not associated with workload.

Psychosocial factors. Compliance rates were higher among workers reporting tolerant attitudes toward patients with HIV infection or AIDS (25%) than among respondents reporting less tolerant attitudes (14%, $p = 0.003$). Compliance was also higher among workers who perceived that their risk of exposure would be low if they followed UP than among workers who did not believe that

Table 1. Characteristics of respondents

Feature	Mid-Atlantic (n = 785)	Southwest (n = 337)	Midwest (n = 594)	Combined (n = 1716)	p
Age (yr)					0.156
N	754	330	572	1656	
Mean ± SD	35.4 ± 9.4	36.4 ± 8.0	36.1 ± 8.8	35.8 ± 8.9	
Mode	29	29	30	29	
Range	20–65	23–68	20–65	20–68	
Sex					<0.001
N	782	336	587	1705	
No. female	677	195	469	1341	
% female	86.6	58	80	79	
Education					<0.001
N	782	334	587	1703	
High school	53 (6.8%)	5 (1.5%)	1 (0.2%)	59 (3.5%)	
Vocational training/some college	120 (15.3%)	40 (12.0%)	105 (17.9%)	265 (15.5%)	
College graduate (>16 yr education)	609 (77.9%)	289 (86.5%)	481 (81.9%)	1379 (81%)	
Tenure in health field (yr)					<0.001
N	769	334	582	1685	
Mean ± SD	6.1 ± 6.9	4.4 ± 5.3	7.1 ± 6.7	6.1 ± 6.6	
Mode	2	1	1	2	
Range	0–38	0–50	0–34	0–50	
Tenure in job (yr)					<0.001
N	766	326	583	1675	
Mean ± SD	10.3 ± 8.1	10.4 ± 8.2	12.2 ± 8.2	11.0 ± 8.2	
Mode	5	2	10	10	
Range	0–42	0–45	0–42	0–45	
Occupation					<0.001
N	777	334	588	1699	
Nurse	479 (61.6%)	113 (33.8%)	301 (51.2%)	893 (52.6%)	
Physician	58 (7.5%)	174 (52.1%)	89 (15.1%)	321 (18.9%)	
Technician	139 (17.9%)	10 (3.0%)	134 (22.8%)	283 (16.7%)	
Other	101 (13.0%)	37 (11.1%)	64 (10.9%)	202 (11.9%)	
Hours worked/week					<0.001
N	779	334	586	1699	
<40	210 (27.0%)	31 (9.3%)	273 (46.6%)	514 (30.3%)	
40-50	498 (63.9%)	124 (37.1%)	221 (37.7%)	843 (49.6%)	
>50	71 (9.1%)	179 (53.6%)	92 (15.7%)	342 (20.1%)	
Full-time employment					<0.001
N	785	337	594	1716	
No	157 (20%)	31 (9.2%)	155 (26.1%)	343 (20%)	
Yes	628 (80%)	306 (90.8%)	439 (73.9%)	1373 (80%)	

adherence to UP would lower their risk (24% vs 10%, $p < 0.001$). Compliance levels were higher among those with low levels of work stress (19%) than among workers with higher levels of work-related stress (26%, $p = 0.005$). Compliance was statistically associated with fear of occupational transmission of HIV ($p = 0.001$).

Organizational management factors. Several important factors of organizational management were found to be correlated with compliance. For example, compliance rates were higher for workers who perceived that the hospital had a strong commitment to safety (a strong safety climate, 26%) than for those who did not perceive a strong safety commitment (9%, $p < 0.001$). Safety training was also an important variable; those workers receiving at least one hour of training on blood-borne pathogens each year were more likely to be compliant (26%) than workers receiving no training (15%, $p < 0.001$). The more training employees received, the higher the compliance scores; the highest scores were associated with six or more hours of training each year ($p < 0.001$).

Factors correlated with compliance: Multivariate models

Variables significantly associated with compliance in univariate analysis were entered into multiple logistic regression models, and significant results are shown in Table 4. Compliance among respondents who perceived a strong commitment to safety at their institution was nearly three times that reported by respondents who did not perceive a strong safety climate. Respondents

Table 2. Proportion of HCWs who reported UP compliance activities "always" or "often," overall and by region

Item	Mid-Atlantic		Southwest		Midwest		Combined		
	Yes (%)	Total response	Yes (%)	Total response	Yes (%)	Total response	Yes (%)	Total response	*p*
Dispose of sharp objects into a sharp container	94.9	769	94.3	333	94.0	585	94.5	1687	0.756
Wash hands after removing disposable gloves	93.7	781	94.0	335	87.8	589	91.7	1705	<0.001
Wear a disposable outer garment that is resistant to blood and body fluids whenever there is a chance of soiling my clothes at work	62.8	752	59.8	323	62.2	572	62.0	1647	0.640
Wear disposable gloves whenever there is a possiblitiy of exposure to blood or other body fluids	98.1	778	94.6	335	95.9	591	96.7	1704	0.007
Wear protective eye shields whenever there is possibility of a splash or splatter in eyes	64.6	742	65.5	319	59.8	555	63.1	1616	0.133
Wear a disposable face mask whenever there is a possibility of a splash or splatter to my mouth	57.6	727	62.5	325	48.5	548	55.5	1600	<0.001
Dispose of all potentially contaminated materials into a red (and/or labeled) bag for disposal as biomedical waste	97.7	773	90.6	328	92.4	580	94.5	1681	<0.001
Promptly wipe up all potentially contaminated spills with a disinfectant	83.1	761	72.9	314	84.8	567	81.7	1642	<0.001
Refrain from eating or drinking while working in an area where there is a possibility of becoming contaminated with blood or body fluids	86.9	765	81.2	329	85.4	574	85.3	1668	0.047
Take special caution when using scalpels or other sharp objects	97.4	725	97.3	328	99.6	563	98.1	1616	0.005
Refrain from recapping needles that have been contaminated with blood	79.6	702	66.3	326	67.8	538	72.8	1566	<0.001

who reported low levels of conflict of interest were more than twice as likely to be compliant as those with high levels of compliance. Respondents with a low perception of personal risk and those with a risk-taking personality profile were less likely to comply with UP. HCWs with knowledge about alternate modes of transmission (unlikely or related to casual contact) were more apt to comply.

DISCUSSION

Potentially modifiable correlation factors

Sociodemographic and individual characteristics. Knowledge of UP practices is necessary but not sufficient for adoption of recommended safe work practices. Almost all respondents from all three sites had extremely high levels of knowledge regarding UP practices. It is therefore unlikely that simply lecturing HCWs on UP practices will help improve compliance. Training should address the factors noted to be correlated with compliance, such as conflict of interest, perception of risk, and others. Because knowledge scores related to alternate (casual contact) modes of transmission were generally low, however, information about the routes of transmission of bloodborne pathogens and information on ways in which HIV is not transmitted are important to include in training and educational programs.

Table 3. Factors correlated with compliance: Univariate results

Variable	*n*	% compliant (11 items)	*p*
Center			0.001
Mid-Atlantic	785	27.5	
Midwest	594	20.0	
Southwest	337	20.2	
Age (yr)			0.139
≤35	920	22.4	
>35	737	25.5	
Sex			0.117
Female	1341	25.0	
Male	364	19.0	
Profession			0.001
Nurse	893	26.5	
Technician/phlebotomist	283	19.8	
Physician	321	16.2	
Education (yr)			0.001
<16	324	31.8	
≥16	1379	21.7	
Tenure in position (yr)			0.540
≤10	940	23.4	
>10	726	24.1	
Tenure in field (yr)			0.739
≤10	940	23.4	
>10	726	24.1	
Hours worked/wk			0.002
<50	1357	25.4	
≥50	342	17.3	
Knowledge about UP			0.470
High	1616	23.7	
Low	93	20.4	
Knowledge of alternate modes of transmission			0.009
Low	1140	21.8	
High	576	27.4	
Perceived conflict of interest between self-protection and providing patient care			0.001
High	157	10.2	
Low	1557	25.0	
Risk-taking personality profile			0.001
Not risk taker	1395	25.4	
Risk taker	299	16.4	
Workload			0.342
High	1450	23.2	
Low	258	26.0	
Attitudes toward patients with HIV/AIDS			0.003
Intolerant	152	13.8	
Tolerant	1561	24.5	
Perception of risk			0.001
High	810	24	
Low	895	10	
Level of work stress			0.005
Low	1245	25.5	
High	450	18.9	
Fear of contagion			0.001
High	810	20.1	
Low	895	26.8	
Rating of organizational safety climate			0.001
Low (≤2.5)	236	9.3	
High (>2.5)	1479	25.9	
Training on UP			0.001
Yes	1283	26.3	
No	424	15.3	
Rating of PPE availability at hospital			0.121
Low (≤2.5)	69	15.9	
High (>2.5)	1643	24.0	

PPE, Personal protective equipment.

Table 4. Factors significantly correlated with compliance: Multivariate results

Variable	Adjusted OR	95% CI
Center		0.59–0.99
Midwest	0.77	
Mid-Atlantic	1.00	
Education (yr)		1.25–2.20
<16	1.65	
≥16	1.00	
Rating of organizational safety climate		1.61–4.19
High	2.60	
Low	1.00	
Training on UP (at least 1 hr)		1.19–2.24
Yes	1.63	
No	1.00	
Risk-taking personality profile		0.40–0.80
Risk taker	0.57	
Not risk taker	1.00	
Perceived conflict of interest		1.31–3.90
Low	2.26	
High	1.00	
Perception of risk		0.54–0.87
High	0.68	
Low	1.00	
Knowledge on alternate modes of transmission		1.07–1.73
High	1.36	
Low	1.00	

OR, Odds ratio; *CI*, confidence interval.

Employees with long work hours may simply be too tired to make the effort to comply. Overwork puts the worker at risk for work stress, as well as for occupational injuries and accidents. Supervisors should be alert to this potential problem among their staff members.

Physicians, as other studies have shown, were noted to have particularly low rates of compliance. They may be "out of the loop," so to speak, regarding organizational safety climate. Every effort must be made by senior management and safety specialists in the hospital to bring physicians back into the loop by involving them in training, safety programs, safety committees, and other factors in organizational safety climate.

Psychosocial factors. Employees must be provided with up-to-date and accurate risk information. It is inappropriate to categorically state, "The risk of occupational HIV infection is low." For many workers, certain tasks that they perform, the prevalence of infection among patients at their hospital, their use of sharps, and many other factors may place them at substantially greater than average risk of exposure. For many workers, the risk related to HIV is all or nothing; downplaying a potentially fatal hazard such as HIV is therefore counterproductive and may lead to poor compliance. Some workers may question why they should comply if the risk is that low. As mentioned earlier, training time might be more effectively used by focusing on this issue.

In an earlier study, we identified several factors that were associated with tolerant attitudes toward persons with AIDS.[57] These were as follows: (1) acquaintance with someone with AIDS, (2) high level of knowledge regarding the alternate transmission routes of HIV, (3) low level of fear, and (4) accurate perceptions of risk. These factors may be addressed to assist HCWs in the adoption of more tolerant attitudes.

One factor in particular that may be difficult to address is risk-taking profile. Persons with risk-taking tendencies can be provided with strong supervisory support, as well as counseling through employee assistance or employee health programs if available. Many hospitals now require such counseling for employees who undergo multiple exposures.

Employees who perceive a strong conflict of interest between self-protection and providing patient care may be assisted in several ways: (1)

Workers (including physicians) must have a clear understanding of the organization's commitment to having them provide care while *still* protecting themselves from potential occupational blood exposure. This message must be as unambiguous as possible. (2) All necessary personal protective equipment must be not only immediately accessible but also comfortable, and it must not interfere with the provision of medical care. (3) It may be useful to hold interactive training sessions in which participants role-play what they would do in an emergency medical situation to both care for the patient and protect themselves.

Work stress is a complex problem related to a number of variables, such as organizational factors, individual and personal life factors, and coping strategies. For many different reasons, including the desire to reduce work stress–related injuries and accidents, it is desirable to identify work stress and reduce it as much as possible. Prevention of work stress through organizational programs designed to limit workplace stressors may help improve UP compliance.[58,59]

Organizational management factors. Hospital administrators and managers must be aggressive in providing optimal safety programs. These programs are now required under the new Joint Commission survey requirements. The various elements of safety programs must be identified, instituted, and evaluated for effectiveness. Several excellent sources provide valuable information on developing a "climate of safety."[60-62] The additional benefits of such programs include improved employee-employer relations, decreased worker injuries, decreased compensation costs, decreased liability, improved performance, and improved quality of work life.[50,63,64]

Because employees who had received at least 1 hour of training on UP were found to be more likely to comply, it is important to ensure that all staff members (and physicians) receive annual updates on UP. Training programs are yet another demonstration of an organization's commitment to safety.

Study limitations

Although these results provide direction and focus for applicable interventions, caution must be exercised in generalizing them to other hospital-based health care populations because only three hospitals were selected. These data were collected by means of confidential self-reports, and employees therefore may have given socially desirable responses. Nonresponder bias must also be considered because of the response rate and the possibility that compliant workers were more likely to complete the questionnaires. Responders were compared with late responders (n = 22, (reclassified from nonresponders) regarding demographic characteristics and found to be similar regarding sex, age, occupation, and job tenure.

The overrepresentation of physicians from one site was controlled for by adjusting for occupation in the analysis. It must also be pointed out that because these data were cross-sectional we cannot establish causality. Although these are all potential limitations, the study results still provide insights into the complexity of the problem. Scale information and copies of the questionnaire, as well as coding information, can be obtained by contacting the senior author (R. R. M. G.).

Because of the potentially serious consequences of occupational bloodborne exposure, many different approaches may be needed to minimize risk. Although emphasis has recently been appropriately placed on "engineering out" some of the risk of needlesticks through the use of safer needled devices, additional approaches are needed for other elements of compliance, such as the use of barrier equipment. Special emphasis should be placed on organizational safety management. Self-protective behavior is complex, and a multidisciplinary approach may best maximize prevention efforts.

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