

Effects of Hospital Staffing and Organizational Climate on Needlestick Injuries to Nurses

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Exposures of health care workers to blood-borne pathogens through accidental contact with sharp instruments have been widely publicized, and the prevention and control of exposure to sharp instruments is a high-profile issue. Estimates from the University of Virginia's Exposure Prevention Information Network (EPINet) surveillance system for 1996 placed the number of the percutaneous injuries to US health workers in that year at almost 600 000.¹ In the largest study of needlesticks to date based on nurse reports (as opposed to institutional surveillance), we reported a startlingly high rate of nearly 1 injury per nurse-year using data from a national nurse survey in 1991.² Because the potential consequences of hepatitis B and C and HIV and AIDS infection are so severe, the relatively low rates of seroconversion after percutaneous injuries—estimated at less than 0.5% for HIV—are not particularly reassuring.^{3–5} Moreover, because the personal and professional consequences of needlestick injuries can be devastating even when they do not result in infections,⁵ needlestick and related injuries remain a very serious occupational health concern for nurses and other health care workers.

The dominant perspective in the literature and in most agency guidelines is that the transmission of bloodborne pathogens from patients to health care workers is largely preventable through the use of universal precautions and special equipment (primarily systems that resheath needles after use and needleless access devices). Exclusive reliance on these strategies is inadequate, however, for several reasons. First, the adoption of universal precautions to date has been far from universal. Studies have shown, for example, that nurse compliance with universal precautions is affected by the availability of protective equipment, the perceived commitment of management to safety, and perceptions regarding the in-

terference of precautions with job performance.^{6,7} Second, the adoption of needleless technology has been widespread, but it is unlikely that any technology can ever entirely remove the need for health professionals to handle bare needles and sharps. Third, awareness is increasing that needlestick accidents, like medical errors, complications, and other reportable incidents in hospitals, may be related to organizational factors such as staffing and the nurse practice environment as well as staff education and the types of equipment used.

Although many aspects of sharps injuries and body fluid exposures have been extensively studied, Hanrahan and Reutter⁸ noted in their review of the literature that an organizational perspective on this issue is needed. To our knowledge, little research has been conducted to determine what factors produce variations in needlestick injury rates across hospitals or hospital units and whether nurse staffing and organizational climate are important determinants. Examining the organizational context of needlestick injuries is particularly timely, given recent state and national initiatives to reduce bloodborne pathogen exposures by requiring the use of specific types of devices in hospitals and separate broader state initiatives mandating minimum staffing levels in hospitals.

Objectives. This study determined the effects of nurse staffing and nursing organization on the likelihood of needlestick injuries in hospital nurses.

Methods. We analyzed retrospective data from 732 and prospective data from 960 nurses on needlestick exposures and near misses over different 1-month periods in 1990 and 1991. Staffing levels and survey data about working climate and risk factors for needlestick injuries were collected on 40 units in 20 hospitals.

Results. Nurses from units with low staffing and poor organizational climates were generally twice as likely as nurses on well-staffed and better-organized units to report risk factors, needlestick injuries, and near misses.

Conclusions. Staffing and organizational climate influence hospital nurses' likelihood of sustaining needlestick injuries. Remedying problems with understaffing, inadequate administrative support, and poor morale could reduce needlestick injuries. (*Am J Public Health.* 2002;92:1115–1119)

In our previous study of AIDS care provided in 20 hospitals across the United States, 1990–1991, we estimated the frequency of needlestick injuries to hospital nurses based on data from various sources.² In addition to retrospective reports from surveyed nurses regarding the number of times they were injured with a blood-contaminated needle in the prior month, we asked the same nurses to report needlesticks at the end of every shift they worked for 30 days (i.e., prospectively). On the basis of the prospective shift-based reports, we estimated that the rate of injuries to staff nurses was 0.8 per nurse per year. Prospective and retrospective rates were statistically indistinguishable. Our data also showed that only about 1 in 4 needlestick injuries were reported to hospital authorities. We also found that nurses who reported recapping needles were at heightened risk for injury and that nurses working in magnet hospitals (3 of the 20 hospitals were known for having an especially positive working climate for nurses⁹) were at significantly reduced risk for injury. The results reported in this article extend the work of that study by exploring how risk factors associated with needlestick injuries and the relative frequency of needlestick injuries among hospital nurses are related to the staffing levels and organizational cli-

mates on the hospital units on which nurses work.

METHODS

Sample

We analyzed data from a survey conducted in 1991 of nurses working on 40 inpatient units in 20 general hospitals located in 11 cities with high AIDS prevalence: New York, NY; Baltimore, Md; Boston, Mass; Chicago, Ill; Miami, Fla; Dallas, Tex; New Orleans, La; Atlanta, Ga; Philadelphia, Pa; San Francisco, Calif; and Los Angeles, Calif.^{10,11} In the parent study of hospital organization and inpatient AIDS care, a purposive sample of 10 hospitals was chosen from a national master list of institutions that have specialized AIDS units with at least 10 beds. A matched group of 10 hospitals in the same geographic areas but without specialized AIDS units was drawn on the basis of characteristics such as bed size, governance, and clientele served. Details are discussed in an earlier publication.¹⁰

In addition to instruments measuring the working climate in the study hospitals and hospital units, the confidential, self-administered questionnaire filled out by the nurses included items dealing with exposures to sharps over the previous 1-month and 1-year periods.² Of the 865 staff nurses permanently assigned to the study units who received the questionnaire, 762 returned it, and 732 questionnaires were usable. Additional prospective data dealing with exposures to sharps and near-miss injuries were collected from all nurses working on the study units (regular staff nurses and temporary nurses) at the end of each shift over two 1-month periods in late 1990 and early 1991. Reports were obtained for 12 349 (86%) of the total 14 379 shifts worked by 960 regular and temporary staff nurses. Because the retrospective survey was conducted 2 months before the prospective portion of the study began, the periods of time and the injuries that occurred during the prospective and retrospective data collection did not overlap.

Measures

Exposures to contaminated sharps. The nurses who completed our retrospective sur-

vey were asked whether they had ever been stuck with a needle or sharp object contaminated with blood. Those who responded affirmatively were then asked how many times this had occurred and how many of the incidents had occurred in the past month.

The prospective portion of our data collection involved the use of booklets containing a sufficient number of reporting forms (coupons) for a month of shifts. These coupon booklets were distributed to staff and nonstaff nurses (both registered nurses and licensed practical nurses) on each of the study units. One coupon was filled out by each nurse at the end of each shift worked and placed in a secure box on the study unit. Nurses indicated on each coupon whether they had incurred a needle or sharp injury, defined as “a puncture with a needle or sharp instrument that is contaminated with blood,” and whether they had had a “near-miss with a used needle or sharp” on that shift.

Staffing data. The number of full-time-equivalent registered nurse positions and the average daily patient census on each of the units for each day of the first month of the study period were determined from administrative data provided by the managers on the nursing units, including payroll sheets and patient assignment worksheets. Ratios of registered nurse positions to average daily patient census on each unit were calculated, cross-checked, and used in the analyses later in this article. In the results presented here, lower-staffed hospital units had registered nurse-to-average daily patient census levels reflecting ratios of approximately 1 nurse for every 10 or more patients on average.

Resource adequacy and nurse manager leadership. Resource adequacy and nurse manager leadership were drawn from the Revised Nursing Work Index, a battery of items that gauge nurses' perceptions of the presence of selected organizational characteristics in their work setting. Details about the development of this tool, its psychometric properties, and its validation in successive studies by our team are available in another recent publication.¹² The Revised Nursing Work Index contains 49 items that asks nurses to indicate, on a 4-point scale from “strongly agree” to “strongly disagree,” whether various features are present in their practice setting.

Three theoretically derived summary measures were initially constructed from these items, and 6 empirically derived subscales were subsequently isolated with factor analytic techniques.¹³ The resource availability and nurse manager leadership subscales ($r=0.63$) used in the current analyses deal with unit-level organizational support for nursing practice and were therefore believed to be the most plausible correlates of needlestick risk. Other subscales address factors such as the influence of senior nurse executives and the quality of nurse-physician relationships. Resource adequacy was derived from 4 items that dealt with nurses' perceptions of whether staffing was sufficient to accomplish the work to be done and to provide quality patient care and whether they had enough time and opportunity to discuss patient care problems with other nurses. Nurse manager leadership was derived from 5 items that dealt with perceptions of the nursing unit manager's leadership and support of nurses' initiative and decisionmaking. Cronbach α s for these 2 subscales in the current data were .83 and .81, respectively. Scores on these subscales provided by each nurse on a given nursing unit were considered independent judgments or evaluations of that unit's organizational climate. Mean subscale scores for all of the nurses on the same units were calculated and used in the analyses described later in this article as aggregate indicators.¹²

To avoid confounding our measures of these 2 organizational characteristics with our measures of needlestick exposures (the occurrence of which influenced nurses' perceptions of resource adequacy and nurse leadership), we calculated all mean unit scores both with and without the evaluations of the nurses who had experienced an injury. Although the results of our analyses were the same regardless of whether the assessments of injured nurses were included in estimating these characteristics, we present the more conservative results (i.e., excluding the evaluations of nurses who were injured).

Emotional exhaustion. The emotional exhaustion subscale of the Maslach Burnout Inventory¹⁴ measures the extent to which nurses feel emotionally overwhelmed by their work. In the current data, this subscale had a Cronbach α coefficient of .89. In our re-

search, we have found that this is a psychometrically valid index that, when aggregated to the level of nursing units, gauges the extent to which working conditions of various types have led to a generalized sense of frustration, strain, and weariness among a particular unit's nursing staff. As in the case of the organizational climate measures, we calculated mean scores for each unit with and without data from the small number of nurses who were injured. There were no differences in the results obtained in the analyses with either approach.

Risk factors. Our survey instrument also asked nurses a series of questions about how often they recapped used needles when they cared for patients with known and unknown HIV status (with responses ranging across 4-point scales from "never" to "always"). A further series of questions asked nurses whether certain factors were present on their units that created a significant risk of exposure to bloodborne infections, including carelessness and inexperience of other staff and uncooperativeness of patients. Last, nurses were asked to estimate, on a 4-point scale ranging from "not very good" to "excellent", how good a job they thought their hospital had done in providing them with adequate knowledge about AIDS and with the supplies and equipment needed to protect themselves.

Data Analysis

We first examined whether variation across hospital units in staffing and organizational climate was a significant predictor of nurses' reports of the presence of specific risk factors associated with needlestick injuries on their units. We then estimated the effects of unit staffing levels and organizational characteristics on the odds of nurses experiencing needlestick injuries or near misses with a sharp over the prospective and retrospective surveillance periods. The organizational climate and staffing measures were examined both as continuous variables and as dichotomous variables to test the possibility that nurses working on units where conditions were poorest experienced needlesticks disproportionately. In the analyses in which these variables were dichotomized, nurses from the 10 units of the 40 that had the lowest levels of resource adequacy, nurse leadership, and nurse-to-patient

ratios, and the highest levels of emotional exhaustion, were compared with nurses from the remaining units. Because little difference was seen in the results obtained with the dichotomous (bottom or top quartile vs all others) and continuous approaches, and because of the ease in interpreting the odds ratios computed for dichotomized variables, only the dichotomized results are presented here.

Because the nurses surveyed were grouped by units, their characteristics and their outcomes were not independent, and conventional logistic regression modeling would not have been an appropriate statistical technique. Consequently, in all cases, logistic regression modeling employing generalized estimating equations, with nursing unit as the clustering variable, was used to estimate odds ratios and 95% confidence intervals associated with the effects of the different factors on them.¹⁵ In the case of the analyses of the prospective data, the number of shifts worked by each nurse was used as a control variable because the time at risk for injury in our analyses was directly related to the number of shifts that nurses worked. All analyses were conducted with SAS (Version 6.12; SAS Institute Inc, Cary, NC).

RESULTS

In the retrospective portion of our study, 34 (4.3%) of the 789 nurses who responded to the questionnaires reported a needlestick injury in the previous month. Of the 962 nurses who filled out at least 1 coupon during the prospective survey, 53 (5.5%) reported an injury involving a needlestick or sharp containing blood, and 228 (23.7%) reported an incident involving a near miss.

Table 1 shows that nurses working on hospital units with poorer work climates and lower staffing levels were substantially more likely to report the presence of risk factors associated with needlestick injuries. Although there is some variability in our estimates of the associations between the 4 organizational characteristics and 6 risk factors, 21 of 24 of the associations were significant, and most were substantial. Nurses on units with less adequate resources, lower staffing and less nurse leadership, and higher levels of emotional exhaustion were typically twice as

likely to report the presence of risks due to staff carelessness and inexperience, patient uncooperativeness, frequent recapping of needles, and inadequate knowledge or supplies.

Table 2 shows that these same 4 organizational characteristics of hospital units also were related to the likelihood of incurring needlestick injuries and reporting incidents involving near misses. The likelihood of experiencing needlestick injuries in the month before our survey was 3 times higher, or nearly 3 times higher, among nurses on units with less adequate resources, less nurse leadership and support, lower staffing, and higher levels of emotional exhaustion. The likelihood of experiencing needlesticks and near misses during the period of our prospective (shift-to-shift) data collection was similarly affected by these adverse unit characteristics; also, odds ratios were somewhat smaller when the prospective data were used but often involved a doubling, or near doubling, of the odds of needlesticks and near misses. Some of these estimates were not significant at the 95% confidence level, but virtually all were nearly so, and the importance of staffing and organization in affecting these adverse events is indicated by the considerable consistency in the effects estimated across the 3 separate indicators of exposure.

DISCUSSION

The analyses presented here suggest that hospital nurses' exposures to bloodborne pathogens were associated with the organizational characteristics and staffing levels on the hospital units where they worked. Individual nurses' risks of sustaining percutaneous injuries with used sharps were related to aggregate-level characteristics of their hospital units such that working on units characterized by poor working climates was associated with increased risks of injuries and near misses.

The differences in the odds ratios presented in Tables 1 and 2 indicate that slightly different nursing units were designated as having high-risk conditions when different unit characteristics were used, and there were slight differences in our estimates of the effects of these characteristics on the likelihood of being injured. However, some of the units clearly had uniformly poor climates, whether

TABLE 1—Odds Ratios (ORs) and 95% Confidence Intervals (CIs) Estimating the Effects of Various Organizational Characteristics on the Odds of Nurse Reports of Different Needlestick Risk Factors on Hospital Units

	Low Nurse Staffing OR (95% CI)	Low Resource Adequacy OR (95% CI)	Low Nurse Manager Leadership OR (95% CI)	High Emotional Exhaustion OR (95% CI)
Significant risk due to staff carelessness	1.92 (1.31, 2.82)	1.88 (1.25, 2.83)	1.65 (1.05, 2.58)	2.16 (1.33, 3.50)
Significant risk due to staff inexperience	1.74 (1.04, 2.92)	2.18 (1.47, 3.24)	1.80 (1.11, 2.93)	2.06 (1.31, 3.23)
Significant risk due to patient uncooperativeness	2.11 (1.32, 3.38)	2.13 (1.34, 3.40)	1.71 (1.06, 2.76)	1.32 (0.74, 2.35)
Often recaps needles used on patients with unknown HIV status	2.40 (1.29, 4.46)	3.30 (2.08, 5.23)	2.16 (1.22, 3.16)	1.78 (0.87, 3.62)
Feels hospital has not done a good job providing knowledge to protect workers	2.76 (1.72, 4.42)	2.44 (1.48, 4.00)	1.54 (0.88, 2.71)	1.94 (1.15, 3.27)
Feels hospital has not done a good job providing supplies to protect workers	3.56 (2.18, 5.81)	2.94 (1.64, 5.17)	1.86 (1.07, 3.26)	1.86 (1.02, 3.37)

Note. Odds ratios were computed with generalized estimating equations to allow for clustering by hospital unit.

TABLE 2—Odds Ratios (ORs) and 95% Confidence Intervals (CIs) Estimating the Effects of Various Organizational Characteristics on the Odds of Nurses Sustaining Percutaneous Injuries and Incurring Near Misses

	Retrospectively Reported Needlesticks OR (95% CI)	Prospectively Reported Needlesticks OR (95% CI)	Prospectively Reported Near Misses OR (95% CI)
Low nurse staffing	3.03 (1.22, 7.51)	2.06 (1.00, 4.25)	1.95 (1.02, 3.73)
Low resource adequacy	2.69 (1.08, 6.70)	1.73 (0.82, 3.66)	2.04 (1.08, 3.88)
Low nurse manager leadership	2.84 (1.14, 7.08)	1.56 (0.70, 3.49)	1.89 (1.06, 3.40)
High emotional exhaustion	2.54 (0.90, 7.26)	2.08 (1.03, 4.19)	1.57 (0.80, 3.10)

Note. Odds ratios were computed with generalized estimating equations to allow for clustering by hospital unit. Estimates involving prospectively reported needlesticks and near misses were computed after controlling for the number of shifts worked (time at risk).

these analyses must be interpreted cautiously. The results point to a possible effect of staffing and organization on hospital nurses' needlestick risk, but the data presented here do not permit commentary on specific staffing levels that are potentially safe or unsafe or on the nature of the causal relationship involved, if there is one. We are replicating and extending these findings with more recent and detailed data in more representative samples of hospitals. Currently, we are examining survey data from nurses working in a second nationwide sample of 22 hospitals in 1998. Our most recent data come from surveys completed in 1999 as part of an ongoing international study of nursing organization and hospital outcomes in which 43 000 nurses representing all hospitals in Pennsylvania and 3 Canadian provinces, as well as a sizable number of institutions in the United Kingdom and Germany, provided reports similar to those analyzed here.¹⁷

The recent resurgence of interest in errors and accidents in health care settings heralded by the Institute of Medicine's 1999 report *To Err Is Human*¹⁸ has been characterized by dismay regarding the apparent pervasiveness of quality problems in medical care but also by an optimism that the incidence of misadventures in health care can be reduced by designing better systems to prevent, detect, and minimize hazards. Although needlestick injuries are not medical errors in the strictest sense (as discussed in the Institute of Medicine's report, for instance), they are, like medical errors, adverse events that occur in medical settings, and they have been viewed by

assessed by our survey-based measures of organizational climate and nurse burnout or measured with institutional reports of nurse staffing. Nurses did not experience needlestick and related injuries at random. Injuries and near misses were clustered in specific units and were significantly more common in units with poor working climates and less staffing.

Although needlestick injuries may be reduced by staff education and the use of safer equipment, managers and policymakers trying to alleviate this problem ultimately must address the effect of staffing levels and work environments on these injuries. Previous discussions of this problem have suggested that clinical nurse specialists and nurse managers are well positioned to influence compliance with safer practices by teaching and modeling appropriate behavior, as well as by helping staff to better evaluate the risks and benefits

of their decisions.¹⁶ Although this observation is undoubtedly accurate and provides some concrete guidelines for frontline managers and leaders, the research reported here suggests the need to consider the broader context of nursing care on the units and in hospitals where needlestick injuries occur. The resource adequacy and nurse manager leadership measures in this study not only are a reflection of managerial decisions by frontline nurse leaders but also are markers of the extent to which the top managers in hospitals pay attention to and invest in safe environments for staff and patients alike.

Because the hospitals and nurses in the primary study were sampled to evaluate the effect of specialized AIDS units on patient and nurse outcomes (and not to evaluate needlestick risk in hospital nurses in different settings) and because the sample of nurses in this study was rather small, the results of

clinicians and administrators and examined by researchers similarly. Because needlestick injuries may serve as a proxy for a broad range of safety and quality issues, understanding the organizational context in which they occur is potentially very important. Remedying problems with understaffing, inadequate administrative support, and poor morale in hospitals may turn out to be among the most important steps in building a safer health care system. ■

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This article was accepted April 6, 2001.

Contributors

S.P. Clarke planned and performed the data analysis and wrote the article. D.M. Sloane assisted in the data analysis and contributed to the writing of the article. L.H. Aiken was the principal investigator on the original study, assisted in the planning of the analysis, and contributed to the writing of the article.

Acknowledgments

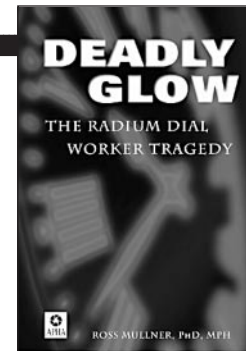
This study was supported in part by grant R01-NR02280, "Outcomes of Inpatient AIDS Care," from the National Institute of Nursing Research, National Institutes of Health, and by an institutional postdoctoral fellowship (T32-NR07104), National Institute of Nursing Research, held by Sean P. Clarke, PhD, RN, at the Center for Health Outcomes and Policy Research, University of Pennsylvania.

References

1. International Health Care Worker Safety Center. Annual number of occupational percutaneous injuries and mucocutaneous exposures to blood or potentially infective biological substances [revised June 15, 1998]. Available at: <http://www.med.virginia.edu/medcntr/centers/epinet/estimates.html>. Accessed January 7, 2001.
2. Aiken LH, Sloane DM, Klocinski JL. Hospital nurses' occupational exposure to blood: prospective, retrospective, and institutional reports. *Am J Public Health*. 1997;87:103-107.
3. Bell DM. Occupational risk of human immunodeficiency virus infection in healthcare workers: an overview. *Am J Med*. 1997;102(5B):9-15.
4. Ippolito G, Puro V, Heptonstall J, Jagger J, De Carli G, Petrosillo N. Occupational human immunodeficiency virus infection in health care workers: worldwide cases through September 1997. *Clin Infect Dis*. 1999;28:365-383.

ciency virus infection in health care workers: worldwide cases through September 1997. *Clin Infect Dis*. 1999;28:365-383.

5. NIOSH Alert: Preventing Needlestick Injuries in Health Care Settings. Cincinnati, Ohio: National Institute for Occupational Safety and Health; 1999. DHHS publication 2000-108.
6. Murphy LR, Gershon RM, DeJoy D. Stress and occupational exposure to HIV/AIDS. In: Cooper CL, ed. *Handbook of Stress, Medicine and Health*. Boca Raton, Fla: CRC Press; 1996:177-190.
7. Grosch JW, Gershon RRM, Murphy LR, DeJoy DM. Safety climate dimensions associated with occupational exposure to blood-borne pathogens in nurses. *Am J Ind Med*. 1999;1(suppl 1):122-124.
8. Hanrahan A, Reutter L. A critical review of the literature on sharps injuries: epidemiology, management of exposures and prevention. *J Adv Nurs*. 1997;25:144-154.
9. Havens DS, Aiken LH. Shaping systems to promote desired outcomes: the Magnet Hospital Model. *J Nurs Adm*. 1999;29:14-20.
10. Aiken LH, Lake ET, Sochalski J, Sloane DM. Design of an outcomes study of the organization of hospital AIDS care. *Res Social Health Care*. 1997;14:3-26.
11. Aiken LH, Sloane DM. Effects of organizational innovations in AIDS care on burnout among urban hospital nurses. *Work Occup*. 1997;24:453-477.
12. Aiken LH, Patrician PA. Measuring organizational traits of hospitals: the Revised Nursing Work Index. *Nurs Res*. 2000;49:146-153.
13. Lake E, Sochalski J. Measuring the social organization of nurses' work. Paper presented at: 70th Annual Meeting of the Eastern Sociological Society; March 2000; Baltimore, Md.
14. Maslach C, Jackson SE. *Maslach Burnout Inventory Manual*. 2nd ed. Palo Alto, Calif: Consulting Psychologists Press; 1986.
15. Allison PD. *Logistic Regression Using the SAS System*. Cary, NC: SAS Institute Inc; 1999.
16. Sulzbach-Hoke LM. Risk taking by health care workers. *Clin Nurs Specialist*. 1996;10:30-37.
17. Sochalski J, Aiken LH. Accounting for variation in hospital outcomes: a cross-national study. *Health Aff (Millwood)*. 1999;18:256-259.
18. Kohn LT, Corrigan JM, Donaldson MS, eds. *To Err Is Human: Building a Safer Health Care System*. Washington, DC: National Academy of Sciences; 1999.



Deadly Glow The Radium Dial Worker Tragedy

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