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Major article

Impact of a single safety-engineered device on the occurrence of percutaneous injuries in a general hospital in Brazil

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Key Words:
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Background: Health care workers are exposed to bloodborne pathogens through occupational injuries, and the replacement of sharps by safety-engineered devices has been recommended as a key preventive measure. This recommendation has been difficult to implement in Brazil.

Methods: We conducted a retrospective study of selected data from a database of blood and body fluid exposures reported from January 2007 through December 2011 in a public general hospital in Rio de Janeiro where, from the end of 2009, a safety lancet for blood glucose testing (BGT) was introduced. A log-binomial model was used to evaluate the effect of the introduction of the safety lancet on the proportion of percutaneous injuries (PIs) during BGT in the nursing staff.

Results: Nursing staff had a significant reduction in rate of PIs per 100 full-time equivalents from 2007 to 2011 ($P < .001$), and medical residents had the highest rate throughout the same period. A reduction of PIs by small-gauge needles was observed since 2009, and injuries during BGT fell abruptly in 2010 and 2011 paralleling the number of purchased safety lancets ($P < .001$).

Conclusion: The adoption of a single safety device, which required no training, significantly reduced PIs among the nursing team.

Bloodborne pathogens are a well-known hazard for health care workers (HCWs), either through percutaneous or splashing exposures. The implementation of safety-engineered devices (SEDs) in addition to educational and administrative measures has been recommended to prevent percutaneous injuries (PIs) in health care settings since the late 1990s in the United States[1] where, since 2000, they have been required by federal law.[2] In collaboration with the International Council of Nurses, the World Health Organization has issued similar recommendations addressing developing countries,[3] whereas the European Union as a whole has been struggling to adopt and put into practice new regulations in 2013 to ensure protection of HCWs from sharps injuries.[4] Similarly, in Brazil, hospitals have been, since 2008, on the top of the list of work places reporting occupational injuries, with 4.42% of the total.[5] Specifically, in the state of Rio de Janeiro, the proportion reaches 6.25%[5] of which over 70% are reported as biologic exposures.[6] A regulatory publication on the "Safety and Health of Work in Health Care Institutions," issued by the Ministry of Labor and Employment in November 2005,[7] recommended that SEDs be made available according to a work plan to be developed by a dedicated commission including members of the government, employers, and workers. Although the replacement of sharps by SEDs "*whenever technically feasible*" has been officially mandatory since August 2011,[8] by the end of 2012, serious gaps still remained, in part because of cost, lack of experience with a number of new devices, and difficulty in training health care personnel.

This study was carried on in a Brazilian public general hospital in Rio de Janeiro, where a retractable and disposable lancet for blood glucose testing (BGT) was introduced during the last trimester of 2009 and became the only SED widely available and well accepted by the nursing staff since. The aim of this study was to examine the impact of such device on the profile of PIs in this institution.

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METHODS

Setting

The setting was a tertiary general hospital in Rio de Janeiro funded by the Ministry of Health, with all clinical and surgical specialties and an average of 500 beds, of which approximately 65 (13%) were distributed in 6 intensive care units. The study was approved by the Research Ethics Committee of the hospital.

Exposed population

For the purpose of this study, permanent medical staff, permanent nursing staff—including registered nurses, licensed practical nurses, nursing aides, and nurses working as assistants in operating rooms—medical and nursing residents, undergraduate or graduating trainees, and ancillary staff—housekeepers, laundry staff, orderlies, personnel in charge of transporting patients, and employees from companies collecting and transporting medical waste—were included.

Recording of accidental exposures to blood and body fluids

Since January 1997, HCWs suffering any kind of exposure to potentially contaminated devices or fluids were immediately seen by a staff physician or resident on duty at the Infectious Diseases Department. Information on the exposure was recorded on a standard form. Data were entered into a database. Because data on the number of HCWs were only available since 2007, the present study addresses exposures reported from January 2007 through December 2011.

The following variables were analyzed: (1) occupation of the HCWs; and (2) exposure-related data such as involved devices, ie, hollow-bore needles specifying whether they were meant to be used for subcutaneous (SC), intramuscular (IM), or intravascular access (IV); suture needles; blades (surgical equipment); glass or other; and circumstance or task being performed.

Hollow-bore needles of unknown gauge were designated nonspecified and regrouped with IM needles. Needles used for IV access included large-bore needles, catheters, butterfly needles, and others used for vascular access.

SEDs

A single-use disposable and automatically retractable blood lancet to collect capillary blood by finger prick (Accu-check Safe-T-Pro UNO; Roche Diagnostics GmbH, Mannheim, Germany) was adopted at the institution from the last trimester of 2009 and has been used since, although occasional gaps have occurred. Before the lancet became available and during such gaps, small-gauge (4.5) hollow-bore needles were used instead. Other SEDs such as IV catheters have also been in use at the institution, but at least 3 different brands with diverse mechanisms have irregularly coexisted with their non-SEDs equivalents. Of note, from August 2010, prefilled syringes containing the locally used commercial presentation of a low-molecular-weight heparin fitted with an automatic safety device have also been in use. No intensive or targeted campaigns were conducted previous to the introduction of such devices.

Statistical analyses

The rate of PIs per 100 full-time equivalents (FTEs) per year was calculated, applying the method used by Whitby et al,[9] for the following groups: staff physicians, nursing staff (including those previously stated), and medical residents. FTEs were not calculated for trainees because of highly variable time schedules and for ancillary staff, which are from payroll companies and rotate among different departments including administration and open areas of the hospital.

Rates of accidents during finger pricks for BGT, during and after the introduction of the device, were calculated by plotting them against the total number of small-gauge needles plus the number of safety lancets purchased by the hospital, yearly from 2009 through 2011, in a modification of the method proposed by Jagger,[10] because no accident was caused by the safety lancet.

A log-binomial generalized linear model[11] was used for studying (1) the proportions of exposures during BGT out of all PIs; and (2) the proportions of PIs by hollow-bore needles used for SC, IM, and IV access out of all PIs caused by hollow-bore needles in the nursing staff. A log-Poisson generalized linear model was used to evaluate (1) the rate of accidents using as an offset the total number of FTEs; and (2) the rate of accidents during finger pricks for BGT using as an offset the total number of devices.

Statistical Package for the Social Sciences (SPSS) version 16.0[12] was used for the regression analyses and R version 2.15.1[13] for the remaining tests. A P value $< .05$ was set as significant in all analyses.

Table 1
Rate of PIs per 100 FTEs for selected occupations per year

Occupation	2007	2008	2009	2010	2011	P value
Nursing staff	9.39	7.45	6.07	4.63	4.31	<.001
Medical staff	1.63	2.42	3.51	3.41	1.92	.237
Medical residents	15.71	22.86	17.79	18.95	21.27	.377

RESULTS

Overall, 806 exposures were reported from January 2007 through December, 2011, of which 668 (82.9%) were PIs.

Occupations

In absolute numbers, nursing staff reported the majority of PIs (44.3%), followed by medical residents (29.6%) and ancillary staff (10.0%), comprising mainly housekeepers. Permanent medical staff reported 7.2% PIs; trainees, 5.6%; laboratory staff, 2.2%; dentists, 0.6%; and other accounted for the remaining. However, when taking into account duration of exposure, ie, by calculating FTEs, medical residents reported the highest number of occupational PIs (Table 1). A fall in the rate of PIs is apparent for the nursing staff from 2007 through 2011, while the rates for other categories remained stable along the period.

Involved devices

Overall, IV and large-bore needles caused 166 PIs (24.8%), medium-bore and nonspecified hollow-bore needles were second (22.8%) along with small-gauge (SC) needles (22.2%), followed by suture needles with 13.9%, and blades with 8.8%. Small-gauge needles were the main cause of PIs reported in the nursing team (32.5%), and 67.6% of PIs caused by such sharps occurred in that professional category. Medical residents reported surgical material (eg, suture needles and blades) as the main cause of PIs (34.3%), whereas housekeepers and other ancillary staff reported a majority of injuries with nonspecified hollow-bore needles (37.7%), usually because of inadequate disposal. When the proportions of each category of hollow-bore needles over the total of sharps involved in PIs are plotted along the years 2007 to 2011, a decrease in the