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Home health care registered nurses and the risk of percutaneous injuries: A pilot study

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Background: Home health care is the fastest-growing sector in the health care industry, expected to grow 66% over the next 10 years. Yet data on occupational health hazards, including the potential risk of exposure to blood and body fluids, associated with the home care setting remain very limited. As part of a larger study of bloodborne pathogen risk in non–hospital-based registered nurses (RNs), data from 72 home health care nurses were separately analyzed to identify risk of blood/body fluid exposure.

Methods: A 152-item self-administered mailed risk assessment questionnaire was completed by RNs employed in home health care agencies in New York State.

Results: Nine (13%) of the home health care nurses experienced 10 needlesticks in the 12-month period before the study. Only 4 of the needlesticks were formally reported to the nurse's employer. The devices most frequently associated with needlesticks were hollow-bore and phlebotomy needles, and included 3 needles with safety features. Exposure was most commonly attributed to patient actions, followed by disposal-related activities.

Conclusions: These data suggest that home health care nurses may be at potential occupational risk for bloodborne pathogen exposure. Risk management strategies tailored to the home health care setting may be most effective in reducing this risk. (Am J Infect Control 2008;36:165-72.)

Although risk and risk factors for occupational exposure to blood and body fluids is well characterized for health care workers (HCWs) employed in the hospital sector of the health care industry, much less is known about the estimated 5 million health care workers employed in the nonhospital sector, which includes home care.[1-4] The home care setting is of particular interest for a number of reasons. First, with approximately 20,000 home health care agencies in the United States, and nearly 1 million health care workers, including more than 110,000 registered nurses (RNs),[5] the sector is large and is the fastest-growing sector in health care. Second, the potential for exposure to blood/body fluids may be rising along with the increasing acuteness of care provided in the home health care setting. In 2003, patients left hospitals after a 4.8-day stay on average, compared with the average length of stay of 6.4 days in 1990; many of these patients are discharged to home health care.[6] In 2000, 48% of recently hospitalized Medicare patients were discharged to home health care.[7] The scope of care provided in home health now includes a wide range of procedures formerly limited to the hospital or outpatient setting, such as home dialysis, infusion therapy, and tracheostomy and ventilation support.

Another reason for the increased interest in home care is that very few blood/body fluid exposure studies on this difficult-to-reach population of RNs have been conducted to date.[8,9] The latest risk assessment study, published 7 years ago by Beltrami et al,[10] found a rate of 2.8 blood contacts and 0.6 percutaneous injuries (PIs) per 1000 home health care procedures and a low rate of compliance with protective barrier use. The authors concluded that home health care workers (HHCWs) were at high risk for blood contact. Importantly, even though extensive guidelines and recommendations have been published since the enactment

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of the 1991 OSHA Bloodborne Standard, the extent of adoption and compliance with these in the home care sector has not yet been fully evaluated.[11] This is of concern, because there may be numerous barriers to adherence related to unique aspects associated with the home care setting.

As part of a larger study designed to address important knowledge gaps regarding the risk of exposure and infection with bloodborne pathogens for RNs employed in the nonhospital sector data from a small sample of RNs employed in the home health care setting were analyzed separately to (1) estimate the risk of PIs, (2) assess potential risk factors (eg, compliance with universal precautions/standard precautions [UP/SP], safety climate) correlated with these injuries, and (3) obtain information on postexposure management.

METHODS

Sample population

Data were collected between 2002 and 2004 from study participants recruited through the New York State Public Employees Federation (NYSPEF) and the New York State Nurses Association (NYSNA). Membership rosters provided by these collaborating organizations were stratified by work setting, and proportionate random samples were selected from the following work categories: doctor's offices, health maintenance organizations, psychiatric facilities, home health agencies, long-term care facilities, free-standing outpatient clinics, public health agencies, and public institutions, including correctional facilities.

Study questionnaire

A new survey instrument was constructed for this study. The 5-page, 152-item survey was informed by in-depth interviews and focus groups, followed by extensive pilot testing. (Copies of the instrument, coding information, and psychometric data are available from the corresponding author on request.) The following constructs were assessed: *individual factors* (eg, demographics, job task variables, hepatitis B virus (HBV) vaccination history, compliance with UP/SP), and *organizational factors* (eg, infection control training, employee health policies and programs, including postexposure management programs, safety equipment availability and use, and safety climate). The dependent variable was percutaneous exposure to blood and body fluids (ie, needlesticks and cuts with contaminated sharps). The major constructs are described below.

Individual factors

- Demographics and work information. Items on gender, age, education, licensure, tenure, current work setting, mandatory overtime, and other workplace factors were included.
- Job task variables. The RN was asked to report the number of hours that she or he worked in a typical day and week, the number of patients to whom she or he provided care in a typical work day, and details regarding her or his job duties.
- HBV vaccination history. The RN was asked 5 questions regarding her or his history of HBV vaccination (including the number of doses received). An RN who reported receiving a primary vaccine series of 3 doses was categorized as ''vaccinated.'' An RN who reported receiving fewer 3 doses or did not remember her or his vaccination status was categorized as ''unvaccinated.''
- Compliance with UP/SP. To ascertain the relation between exposure history and safe work practices, the RN was asked to report her or his practices with respect to UP/SP using a 12-item compliance scale.[12] Response choices included ''never,'' ''rarely,'' ''sometimes,'' ''often,'' ''always,'' and ''not applicable'' for each of the 12 items. The 5-point compliance scale was dichotomized for the analyses into 2 categories: ''strict'' compliance (eg, always) versus ''nonstrict'' (often, sometimes, rarely, and never), excluding nonapplicable.

Organizational factors

- Infection control training. The RN was asked about the amount of infection control training she or he had received within the past 12 months, with 5 response choices: ''none,'' ''15 minutes,'' ''30 minutes,'' ''1 hour,'' and ''2 or more hours.''
- Employee health policies and programs. The items addressed access to employee health and infection control practitioners, bloodborne pathogen exposure control and emergency care plans, HBV vaccination availability, sharps injury logs, and safety product selection committees. Response choices were ''yes,'' ''no,'' ''don't know,'' and ''not applicable.'' Because some items would not be applicable in some settings (eg, infection control practitioner onsite in a small private physician's office), ''not applicable'' was provided as 1 of the choices.
- Postexposure management programs. In this area, 17 items addressed postexposure management, including reporting, barriers to reporting, follow-up with a health care provider, postexposure prophylaxis, referral to a human immunodeficiency virus (HIV) specialist, explanation of postexposure treatment, and lost work time related to postexposure prophylaxis. One item addressed whether the RN had ever left a job because of a needlestick injury. These questions were answered with ''yes,'' ''no,'' or ''not applicable'' or were open-ended.

- Safety equipment availability and use. A safety equipment scale was designed to evaluate safety equipment access. The RN was asked 20 questions related to the availability of various safety devices, such as safety needles, catheter securement devices, sharps containers, medical waste bags and containers, gloves (latex and powder-free), face shields, eye protection, and barrier gowns. Responses included ''personally available to me,'' ''not available to me,'' ''I personally use,'' and ''not applicable to my job.'' The scale was dichotomized in the analysis as ''high availability'' (ie, 75% of safety equipment was available) vs. ''moderate/low availability'' (ie, 25% or less of safety equipment was available.) To assess use, safety equipment scale items that were available were further categorized as ''used'' versus ''not used.''
- Safety climate. A 21-item safety climate scale, adapted from a preexisting instrument,[13] was included to measure the RN's perception of her or his work site safety program (ie, safety climate). There were 5 possible response categories: ''strongly disagree,'' ''disagree,'' ''neutral,'' ''agree,'' and ''strongly agree.'' The scale was dichotomized at the median into 2 groups: ''strong/moderate'' safety climate and ''weak/poor'' safety climate.

Blood/body fluid exposure. Each RN was asked to recall any known percutaneous, mucocutaneous, or nonintact skin exposures to blood or body fluids experienced in the 12 months before the study, as well as any PIs that occurred during her or his current job and during her or his entire nursing career. The RN was also asked how many of the exposures (by category) that she or he had experienced were formally reported to her or his employer. Detailed information was obtained for the most recent exposure, including type of injury, level of severity, type of instrument being used at the time of injury, and whether or not it had a safety feature. The factors that contributed to the injury (eg, type of procedure, during disposal, equipment failure, whether patient-caused) also were assessed. The respondent was asked to explain, in her or his own words, how the incident occurred and describe how it could have been prevented.

Questionnaire administration

Coded questionnaire packets were mailed to the home addresses of a random sample of 3000 RNs from lists provided by NYSPEF and NYSNA. Follow-up mailing procedures followed a standard methodology.[14] A final 1-page questionnaire on sociodemographic status was sent to all nonresponders in an attempt to compare the nonresponders and responders on these basic elements. All procedures involving human subjects had institutional human subjects approval.

Data analysis

Data were analyzed using SPSS statistical software, version 11.0 (SPSS Inc, Chicago, IL). The psychometric properties for the responses to the compliance and safety scales were determined, and internal consistency reliability was assessed using Cronbach's α test. This test indicates how well the responses to each scale item are intercorrelated with the other items, and thus provides a measure of reliability and consistency of responses to the scale. Descriptive statistics were then generated for the data set, and frequency rates for percutaneous and other types of exposures were calculated. To determine the correlation between exposure (dependent variable) and potential risk factors (independent variables), we conducted bivariate analysis. Odds ratios and their 95% confidence intervals were estimated using χ^2 statistics.

RESULTS

Of the list of 3000 RNs to whom questionnaires were mailed, 40 names of retirees, 158 transfers and decedents, and 175 names with incorrect contact information were deleted, resulting in 2627 eligible RNs. Of 1156 completed and returned questionnaires (overall response rate, 44%), 72 HHCWs were identified. This response is comparable to other mailed surveys as reported in a review article on survey response.[15] In addition, sociodemographic data were collected from a sample of 39 nonrespondents (or, more correctly, from those unwilling to complete the full questionnaire). Their demographic characteristics were similar to those of the sample as a whole.

Individual factors

Sample demographics. Most of the RNs were female (n = 65; 90%), with a mean age of 49.6 years. Most were degree-level trained (n = 41; 57%) and had worked in nursing for an average of 20 years. The average length of time that the RNs had worked in home care was 10.6 years. More than 1/3 (n = 28; 39%) reported that they worked for an agency affiliated with a hospital; a slightly lower number (n = 19; 28%) reported that their agency was affiliated with a medical center as well.

Job tasks. The RNs typically provided care to roughly 5 patients (median, 7.3; mode, 5) per shift, which was generally 8.5 hours long. Typical daily job duties included performing dressing changes and wound care (n = 46; 63%), managing body fluids (n = 31; 43%), manipulating and managing drainage tubes (n = 28; 39%), and, less frequently, providing assistance with activities of daily living (n = 13; 18%). In addition, the RNs also reported handling needles and other

Table 1. Compliance with standard precautions

Item	Strict compliance ("always")		Non strict compliance ("never, rarely, sometimes, often")		Not applicable	
	N	%	N	%	N	%
Disposes of sharp objects into a sharps container	38	54	21	30	11	16
Follows standard precautions with all patients regardless of their diagnosis	58	82	8	11	5	7
Washes hands after removing disposable gloves	52	73	14	20	5	7
Wears disposable outer garment that is resistent to blood and body fluids	17	24	34	48	20	28
Wears disposable gloves whenever there is a possible exposure to blood or other body fluids	56	79	8	11	7	10
Wears eye protection whenever there is a possibility of splashes or splatters to eyes	22	31	25	35	24	34
Promptly disposes of contaminated spills	44	63	5	7	21	30
Refrains from eating or drinking while working in areas where possible contamination exists	48	68	7	10	16	22
Takes special caution when using scalpels or other sharp objects	49	69	1	1	21	30
Does not recap contaminated needless	39	55	19	27	13	18
Wears gloves when exposed to blood products	16	31	4	8	31	61
Treats all materials that have been in contact with patient's body fluids as if they were infectious	54	76	10	14	7	10

sharps (n = 53; 74%), contaminated sharps (n = 25; 35%), and contaminated waste (n = 24; 33%).

HBV vaccination history. A large proportion (n = 58; 82%) of the RNs reported receiving all 3 doses of the HBV vaccine, with 4 (6%) reporting that the vaccine was declined due to a positive history for HBV.

Compliance with UP/SP. The overall compliance scale had a high mean score across the 12 items of 4.54 (standard deviation ± 0.34; range, 3.9 to 5.0) and an α value of 0.91, indicating a high level of internal consistency. Very high levels of self-reported compliance were noted for disposable glove use (n = 56; 79%) and handwashing (n = 52; 73%). Conversely, compliance with eye protection use was poor (n = 22; 31%), as was use of disposable outer garments (n = 17; 24%). The compliance scores for individual items are given in Table 1.

Organizational factors

Infection control training. In the 12-month period before the study, 15 RNs (56%) reported receiving 2 hours or more of infection control training, 5 (19%) received 1 hour, 4 (15%) received 30 minutes, and 2 (7%) received 15 minutes. One RN (4%) reported receiving no infection control training in the previous 12 months.

Employee health policies and programs. More than 1/3 of the RNs (n = 26, 37%) reported that they had access to an employee health nurse or infection control practitioner, and most (n = 51; 72%) reported that their employer conducted annual medical screenings. Nearly all (n = 68; 97%) had been informed about the HBV vaccine, and 87% (n = 62) had been offered no-cost HBV vaccine by their employer. Slightly more than half (n = 39; 56%) reported that their postvaccine titer had been checked. Most respondents (n = 63; 89%) reported that their employer had formal arrangements for the provision of emergency care after blood/body fluid exposure. The vast majority (n = 66; 92%) reported that they were encouraged to report all blood/body fluid exposures, with only a small percentage (n = 6; 9%) stating that they were encouraged to report only significant exposures. There was reluctance to report exposures, although this was uncommon; 14% (n = 9) of the RNs reported reluctance, with the reasons most commonly cited as wanting to keep it confidential, lack of time, and fearful of getting into trouble.

Safety equipment availability and use. Regarding the availability and use of safety equipment, the RNs reported the following items were most often available: face masks (95%), sharps containers (93%), eye goggles (90%), safety vacutainers (89%), barrier gowns (88%) and powder-free disposable gloves (87%). However, even though RNs reported that these items were available to them, many of the items were not used. For example, whereas most of the RNs (76%) stated that safety butterfly needles were personally available to them, only about 1/4 of them (n = 13; 28%) reported that they actually used these needles when indicated, even though they reported that training on the safety devices was provided. More than 1/3 of the RNs (n = 26; 38%) reported that their agency had a safety product selection committee.

Safety climate. On this scale, the α coefficient was high (α = 0.91), and the mean score across the 21 items in this scale was relatively high (3.69 ± 0.08; range, 1 to

Table 2. Safety climate

Factors	Disagree/strongly disagree		Neutral		Agree/strongly agree	
	N	%	N	%	N	%
Protection of workers from occupational exposures	11	15	8	11	53	74
All reasonable steps are taken to minimize hazardous job tasks and procedures	10	14	9	13	51	73
Employees are encouraged to become involved in safety and health matters	7	10	16	23	48	68
My job duties often interfere with being able to follow standard precautions	7	10	8	11	56	79
I have enough time to always follow standard precautions	11	16	8	12	49	72
I usually follow standard precautions	1	2	1	2	63	97
Unsafe work practices are corrected by supervisors	12	18	16	24	38	58
Nurse manager often discusses safe work practices	14	22	18	28	33	51
I have had the opportunity to be properly trained to use safe needle devices	15	21	8	11	47	67
Employees are taught to recognize potential health hazards at work	5	7	9	13	58	81
At worksite, a copy of the safety manual is available	8	12	10	15	50	74
Work area is kept clean	5	8	11	17	50	76
There is adequate staffing	23	32	13	18	35	49
I am provided with all necessary equipment	10	15	8	12	50	74
Work area is not crowded	11	17	13	20	42	64
There is minimal conflict within my group	16	23	11	15	44	62
There is coworker support	8	11	8	11	56	78
There is open communication between nurse management and staff	9	13	14	20	48	67
Product review board monitors new safety products as they become available	16	25	20	32	27	43
Nurses who provide patient care are involved in safety product selection	24	38	16	25	25	38
Overall, I am satisfied with working conditions	8	11	18	25	45	63

5). Results for each item are presented in Table 2. Particularly high scores were obtained for the following items: ''protection of workers from exposure to bloodborne pathogens'' (74%) and ''employees taught to recognize potential health hazards'' (81%). Other items received lower scores; 35% of the RNs agreed that nurses involved in patient care can serve on safety product selection committees, and 49% thought that there was adequate staffing.

Exposure history

Postexposure management programs. Nearly 1/4 (n = 16; 22%) of the RNs reported sustaining at least 1 PI during their tenure in their current home health care job. Within the 12-month period before the study, 8 RNs (13%) reported 1 PI (all needlesticks) and 1 RN reported 2 PIs, for a total of 10 PIs over the previous 12-month period. Although only a fraction of the RNs reported that they were reluctant to report exposure, in fact only 4 (40%) of the 10 needlesticks were formally reported to the agency's administration, indicating an underreporting rate of 60%. Other types of exposures also occurred; 7 RNs reported 22 splashes to the eyes or mouth to the eyes or mouth (none were formally reported), and 15 RNs reported 26 instances of blood/body fluid contact with intact skin, only 1 of which was reported.

The instruments most frequently in use during the most recent needlesticks were hollow-bore needles (n = 2; 29%) and phlebotomy needle/blood collection devices (n = 2; 29%). In 3 of the 10 needlesticks, a safety device was in use, including a safety butterfly needle (n = 1), a safety phlebotomy needle (n = 1), and a retractable needles (n = 1). In all cases, the RNs reported that they had received training on the device. The most commonly reported causes of the PI exposure incidents included disposal-related or patient-related behaviors, overfilled or absent sharps container, needle left in unusual location (eg, bed linens), design flaw, equipment failure, and action of coworker.

Correlates of needlesticks

Due to the small numbers, the correlation models were unstable and could not be assessed using these pilot data.

DISCUSSION

HHCWs with job duties requiring the frequent handling of sharps may be at risk of exposure to blood and body fluids, thereby increasing their potential risk of bloodborne pathogen exposure. Because prevalence rates for certain bloodborne pathogens may be greater in certain home care patient populations (eg, hospice care)[16,17] than in the general community, the risk of exposure to these agents (given an exposure incident such as a needlestick injury) may approximate or even exceed that experienced by hospital-based RNs. Active surveillance of infections in home care patients and seroprevalence studies in this population would help better estimate this risk.

Our data are consistent with both the incidence of PI exposure and the reporting rates noted by Beltrami et al.[10] In their large prospective study of 548 HHCWs, 5 PIs were reported over an 11-month period. Extrapolated out, their reports are the equivalent of 203 PIs/1000 HCWs per year, compared with the rate of 153/1000 RNs per year found in the present study. However, their data set included phlebotomists and other HCWs who provided home infusion therapy, and they found that phlebotomists and technicians were more than twice as likely as nurses to report PIs, even though they represented a fraction of the sample as a whole. None of the injuries reported by Beltrami et al[10] involved a safety device. In the 12-month period before their study, 154 HCWs (28%) recalled 245 PIs, of which 40% were reported; in comparison, in our study, 9 RNs (13%) recalled 10 PIs, of which 40% were reported. The rates for use of infection control barriers, such as gloves, masks, and gowns, that Beltrami et al[10] reported were lower than the rates that we found, perhaps reflecting improved infection control practices since their study was conducted in 1996–1997. We also note that the PI underreporting rate in our study is similar to published hospital rates during a comparable time period.[1-3,18-20] Finally, safety climate scores in our study are similar to published scores for hospital-based workers and other HCW populations.[13]

The relatively high PI rate that we found was somewhat unexpected. Even though invasive procedures are increasingly being conducted in the home health sector, we still expected to find that the hospital setting, which includes such high-risk departments as emergency medicine and surgery, presented a greater risk of PIs. But our data indicate that this may not be the case. Further risk assessment studies for the home care setting are needed. Fortunately, this has been the focus of recent Centers of Disease Control and Prevention/National Institute for Occupational Safety and Health funding efforts. Extensive data on this topic should be forthcoming in the next few years.

Several unique aspects associated with the home health care work setting may serve to increase the risk HHCWs. For instance, HHCWs may work in homes that have poor lighting, extensive clutter, presence of vermin and other hazards, poor temperature controls, inadequate or unavailable sharps containers, and lack of readily accessible personal protective equipment.[21-23] Conditions not typically found in hospitals, such as unrestrained and aggressive pets and drug- or alcohol-impaired and aggressive family members and neighbors who may threaten HHCWs, also may make the HHCWs' tasks more hazardous to perform. Violence in the neighborhood, suboptimal building security, and guns and other weapons in the home may not only be a risk to the personal safety of the HHCW, but also result in work stress, which has been correlated with work injuries.[24-26] Other organizational aspects of home care may inadvertently serve to increase risk, such as the lack of peer and supervisory support for the adoption of safe work practices. Cutting-edge safety equipment and supplies may not be readily available, especially in some of the smaller agencies, although we did not find this to be the case in the present study. We did note, however, that even when available, many safety devices were not used. Additional studies to explore the barriers to safety device use might be informative. Given that 30% of the needlesticks reported in the present study involved safety devices, risk factors for device failure need to be examined. This need was pointed out by Haiduven and Ferrol[27] in a study examining needlesticks in home health care agencies between 1993 and 1996. A related qualitative study by Haiduven[28] exploring blood exposure in home care found that nurses were frustrated with the safety design features of some devices, and interestingly noted that training patients on the use of these devices (for self-administration) was extremely difficult. Perhaps the complexity of some of the devices requires more intensive training than is typically offered; 60% of our study participants received 1 hour or less of infection control training. Scheduling training for staff who are at the home agency only intermittently and usually for short periods is a well-recognized challenge for home health care agencies.

Finally, a lack of ready access to infection control and employee health expertise also can affect training, access to new products, vaccination programs, support for postexposure reporting and/or medical surveillance, and exposure follow-up. Both formal and informal consultations with infection control specialists can be an important source of information and support for providers. For some of the smaller agencies unaffiliated with hospitals, lack of such consultation has been reported to be an important barrier to rapid, effective postexposure care. Although many agencies have taken the proactive step of arranging for postexposure care with local hospitals, this is usually provided by emergency departments, whose focus and continuity of care is necessarily limited.

The impending crisis looming over the health care system as a whole is the aging population and their ever-increasing need for health care services. This is especially true for home care, with more than 60% of the home health patient population age 70 years or older.[29] At the same time, the existing nurse shortage will be further exacerbated by the impending retirement of the aging health care workforce, which will undoubtedly have a significant impact on home care. In our study, the average age of the RNs was nearly 50 years; nationally, the mean age of nurses is 46.8 years.[30] Heavy patients loads (HHCWs typically provide

care to 5 or more patients per shift) coupled with long commutes between patients can lead to exhaustion, potentially increasing the risk of injury. Numerous studies have found important links between quality of work life, including safety climate, and injuries, and these in turn are associated with job satisfaction, turnover, retention, and premature retirement.[20,31,32] Thus, efforts to make the home care workplace safe for HHCWs will potentially have important affects on the sector as a whole.

The present study has several limitations. Most importantly, our sample is small and all recruited from New York State; therefore, our results may be biased and may be not generalizable. If nonparticipation were related to either the factors associated with the risk factors or the risk of needlesticks, or both, then this could lead to threats to external validity and low strength of association. Nonetheless, it is interesting to note the similarities between our findings and those from the much larger national (plus Canadian) sample in the first assessment study published.[10] Another limitation is the self-reporting construction; participants may have provided socially desirable responses, even though the confidential nature of the study was made clear, and all questionnaires were mailed to the RNs' home addresses. Despite these limitations, however, our data provide further evidence of the continuing risk that HHCWs face and provide new impetus for additional study and intervention.

CONCLUSION

Recommendations include additional assessments of risk in the home health sector, as well as interventional studies aimed at identifying novel solutions that address underreporting, postexposure care, and safety device selection and implementation. Some of these interventions already have been implemented by some agencies. Escort services, preplanning and delivery of personal protective and safety equipment, and infection control guidelines specific to home care are becoming increasingly prevalent. However, further studies are needed to assess the quality and effectiveness of these interventions in reducing risk to home health care providers.

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