A) FINAL PROGRESS REPORT

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Principal Investigator:
Margaret M. Quinn, Sc.D., CIH
Professor, Department of Work Environment
University of Massachusetts Lowell
One University Avenue, Department of Work Environment
Lowell, MA 01854
Phone 978-934-3196
Email Margaret_Quinn@uml.edu

Institution:
University of Massachusetts Lowell
One University Avenue
Lowell, MA 01854

Project Title:
Sharps Injuries and Blood Exposure in Home Health Care

Final Progress Report
November 30, 2009

Grant number:
5 R01 OH008229
3R01 OH08229-04W1

Project period: 9/1/04 – 8/31/09 (including no-cost extension)

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Terms and Abbreviations

BBP – bloodborne pathogens
Bloodborne Pathogens means pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus (HBV) and human immunodeficiency virus (HIV). (Reference 1)

BBFE – blood/body fluid exposure

Body fluids – as per the OSHA definition of human body fluids that may comprise *Other Potentially Infectious Materials:* The following human body fluids: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any body fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids.[1]

CI – confidence interval

Engineered safety feature - engineered sharps injury protection feature, as per the OSHA definition: *Sharps with engineered sharps injury protections* means a non-needle sharp or a needle device used for withdrawing body fluids, accessing a vein or artery, or administering medications or other fluids, with a built-in safety feature or mechanism that effectively reduces the risk of an exposure incident. (see the OSHA Bloodborne Pathogen Standard, Reference 1)

FTE – full time equivalent; the percentage of full-time the employee is assigned to work. Full-time equals 1.0 FTE.

Full time employment – 35 or more hours per week

HC – home care
HHC – home healthcare
HCA – home health aide employed through healthcare sector

MDPH – Massachusetts Department of Public Health

OSH – occupational safety and health

Other Potentially Infectious Materials: The following human body fluids: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any body fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids. (see the OSHA Bloodborne Pathogen Standard, Reference 1)

Part time employment – less than 35 hours per week

Per diem employee - an employee who is scheduled to work on an "as needed" basis. The employee may work the offered hours as he/she chooses, but is not eligible for regular employee benefit programs and may be excluded from future service at any time. Per diem employees receive the hourly rate of pay offered by the employer.

RR – relative risk

Sharps with engineered sharps injury protections or engineered safety feature means a non-needle sharp or a needle device used for withdrawing body fluids, accessing a vein or artery, or administering medications or other fluids, with a built-in safety feature or mechanism that effectively

reduces the risk of an exposure incident (see the OSHA Bloodborne Pathogen Standard, reference 1).

Sharp injury - percutaneous injury from a sharp medical device that has been previously used in contact with blood and other body fluids (see the OSHA Bloodborne Pathogen Standard, Reference 1).

SHARRP – Safe Homecare and Risk Reduction for Providers, the name of the NIOSH-funded research project.

SI – sharp injury; a percutaneous injury from a previously used sharp.

Abstract

Introduction: Home health care is one of the fastest growing industries in the United States.[2] Approximately 7.6 million people receive care in their homes from nurses, aides and other professionals employed by more than 17,000 provider organizations .[3] Home health care will continue to grow as a result of the aging population, technological advances, health care cost containment strategies, infection control, and the common desire to be cared for at home.[2,4,5]

Objectives: The objectives of the completed study were to evaluate and quantify the risks of sharp medical device (sharps) injuries and other blood and body fluid exposures among home health care (HHC) nurses and aides, identify risk factors, assess the use of sharps with safety features, and evaluate underreporting in workplace-based surveillance.

Methods: The study was conducted by a multi-disciplinary team at the University of Massachusetts Lowell and the Massachusetts Department of Public Health collaborating with 9 home health care agencies (26 worksites) and 2 labor unions. The partner agencies deliver most of the home health care in eastern Massachusetts.

The study, called Project SHARRP (Safe Homecare and Risk Reduction for Providers), was conducted in multiple phases. Initial focus groups of direct care home health nurses and aides and in-depth interviews of managers and union representatives were conducted in 2005 – 2006 in order to learn about the culture of their work as it relates to occupational health and safety and in particular about the circumstances by which HHC nurses and aides use or encounter sharps and other blood and body fluid exposures. These qualitative findings informed the development of a large questionnaire survey which was conducted via the agency worksites or via the mail in 2006 -2007. The findings of the survey yielded quantitative risk estimates of sharps injuries and other blood and body fluid exposures for HHC nurses and aides and of the main factors contributing to the injuries and exposures. A second set of focus groups with direct care workers and in-depth interviews with managers and union representatives were conducted in 2008-2009 to present the survey findings and gain input from the workers, managers, and union regarding their interpretation and on the most effective ways to formulate the study findings in terms of an OSH prevention message and how to disseminate it to the broader home health care sector and the patient/clients who use it. Finally, a workplace-based surveillance system for sharps injuries was developed for 3 of the largest agencies. 2 years of surveillance data were collected in 2006 - 2008, corresponding to the period covered by the questionnaire survey. The SI findings of the surveillance system were compared to those of the questionnaire survey.

Results: 1,125 surveys were completed yielding a response rate of nearly 70%. Approximately 35% of nurses and 6.4% of aides had experienced at least 1 sharps injury during their home healthcare career; corresponding figures for other blood and body fluid exposures were 15.1% and 6.7%, respectively. Annual sharps injuries incidence rates were 5.1 per 100 full-time equivalent (FTE) nurses and 1.0 per 100 FTE aides. Medical procedures contributing to sharps injuries were injecting medications, administering fingersticks and heelsticks, and drawing blood. Other contributing factors were sharps disposal, contact with waste, and patient handling. Sharps with safety features frequently were not used. Underreporting of sharps injuries to the workplace-based surveillance system was estimated to be about 50%.

Several important predictors of SI rates were identified in HHC nurses including: The SI rates were significantly higher for per-diem nurses (13.4/100 FTE) than for part-time nurses

(9.1/100 FTE), and lower still for full-time nurses (2.9/100 FTE). HHC nurses reporting low job satisfaction were more than twice as likely to have an SI in the last 12 months compared to those with high job satisfaction (RR = 2.6, 95% CI = 1.3 to 5.4). HHC nurses who agreed that "patient care comes before employee safety in my workplace" were more than twice as likely to have an SI compared to those who disagreed with this statement (RR = 2.2, 95% CI = 1.1 to 4.4).

Conclusions: Sharps injuries and other blood and body fluid exposures are serious hazards for home health care nurses and aides. The risk estimates for sharps injuries are in a similar range as in some areas of hospitals. In addition, the use of sharps without safety features is common in home healthcare, despite federal and state regulations requiring them. Home healthcare working conditions differ from the hospital setting and require specific attention for future study and the design of safe practices and interventions. The findings of this study will assist home healthcare agencies, unions, professional organizations, and government agencies by providing information that can aid in reducing blood exposure and sharps injury. Future studies of the occupational health and safety of home care are urgently needed because this industry is understudied and yet it is one of the fastest growing sectors in the U.S.

1. Highlights and Significant Findings of Project SHARRP

- Home health care (HHC) nurses and aides experience many hazards that are common to the hospital setting, such as SIs and musculoskeletal strain from patient handling. HHC workers also experience OSH hazards not found in other health care settings including the re-use of sharps and their improper disposal, unclean and cluttered work spaces, distractions from family members, and aggressive, uncooperative patients in isolated home-work environments.
- Over their entire career in HHC, 35% of nurses and 6% of aides had at least one sharps injury (SI). In the 12 months prior to the survey, 4.3% of nurses, and 0.7% of aides sustained at least one SI.
- When the annual SI rates are expressed as the number of injuries per 100 full-time equivalent (FTE) employees (which corrects for the number of hours worked), HHC nurses reported 5.1 SI/100 FTE (95% confidence interval = 3.7 to 7.1), while HHC aides reported 1.0 SI/100 FTE (95% CI = 0.2 to 4.0).
    - While the annual incidence of SI from our survey is relatively low among HHC aides compared to nurses, the public health impact is high because of the potentially severe health consequences and because the number of HHC aides is so great.
    - Based on the rates calculated from our study and the number of HHC nurses and aides in the U.S. we estimate that there are approximately 8,000 SI annually among HHC nurses and 10,000 among HHC aides[6-8].
    - Because our partner agencies tended to be large and well-managed, these rates may be lower than those across the full range of HHC agencies nationwide.
- Several important predictors of SI rates were identified in HHC nurses including:
    - The SI rates were significantly higher for per-diem nurses (13.4/100 FTE) than for part-time nurses (9.1/100 FTE), and lower still for full-time nurses (2.9/100 FTE). This finding is consistent with a recent study by NIOSH researchers suggesting higher OSH risks for contingent workers than for those in traditional employment[9].
    - HHC nurses reporting low job satisfaction were more than twice as likely to have an SI in the last 12 months compared to those with high job satisfaction (RR = 2.6, 95% CI = 1.3 to 5.4).
    - HHC nurses who agreed that "patient care comes before employee safety in my workplace" were more than twice as likely to have an SI compared to those who disagreed with this statement (RR = 2.2, 95% CI = 1.1 to 4.4).
- Most SI occurred after the sharp had already served its intended purpose and was being disposed or had been set aside by a patient for later reuse or disposal.
    - For HHC nurses, SI occurred most often during or after the following medical procedures: injecting medication, fingerstick/heelstick, phlebotomy/venipuncture, and accessing/deaccessing an IV line or device.
- Among HHC aides, SI often occurred during cleaning tasks, while other blood/body fluid exposures most often happened while assisting patients with toileting needs, bathing, and helping the patient move.
- When HHC nurses were asked to describe in detail the circumstances of their most recent SI, 65% were found to involve a sharp device (e.g. syringe, lancet) with no integral safety feature.
- A surveillance system established by the MDPH Occupational Health Surveillance Program in 3 partner agencies recorded an unexpectedly low number of injuries: approximately half the number expected based on our questionnaire survey responses from HHHC workers in those agencies. Injury and exposure under-reporting is likely to have occurred; a problem well-known in other health care settings.

Translation of Findings

SHARRP achieved a much clearer definition and quantification of BBP exposure risks in HHC nurses and home health aides than previously available. We also identified other important OSH hazards that merit further investigation and quantification. Quantification of these hazards makes it possible to communicate the problem in terms of public health impact and to provide insight into the methods and benefits of solving it. Our ultimate goal is to protect workers and it is essential that HHC

agencies and workers have the information needed to perform their work safely and to respond in a timely and appropriate manner when injuries/exposures occur. For the agencies and unions, thoughtful and user-friendly communication of findings serves as an intervention by making readers aware of and able to address hazardous situations. For the scientific and public health communities, publication and presentation of our methods, analysis, and findings establish a baseline critical for future efforts and prioritizing interventions. Several of our publications were targeted for nursing journals that do not typically address OSH to reach new audiences relevant to HHC.

In Year 1 of SHARRP we held a press conference and distributed a press release to local newspapers and designed a poster for agency and union offices. We prepared a factsheet on SIs and posted it on our website. At the end of the study, a visually appealing, tri-fold brochure summarizing highlights of the survey findings was distributed to all study participants, partner agencies and unions, and public health professionals concerned with SIs in Massachusetts. In addition, our partner agencies and unions received a 14-page summary report "Project SHARRP Preliminary Survey Findings". Our contacts at partner agencies and unions provided very favorable anonymous feedback elicited by a brief survey on the summary report and brochure. In addition, educational sessions and focus groups were held to communicate findings, and elicit reactions, interpretations, and ideas about workable interventions.

SHARRP has been highly productive in publications and scholarly conferences. There have been seven scholarly articles in peer-reviewed journals [10-16]. Two articles were published in nursing trade publications[17,18]. Fourteen presentations have been made at national or international scientific meetings[19-32]. In order to educate and reach out to audiences beyond OSH, we targeted dissemination of our findings to nurses. Four of the above peer-reviewed articles are in nursing journals [10-13] and there were 3 presentations at nursing conferences[19-21,30-32]

Outcomes/Relevance/Impact

Our research quantified the risks of SI and other blood/body fluid exposure (BBFE) among HHC nurses and aides. As noted above, while the SI risk was lower in HHC aides than nurses (1.0/100 FTE versus 5.1/100 FTE respectively), the absolute number of SI may be higher among aides because they are such a large part of the workforce. In addition, the risk of other BBFE was quite similar for nurses and aides occupations – about 6/100 FTE.

Close collaboration with the Massachusetts Department of Public Health (MDPH) expanded SHARRP's reach. A representative of a home health care trade association was added to the MDPH Sharps Injury Prevention Advisory Committee. SHARRP findings have been shared with this committee. In addition, a new MDPH working group was formed to develop state policy regarding community disposal of sharps. Until this latter committee saw SHARRP findings, they had not considered worker OSH as a community issue. One of the investigators also is participating in a national product stewardship roundtable which is focusing on community disposal of needles. We also are beginning to engage medical device manufacturers responsible for safer sharps designs. Dr. Quinn is on the NIOSH committee "Prevention through Design" and has initiated conversations with manufacturers and with representatives of healthcare system group purchasing organizations which write product specifications into purchasing contracts.

Our partner agencies and unions have expressed the concern that our society does not perceive HHC as real work. This makes HHC hazards invisible and OSH improvements difficult. A goal of SHARRP has been to increase awareness of OSH issues in HHC and to emphasize industry's and labor's importance as partners in prevention. Feedback from our publications and presentations suggest that this is taking place[33].

2. SCIENTIFIC REPORT

Project SHARRP completed its final year of the NIOSH grant in August 2009. The project successfully achieved its aims which remained unchanged since the original proposal. Our findings in the form of peer-reviewed journal articles, professional trade journal publications, and prevention communication and training materials are being utilized by HHC industry members, labor unions, and the scientific community. A supplemental award in Year 4 enabled us to extend our original survey (Aim 2 below) to include additional numbers of HHC aides and agencies. In total, we exceeded the number of survey participants even beyond that anticipated with the supplement. At the start of Project SHARRP, we had to work hard to recruit industry partners; by the end of the research agencies were calling and asking to participate in this or future research.

Specific Aims, years 1 to 4 (2004 – 2008)

Overall project aims were unchanged from the 5 aims outlined in the original proposal (2004). The project was completed on schedule. A strong and very favorable response from participants, including an industry trade association, 2 unions, 9 agencies and individual clinicians, resulted in high participation and high quality data. The strong response led to an opportunity to increase the study population in Aim 2 by approximately 50%, with supplemental funding awarded in Year 4. The new population primarily included a difficult-to-reach population of HHC aides (see below for section on HHC worker survey, Aim 2).The aims of the original study were:

Aim 1. Establish a surveillance system for sharps injuries and other blood exposures by adapting the Massachusetts Sharps Injury Surveillance System for use in 3 home health care agencies. Gather sharps injury and blood exposure data for 2 years.

Aim 2. Conduct 2 surveys of HHC workers in 3 agencies and 2 unions to identify risk factors for blood exposures, the magnitude of and reasons for reporting and under-reporting of these exposures, and barriers and incentives for the use of medical safety devices.

Supplement to Aim 2 (received in Year 4). Expand the target population for the first survey in Aim 2 by approximately 50% to include a large group of difficult to access HHC aides.

Aim 3. Work with 3 HHC agencies and 2 unions to identify the institutional barriers and incentives for safety programs, exposure/injury reporting, and medical safety device availability and use.

Aim 4. Analyze data from the surveillance system established in Aim 1 and the surveys conducted in Aim 2. Investigate alternative denominators for calculating blood exposure and sharps injury rates in the home healthcare setting. Calculate and report rates of exposure/injury, and compare them to rates in Massachusetts hospitals. Using survey data, identify factors that affect reporting behavior, exposure/injury, and the availability and use of medical safety devices.

Aim 5. Disseminate the findings to the study participants and agency/union partners and more widely in the home healthcare industry and the scientific community. Develop training materials to assist home health care workers to select, use, and evaluate safe needle and other medical safety devices.

The methods and results of Project SHARRP research are reported below by topic, with the aim number(s) from the original proposal noted for each.

Focus Groups & Interviews (Aims 2 & 3). The qualitative study phase early in Project SHARRP comprised 5 focus group discussions with non-supervisory HHC clinicians and 10 in-depth interviews with managers or specialists. The methods and findings from this research phase have been published[13]. The principal objective of this phase was to

investigate and describe the nature of HHC work and its associated OSH risk factors, circumstances surrounding SIs and other blood exposures, as well as availability and efficacy of sharps with safety features. This effort also informed the development of a comprehensive questionnaire survey (Aim 2) and provided insight into institutional barriers and incentives for good OSH practices, as viewed by both non-supervisory clinicians and manager/specialists.

Details of the focus group and interview methods have been published[13]. The main results are shown in Tables 1 – 4, below. The resulting data provide a detailed, complex, and structured analysis of work in HHC: advantages, disadvantages, general job hazards (e.g. violence in neighborhoods and home, lack of work stations, heavy patient lifting, high productivity demands), BBP hazards (e.g. improper disposal of sharp medical devices or dressings), and suggestions for how to prevent BBP exposures. The study subjects raised three major themes as reasons for not reporting SIs and other BBFEs. We termed these: "the big deal factor", "the fear factor", and "the health insurance factor". "The big deal factor" covered such reasons as reporting takes too much time, dedicated clinicians did not want to disrupt the workday, unclear reporting procedures, and not having a health care facility in the immediate vicinity when the injury occurs. "The fear factor" comprised worries about developing an illness and not wanting to face it, being regarded as a careless clinician, and fear that the incident would adversely impact employment status. "The health insurance factor" includes complete lack of health insurance, inadequate health insurance, or possible negative consequences affecting personal health insurance if an injury/exposure was reported[13]

Table 1:
Advantages and challenges of home health care described in focus groups and interviews.

Advantages	Cited in:	Focus groups	Interviews
Flexibility, independence	• accommodates family responsibilities	√	√
	• work not restricted within four walls	√	√
Long-term patient relationships	• can see patients' health progress	√	
	• learn to know patients and families	√	√
Acts of appreciation and gratitude by the patients		√	
Diversity of nursing	• diversity of patients, diagnoses, and environments	√	√
	• teach and support patients to improve their lives (e.g. teach a teenage girl how to draw blood off IV line)	√	√
	• multi-tasked work duties		√
Informality of work		√	
Supervisor support		√	
Patient's choice bears importance	• patient chooses to stay and be cared for at home		√
	• patient has position of power at home (vs. facility-based care setting)		√
	• choosing to die comfortably either at home or in hospice		√
Cost-effectiveness of healthcare			√
Challenges			
Detailed paperwork	• medicare billing, insurances, payment reimbursements	√	√
	• paperwork often continues home	√	
Long-distance driving		√	√
Emotional attachment	• patient dies	√	
Insensitive, cranky, or moody patients/ family members		√	
High patient workload		√	
Lack of information about patient's health condition	• concern of health aides	√	
Culture shock	• extreme poverty in some neighborhoods	√	
Isolation	• some situations where a nurse does not have skills or lacks needed medical supplies		√
	• no timely backup/ help may not be available		√
Time constrains and productivity pressures			√
Communication boundaries	• difficulty reaching physicians in the field • provider-patient language differences		√
Less salary than in the hospital setting			√
Possibility of a sentinel event	• sudden health deterioration of a patient		√

Table 2:
General work hazards described in focus groups and interviews.

Work Hazards	Cited in:	Focus groups	Interviews
General security/ personal safety concerns	• unsafe neighborhoods (e.g. drugs, guns, robbery, violence)	√	√
	• violent or unstable patients/family members	√	√
	• clinician out in the field alone		√
	• working during dark hours		√
	• snowy/ slippery walkways, clutter, rickety or unsafe stairs, inadequate lighting, fire hazards	√	√
	• entering an unknown place, not knowing the person who lives in the house	√	
	• pets [dogs (can bite when sensitive to sick master), birds, cats]	√	
Rapid work pace	• clinicians may feel rushed to complete an assignment, even a risky procedure		√
	• dealing with uncontrollable situations in a hurry and alone		√
Long distance driving	• accidents	√	
Hygiene issues	• insects, rodents, hot in-door air and other in-door air quality concerns (smoking)	√	
Lack of work stations	• carrying out risky sharp use procedures	√	
Heavy lifting and moving	• heavy lifting and moving of patients or other items	√	√
Lack of supplies		√	
Allergies/ irritations	• cleaning chemicals, latex gloves	√	
Exposures to bloodborne pathogens (see Table V)		√	√

Table 3:
Factors related to blood and body fluid exposures, sharps injuries, or near-exposures as expressed in focus groups and interviews.

Factor	Cited in:	Focus groups	Interviews
Sharp disposal or management	• injuring others through trash, lack of containers, overfilled containers, poor container design (too small/big, no leak-proof cover)	√	√
	• poor disposal technique either by patient or clinician (e.g. handing over a syringe in a styrofoam cup to a coworker)		√
	• patients leaving sharps around in the house	√	
Patient moving when clinician uses a needle or sharp item		√	√
Wound care	• dressing change/ disposal, treating bed sores, irrigation/ forceful irrigation, dressing a deep wound, dressing comes off, debridement	√	√
Certain medical conditions/ treatments:	lancets, pens, blood-draw, IV lines, insulin syringes (e.g. used multiple times and left out unshielded)	√	√
	Examples: • incidents with blood drawing equipment, e.g. injuries with butterfly needles when patient flinches, vacutainer explodes in the hand, blood-draw needle that extends through a vacutainer adapter sticks, splashes if syringes used for blood drawing		√
	• incidents with IV equipment, e.g. Huber needle bounces (de-accessing & accessing port-a-caths), "piggyback tubing"		√
	• pulling needle out from a vein when the tourniquet is tight	√	
	• amputations, bleeding tumors	√	
Patient falls and bleeds			√
Malfunctioning/ ineffective safety sharp device		√	√
Clutter/ lack of work space		√	√
Recapping habits		√	√
Exposure of health aides	• bathing a patient, encountering sharps when housekeeping (e.g. in linen)		√
Incidents in hospice	• patient may bleed out before dying - not enough time to put gloves on		√
Glove issues	• no glove use during blood work, slippery gloves		√
Carrying sharp supplies in nursing bag	• traveling with sharps (e.g. disposal container opened and syringe fell out)	√	√
Different sharp supply vendors	• educating clinicians on all existing safety sharp products		√
	• with a same agency, different products may be used for a same medical procedure		√

Table 4:
Advice on prevention of blood exposures and sharp injuries and improving exposure reporting as expressed in focus groups and interviews.

	Cited in:	Focus groups	Interviews
Safety sharp device design	• easy to use	√	
	• needleless systems	√	√
	• designers collaborate with sharp device users		√
	• improving retractable needle design; no splash-backs or pain to patients		√
	• device fully tested before market introduction		√
	• reduced cost for safety devices		√
Sharp disposal containers and practices	• being prepared with a container ready • improved container design • safe sharps containers for patients (e.g. diabetics) • one disposal container for one sharp	√	
	• have two sharps disposal containers ready • disposal containers provided by patients • leak-proof cover for disposal container		√
Training of clinicians	• not punished when reporting injuries	√	
	• pre-event planning for an injury (patient care plan) • educational intervention after sharps injury/ blood exposure • reporting is the right thing to do		√
Safe work area	• setting up a clean, safe work area for sharps use	√	
	• clear work area of distractions	√	
Work posture	• heavy patients should recline before sharp insertion	√	
	• IV or blood draw procedure, set the patient in a position you are comfortable with		√
Dressing disposal	• improving current awkward practice		√
Patient education		√	
Safe butterfly needle use	• when a needle is in the patient, keep your hand on the needle in case the patient flinches		√
Consistency among manufacturers and vendors	• standardizing sharps devices for improved safety	√	
Compensated involvement of clinicians	• participating in committees/ meetings on bloodborne pathogen prevention		√
Injury and exposure reports	• using reports as lessons learned from staff safety and patient safety perspective • one agency reporting form for all workplace injuries		√
Home health aides/ personal care attendants (PCAs)	• aides need better information about patient health status	√	
Standard precautions	• consistent use of personal protective equipment (gloves, gown, face protection)	√	
	• using gloves when drawing blood		√

Survey of HHC workers (Aim 2). Building on the qualitative research, was a survey of HHC workers conducted in partnership with 8 home health care agencies and 2 healthcare unions (one agency participated in the surveillance system and not the survey bringing the total partner agencies to 9). The survey quantified SIs and other BBFEs, identified related risk factors, evaluated the availability and use of sharps devices with engineered safety features, and identified barriers to reporting SIs. The 18-page, self-administered questionnaire was piloted twice among HHC nurses and aides who did not participate in the full-scale survey to insure comprehension and completion in 30 minutes or less. Figure 1 summarizes the questionnaire development and piloting methods:

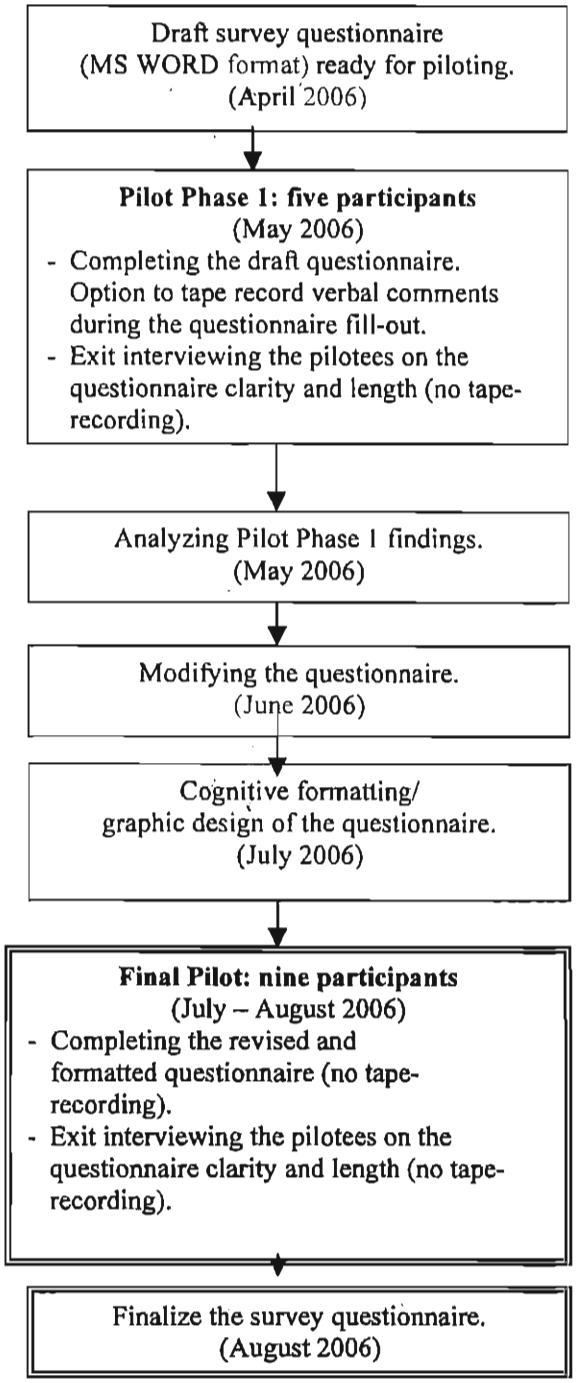


Figure 1: Project SHARRP methodology for piloting the survey questionnaire

Details of the methods for the survey population recruitment and administration have been published[12]. A total of 1,772 surveys were distributed, and 1,225 usable surveys were returned, yielding an overall response rate of 69%. The original proposal planned for surveys from a study population of 700 HHC workers, consisting of 2/3 nurses and 1/3 aides. However, due to structural changes in the HHC industry partner organizations that occurred during the early years of our study, aides were split off from partner nursing agencies into separate agencies and so we had to recruit aides from new agencies that had not initially joined the study. A supplemental award enabled us to recruit 5 additional agencies and increase our population by more than 50%, while maintaining the number and proportion of aides originally proposed (see survey results section below).

Structure of Survey Content. A self-administered survey questionnaire was designed specifically for this study population. Several questions were used to elicit information on SIs and BBFEs. Participants were asked: "Have you ever had a sharp injury while working in home healthcare?" and "Have you ever had a blood/body fluid exposure while working in home healthcare?" Follow-up questions asked "In the past 12 months, how many times have you been stuck or cut by a previously used sharp object?" and "In the past 12 months, how many times did blood or body fluids come in direct contact with your eyes, mouths, or broken skin?" Those who said that they had had at least one SI or BBFE were asked to supply detailed narratives on the circumstances leading up to the event. For the most recent event, participants were asked detailed questions on risk factors including the medical procedures, and circumstances at the time the event. Questions were either yes/no responses or multiple choice checklists. Three classes of employment status were provided in the survey: full-time (35 or more hours per week); part-time (less than 35 hours per week); and per-diem.

Survey Data Analysis and Results (Aim 4).

Sociodemographic and occupational characteristics. The survey methods and results were published in the American Journal of Public Health[16]. Survey participants were mostly female and white. This reflects the nursing population in central and eastern Massachusetts and, to a lesser degree, the home health aide population (HCA III) employed through the healthcare sector. We later learned that the HHC aide population employed through the social assistance sector (which includes HCA III and also HCA II and HCA I) is much more racially and ethnically diverse. This is a main reason we believe it is important to widen the survey study population to include aides in the social assistance sector in subsequent studies. The average nurse was 48 years old, and had worked in home healthcare for 11 years. The average aide was 47 years old, and had also worked for 11 years in home healthcare. Most participants were full-time (52%) or part-time (38%) employees of home healthcare agencies, while 10% worked on a per-diem basis.

Table 5. Measures of SI and BBFE occurrence in HHC.

	Nurses (n=787)	Aides (n=282)
Home Care Career Risk		
At least one SI	34.9% (31.6-8.4)	6.4% (3.8-9.9)
At least one blood/body fluid exposure	15.1% (12.7-7.8)	6.7% (4.1-10.3)
Annual risk		
SI	4.3 % (3.0-6.0)	0.7 % (0.0-2.5)
Other blood/body fluid exposure	5.4 % (3.9-7.1)	4.6 % (2.5-7.8)
Annual incidence rate/100 FTE		
SI	5.1 (3.7-7.1)	1.0 (0.2-4.0)
Other blood/body fluid exposure	6.3 (4.7-8.5)	6.5 (3.8-11.0)

BBP risk estimates (Aim 4). Several different measures of SI and other blood/body fluid exposures could be calculated with alternative denominators (Table 5). The percent of participants who reported ever having an SI in home healthcare – the HHC career risk – was 34.9% for nurses and 6.4% for aides. In nurses, the risk of at least one other blood/body fluid (BBF) exposure ever in the entire HHC career (15.1%) was lower than their SI risk. However for aides, the two types of BBP risks – SI and other BBFE career risks were similar (6.4% and 6.7%, respectively). We also calculated the annual risk of SI – the percent who experienced an SI in the previous 12 months (Table 5). For nurses, the annual risk of at least one SI was 4.3%, while for aides it was 0.7%. Blood/body fluid exposure annual risk among nurses was similar to their SI risk – 5.3%, while aides reported considerably more frequent blood/body fluid exposures than SIs – 4.6%; a figure quite close to that for nurses.

These annual risk estimates do not account for the fact that home healthcare clinicians work varying numbers of hours, and this will have an important effect on their risk. To correct for this, we calculated the annual rates of SI and other types of BBF exposures per 100 full-time equivalent (FTE) employees. The hours per week that each participant reported working was used to calculate how many events (SI or other BBF exposure) we would expect if these workers had worked 40 hours/week, 50 weeks per year. These calculations yielded an annual rate of 5.1 SIs per 100 FTE (95% confidence interval = 3.7 to 7.1) for nurses and 1.0 SI/100 FTE among aides (95% CI = 0.2 to 4.0). There was an important difference in risk of both SI and other BBFE depending on whether a nurse worked full-time, part-time or per-diem. Per-diem nurses, who are not formally employees of the agency and work on an as-needed basis, had the highest rate of SI – 13.4/100 FTE, while full-time nurses were the lowest with only 2.9/100 FTE; part-timers had an intermediate rate. The pattern was similar for BBFE as well.

Risk factors for BBP exposure (Aim 4). Participants were asked to describe in detail the circumstances surrounding their most recent bloodborne pathogen (BBP) exposures – either through an SI or another BBFE (Table 6). The table shows the top 6 responses in each category (top 3 for Work Environment/Organization factors).

Role of safety devices in SIs (Aim 4). Nurses were asked about their use of sharps with and without safety features. Nearly all said their employers supplied at least some sharps with safety features, and nearly all nurses were currently using such devices. Nonetheless, use of sharps without safety features was still common (39%). Almost a third of nurses (30%) reported sometimes having to use a sharps device with a safety feature for which they had not received training. When asked if there were reasons why they did not always use sharps with safety features even when they are provided, the main reasons given were: "more difficult to use than a standard device" (26%), "safety feature does not work well" (24%) and "takes more time to perform the procedure than with a standard device" (7%). The principal procedures for which sharps without safety features were being used were: injecting medication, blood drawing and finger stick/heel sticks.

To examine the use and effectiveness of sharps with safety features, we focused on SIs reported by nurses between 2001 and 2007, a period following the adoption in November 2000 of the Needlestick Safety and Prevention Act which revised the OSHA's Bloodborne Pathogen Standard to require the use of safety features unless a specific exemption is in place (Figure 2). In 65% of the SIs reported for this period, the sharp did not have a safety feature. Among the 31% of SIs in which there was a safety feature, the nurse reported that the safety feature failed 28% of the time. On the other hand, when an SI involved a sharp without a safety feature, the nurse stated that she believed a safety feature might have prevented the injury 66% of the time.

Table 6. Risk factors associated with most recent BBP exposure events among HHC workers.

Risk Factor	Nurses (n=39)	Aides (n=37)
Patient Care Procedure	**%***	**%**
Injecting medication	28.7	2.7
Blood drawing	28.7	0.0
Putting sharps into a container	22.8	13.5
Fingerstick/heelstick	20.3	2.7
Debriding	15.5	0.0
Contact with trash	15.2	29.7
Work Environment Factors	**%**	**%**
Lack of work space	31.5	13.5
Clutter or unclean conditions	24.9	21.6
Awkward postures	21.1	10.8
Equipment difficult to reach	20.8	8.1
Distractions from others	20.3	8.1
Poor lighting	19.5	16.2
Patient Characteristics	**%**	**%**
Uncooperative patient	16.8	18.9
Aggressive patient	12.2	16.2
Difficulty communicating with patient	11.7	10.8
Patient needed physical support	9.4	29.7
Inadequate info about patient	3.0	10.8
Patient lifting	1.8	13.5
Work Organization Factors	**%**	**%**
Time pressures	27.9	8.1
Too many patient assignments	15.0	13.5
Long work days	14.7	5.4

* *Percentages do not add to 100% because of multiple responses*

Predictors of SI and BBFE incidence (Aim 4). Using the data reported by those who had an SI or other BBFE in the last year, we could assess who was more or less likely to have a BBP exposure. We used Poisson regression modeling with robust variance using FTE as an offset to investigate these patterns (there were only 2 SI in the last 12 months among aides, and so this modeling was restricted to nurses). As noted above, the most important predictor of SI and BBFE incidence among nurses was employment status. Rates were considerably higher in per-diem nurses than in full-time nurses; part-timers had an intermediate rate. In addition to this finding, we looked for differences in incidence across a number of different potential predictors in the following domains: demographics and work history; safety equipment and training; work environment and organizational factors; attitudes about risk and safety. The main findings are summarized here. The occurrence of SIs tended to decline with tenure in HHC among nurses. The effect was about a 7% decline per year (RR = 0.93, 95% CI = 0.87 to 0.98). There were seven questions which asked about safety climate or culture at work, and only one showed an association with SI or BBFE rates. Agreeing with the statement: "I believe patient care comes before employee safety in my workplace" was associated with a doubling in the risk of having an SI in the past year compared to those who disagreed with this statement (RR = 2.2, 95% CI = 1.1 to 4.4). Similarly, those who were not at all satisfied or only somewhat satisfied with their job had about twice the rate of SI than those who were "satisfied" (RR = 2.6, 95% CI = 1.3 to 5.4).

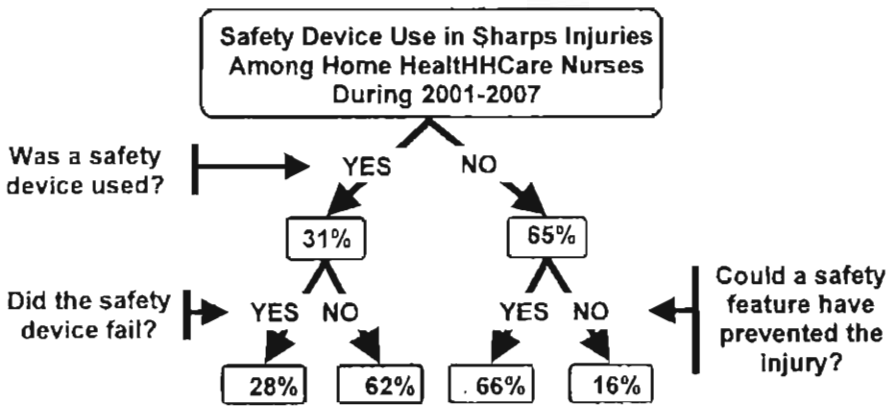
Surveillance System for SI and BBFE (Aims 1 & 4). Under Aim 1 of the original grant, the Massachusetts Department of Public Health (MDPH) established a surveillance system for SIs and other blood exposures in homecare agencies. Three agencies agreed to participate. The MDPH Bloodborne Pathogen Exposure Recording form, developed for the hospital setting, was adapted to the HHC setting and distributed to each participating agency in early 2006. The total numbers of injuries in either system was small, and so caution is needed when interpreting them. More injuries (12) were recorded by SHARRP than reported to MDPH (7). This discrepancy is probably an underestimate because the SHARRP survey had only a 73% rate in the participating agencies. Correcting for this under-estimation, the actual number of SIs in these agencies might have been 16; a little more than twice the number reported to the MDPH surveillance system.

In conclusion, an unexpectedly low number of injuries was reported to the MDPH surveillance system established for this study. This raises the possibility of exposure incident under-reporting, something which is well-known in other healthcare settings.

Dissemination of Information (Aim 5)

The intent of Aim 5 was to ensure that the research findings were made available to those who can affect change among HHC stakeholders. Specific forms of dissemination are described in the section onTranslation of Findings. In addition, to leverage the NIOSH investment, the SHARRP research team has maintained ongoing communication with other NIOSH affiliated HHC research groups and participated in joint conference presentations. These

Figure 2. Sharps injuries and safety features



outreach efforts are detailed in our list of publications and presentations. Our dissemination of information continues and is a vital element of the final year of Project SHARRP and beyond.

Other Accomplishments

A doctoral dissertation was written largely on the basis of the research in SHARRP. Dr. Hyun Kim received his doctorate in Work Environment with a concentration in epidemiology in May 2008[33]. His dissertation is titled: Sharps Injury Surveillance in Home Care. The dissertation has 4 main themes: 1. risk factors for SI in home healthcare; 2. the importance of choosing appropriate denominators for calculating rates of SI and similar surveillance data; 3. New methods for measuring and evaluating near-misses in injury surveillance; and 4. Demonstrating the importance of negative binomial regression when using public health surveillance data.

To provide guidance for the overall SHARRP study, an employee representative from the HHC industry was added to the MDPH Sharps Injury Prevention Advisory Committee. The appointee represents the Home Care Alliance of Massachusetts, a non-profit trade association for Massachusetts home care agencies that employ nurses and aides through the healthcare sector (see letter of support).

In addition to their Project SHARRP research, research team members are involved in other networks working to reduce environmental and occupational hazards. This has allowed us to leverage our SHARRP research for identifying synergies and exploiting other opportunities for injury prevention. For example, work conducted by SHARRP in collaboration with the MDPH Occupational Health Surveillance Program's project on surveillance and prevention of SI among hospital workers led to publication of an article related to SI from medical procedure kits used in hospitals[14]. The close linkages that we have established with HHC industry and unions provide important channels through which we are assisting with capacity building for effective OSH programs and interventions.

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7. Kim H and Kriebel D. *Regression Models for Public Health Surveillance Data: A Simulation Study.* Occupational and Environmental Medicine. Published Online First: 16 August 2009. http://oem.bmj.com/cgi/content/short/oem.2008.042887v1?q=w_oem_ahead_tab (Note: This article was developed by researchers affiliated with Project SHARRP, exemplifying how Project SHARRP expertise is leveraged and generalized to other healthcare settings)

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1. Markkanen P, Quinn M, Chalupka S, Chaulk D, Davis L, Galligan C, Laramie A. *Home as Work Environment for Healthcare Practitioners.* Presented at the 4th International Congress on Women, Work and Health, New Delhi, India. November 27-30, 2005.

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Other Outreach and Education

Presentations

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6. Quinn M. Presentation at National Academy of Sciences (NAS) panel on home healthcare, "The Role of Human Factors in Home Healthcare". Washington, DC. October 1, 2009.

Networking with NIOSH Affiliates: Teleconferences, Meetings, Informal Communication

Teleconferences of NIOSH affiliated home healthcare research groups, including NIOSH, 4 NIOSH-funded home healthcare research teams, and the Labor Occupational Health Program at UC Berkeley. Series of teleconferences and informal communication to build collegial networks and foster collaboration for home healthcare research efforts, February 28, 2006 - present.

Meeting of NIOSH affiliated home healthcare research groups, including NIOSH, 4 NIOSH-funded home healthcare research teams, and the Labor Occupational Health Program at UC Berkeley. This is a continuing effort to build collegial networks and foster collaboration for home healthcare research efforts, Boston, MA, November 6, 2006.

Other Written Materials: Articles, Reports, Posters, Forms

Outreach and promotional poster: *There's No Place Like Home. Project SHARRP: Safe Homecare and Risk Reduction for Providers*. October, 2006

Home Health Care Bloodborne Pathogen Exposure Incident Recording Form. Massachusetts

Department of Public Health, Boston, MA. February 21, 2006.

How to calculate sharps injury rates. Project SHARRP fact sheet, Sustainable Hospitals Program, UMass Lowell, Lowell, MA, January 9, 2006.

Report to agency and union partners: *Sharps Injuries and Blood Exposures in Home Healthcare: Project SHARRP Preliminary Survey Findings.* January 2008

Brochure summarizing survey findings: *Sharps Injuries and Blood Exposures in Home Healthcare.* January 2008

Massachusetts Nurses Association Advocate articles, two-part series by Project SHARRP team members:
Health and safety among Massachusetts home care nurses: bloodborne pathogen exposures. Massachusetts Nurse, Volume 79(7), p.6 (September 2008).

Use of sharps devices with and without safety features: Massachusetts home healthcare nurses. Massachusetts Nurse, Volume 79(8), p.8 (October 2008).

Inclusion Enrollment Report

This report format should NOT be used for data collection from study participants.

Study Title: Project SHARRP: Sharps Injuries and Blood Exposure in Home Health Care

Total Enrollment: 1273 **Protocol Number:**

Grant Number: 3 R01 OH008229-04

PART A. TOTAL ENROLLMENT REPORT: Number of Subjects Enrolled to Date (Cumulative) by Ethnicity and Race

Ethnic Category	Sex/Gender			
	Females	Males	Unknown or Not Reported	Total
Hispanic or Latino	74	4	0	78 **
Not Hispanic or Latino	1122	45	3	1170
Unknown (individuals not reporting ethnicity)	41	0	1	42
Ethnic Category: Total of All Subjects*	1237	49	4	1290 *
Racial Categories				
American Indian/Alaska Native	1	0	0	1
Asian	6	1	0	7
Native Hawaiian or Other Pacific Islander	0	0	0	0
Black or African American	44	3	0	47
White	1118	42	2	1162
More Than One Race	15	1	1	17
Unknown or Not Reported	53	2	1	56
Racial Categories: Total of All Subjects*	1237	49	4	1290 *

PART B. HISPANIC ENROLLMENT REPORT: Number of Hispanics or Latinos Enrolled to Date (Cumulative)

Racial Categories	Females	Males	Unknown or Not Reported	Total
American Indian or Alaska Native	0	0	0	0
Asian	0	0	0	0
Native Hawaiian or Other Pacific Islander	0	0	0	0
Black or African American	5	0	0	5
White	32	1	0	33
More Than One Race	5	1	0	6
Unknown or Not Reported	32	2	0	34
Racial Categories: Total of Hispanics or Latinos**	74	4	0	78 **

* These totals must agree.
** These totals must agree.

Inclusion of Children

HC workers who were between the ages of 18 and 21 were included in the study. Of the people who reported their age (there were 11 with age missing) there were three that were under 21; one 18 year old and two 20 year old participants.

Materials Available for Other Investigators

See publications.