

PERCUTANEOUS INJURIES CORRELATES IN THE NURSING TEAM OF A BRAZILIAN TERTIARY-CARE UNIVERSITY HOSPITAL

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The study aims to identify percutaneous injuries correlates in the nursing team from a Brazilian tertiary-care hospital. A case-control study was conducted from January 2003 to July 2004, including 200 cases and 200 controls. Cases and controls were paired by gender, professional category, and work section. To evaluate the relationship between potential risk/protective factors and the outcome, odds ratios were estimated, using multivariate logistic regression methods. The results shown six predictors of percutaneous injuries: "recapping needles" (OR 9.48; CI(95%): 5.29-16.96); "hours worked per week \geq 50 hours" (OR 2.47; CI(95%): 1.07-5.67); "years in nursing practice \leq 5 years" (OR 6.70; CI(95%): 2.42-18.53); "work shift in night" (OR 2.77; CI(95%): 1.35-5.70); "low self evaluation of risk" (OR 10.19; CI(95%): 3.67-28.32) and "previous percutaneous injuries" (OR 3.14; CI(95%): 1.80-5.48). The results support the recommendation of applying effective strategies to prevent percutaneous injuries in the nursing team working on tertiary-care institutions.

DESCRIPTORS: needlestick injuries; risk factors; nursing, team; accidents, occupational; analytic studies

FACTORES ASOCIADOS CON HERIDAS PERCUTÁNEAS EN EL EQUIPO DE ENFERMERÍA DE UN HOSPITAL UNIVERSITARIO DE NIVEL TERCIARIO

La finalidad del estudio fue identificar factores asociados a los accidentes percutáneos en el equipo de enfermería de un hospital terciario. Un estudio caso-control fue conducido entre enero de 2003 y julio de 2004, con selección de 200 casos y 200 controles, emparejados según género, categoría profesional y sector de trabajo. Las medidas de asociación utilizadas fueron las razones de momios, estimados mediante la regresión logística multivariada. Seis predictores para los accidentes percutáneos fueron identificados: "reencapsular agujas" (OR 9.48; CI(95%): 5.29-16.96); "jornada semanal \geq 50 horas" (OR 2.47; CI(95%): 1.07-5.67); "experiencia en la enfermería \leq 5 años" (OR 6.70; CI(95%): 2.42-18.53); "trabajar en jornada nocturna" (OR 2.77; CI(95%): 1.35-5.70); "auto-evaluar como bajo el riesgo de accidentes" (OR 10.19; CI(95%): 3.67-28.32) y "accidentes percutáneos previos" (OR 3.14; CI(95%): 1.80-5.48). Los resultados permiten la recomendación de estrategias efectivas para la prevención de accidentes percutáneos en el equipo de enfermería de hospitales terciarios.

DESCRIPTORES: lesiones por pinchazo de aguja; factores de riesgo; grupo de enfermería; accidentes de trabajo; epidemiología analítica

FATORES ASSOCIADOS A ACIDENTES PERCUTÂNEOS NA EQUIPE DE ENFERMAGEM DE UM HOSPITAL UNIVERSITÁRIO DE NÍVEL TERCIÁRIO

O estudo teve por objetivo identificar fatores associados aos acidentes percutâneos na equipe de enfermagem de um hospital terciário. Um estudo caso-controle foi conduzido entre janeiro de 2003 a julho de 2004, com seleção de 200 casos e 200 controles, emparelhados segundo gênero, categoria profissional e setor de trabalho. As medidas de associação utilizadas foram os odds ratios, estimados por meio da regressão logística multivariada. Seis preditores para os acidentes percutâneos foram identificados: "reencapar agulhas" (OR 9.48; CI(95%): 5.29-16.96); "jornada semanal \geq 50 horas" (OR 2.47; CI(95%): 1.07-5.67); "experiência na enfermagem \leq 5 anos" (OR 6.70; CI(95%): 2.42-18.53); "trabalhar em jornada noturna" (OR 2.77; CI(95%): 1.35-5.70); "auto-avaliar como baixo o risco de acidentes" (OR 10.19; CI(95%): 3.67-28.32) e "acidentes percutâneos prévios" (OR 3.14; CI(95%): 1.80-5.48). Os resultados permitem a recomendação de estratégias efetivas para a prevenção de acidentes percutâneos na equipe de enfermagem de hospitais terciários.

DESCRIPTORES: ferimentos penetrantes produzidos por agulha; fatores de risco; equipe de enfermagem; acidentes de trabalho; epidemiologia analítica

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INTRODUCTION

Occupational accidents with biological material and health professionals have gained increasing attention in the global research scenario in the last two decades because these professionals' exposure to bloodborne pathogens may lead to infections and, consequently, serious health damage. Occupational transmission of hepatitis B (HBV) and C (HCV) and Human Immunodeficiency (HIV) viruses among healthcare workers is well documented⁽¹⁾.

The first case of occupational HIV infection⁽²⁾ occurred in England in 1984, after a nurse was accidentally contaminated by a needlestick with blood of an infected patient. In a worldwide study on the distribution of occupational HIV infection cases among health workers⁽³⁾, 264 cases were identified and 94 (35.60 %) registered until September 1997, among which, 52 (55.4%) occurred in the United States.

A study carried out in the USA⁽⁴⁾ indicates that 57 cases of occupational HIV infection were registered until 2001, while 24 of these (42%) occurred in nurses after percutaneous injuries involving blood. Nursing injuries rates related to needlesticks are among the highest, and these professionals have also presented the highest HIV seroconversion rates.

Among the four cases of occupational HIV infection identified to date⁽⁵⁾ in Brazil, only one was published in a scientific journal and confirmed by the Ministry of Health in 1999, indicating the need to implement an effective epidemiological surveillance system for occupational accidents.

The Centers for Disease Control (CDC) published a guide with recommendations in 1987, called universal precautions, aimed at preventing occupational exposure to bloodborne pathogens. In 1996⁽⁶⁾, these guidelines were revised and called "standard precautions".

Standard and transmission-based precautions were introduced in the university hospital in 1997, as written guidelines were largely spread through the Hospital and nurses from the Infection Control Committee conducted numerous training sessions.

Considering that only a few epidemiological studies to evaluate correlates to percutaneous injuries have been conducted in Brazil, the present study aims to identify risk/protective factors for outcomes in the nursing team of a tertiary-care university hospital, after adjusting for confounding factors.

METHODS

Setting: The tertiary-care university hospital is an 800 bed-sized teaching hospital located in Ribeirão Preto and is the second larger school hospital from the Sao Paulo State University, Brazil.

Case-Control Study: A case-control study was conducted to identify risk/protective factors for percutaneous injuries. An incident case was defined as any nursing worker who registered percutaneous injuries at the Health Professional Accident Care Outpatient Clinic from 01/01/2003 to 07/30/2004, when the sample size was completed. This case identification source was chosen because a recent study in the same institution⁽⁷⁾ had revealed that about 30% of the true cases are not registered when a traditional source of data is taken into account. Workers who did not register any percutaneous injury during the 24 months previous to the date of their respective case or during the data collection period were considered controls. They were selected through a table of random numbers. To obtain a frequency pairing, cases and controls were paired in the design, according to gender, professional category, and work unit. During the data collection period, four controls became cases, thus they were replaced by new controls, according to the study definition of controls.

The sample size was calculated to detect odds ratio ≥ 2.0 , considering a 5% of type I and 20% of type II errors⁽⁸⁾, which resulted in a sample composed by 153 cases and 153 controls. The researchers decided to select 200 cases and 200 controls, which increased the statistical power to 90%. Data were collected through individual interviews. It was established that cases' and controls' interviews should occur soon after the identification of cases, not exceeding 15 days after the case's accident date. Appropriate informed consent was obtained from all the participants who signed a Consent Form. The project was approved by the Ethical Committee of the institution where the study was carried out.

Data analysis: After the collection phase, data were submitted to double typing to test for external consistency. The database was formatted and analyzed in Statistical Package for Social Sciences software, version 10.0. Data analysis included the following phases: a) characterization of the study population according to potential correlates (descriptive phase) and b) calculation of the effect measures (*odds ratios*), estimated by points and 95%

confidence intervals, using crude and adjusted logistic regression models⁽⁹⁾. The statistical modeling process was developed in the following stages: 1. univariate models were built taking into account that variables with p-values ≤ 0.25 (Wald tests) should be included in subsequent models, and 2. to compose the final model, researchers kept variables with p-values ≤ 0.05 on Wald tests or variables that, when excluded, would change the odds ratios of the variables included in the models by more than 10%⁽¹⁰⁾. Variables with more than two categories were treated as dummy variables, including one independent variable for every ten study cases (10:1 ratio), as recommended⁽¹¹⁾. Conditional and unconditional logistic regression models were run and the results were similar. Thus, taking into account the increased statistical power, the results presented here are those related to unconditional logistic regression.

RESULTS

Table 1 shows the distribution of cases and controls according to time between the accident dates in cases and interview dates. The results show that more than 80% of the interviews were held between 6 and 10 days after the case's accident date. Two cases and four controls were interviewed 16 and 60 days, because the cases had suffered injuries the day just before their vacation had started, and four controls had to be randomly chosen in order to replace those who became cases during the study.

Table 1 - Distribution of cases (n = 200) and controls (n = 200), according to time between the case's accident date and the interviews date. Ribeirão Preto, 2004

Time (days)	Cases		Control	
	Nº	%	Nº	%
≤ 05	49	24.50	48	24.00
06 10	126	63.00	122	61.00
11 15	23	11.50	26	13.00
16 60	02	1.00	04	2.00
Total	200	100.00	200	100.00

The characteristics of cases and controls are presented in Table 2 according to potential correlates. Cases' and controls' distribution are similar, considering *age*, *gender* and *professional categories*. The main differences between them were related to *recapping needles*; *years in nursing practice*; hours

worked per week; *training*; *self-evaluation of risk*, and *previous percutaneous injuries*. A total of 21.0% of cases and 9.5% of controls had professional nursing experience ≤ 5 years. In general, cases worked longer hours per week than controls. Related to self-evaluation of accident risk, 76.5% of controls self-classified their risk as "high risk", against 33.5 % of cases. Previous injuries occurred more frequently among cases (60.5%) than among controls (27.0%).

Table 2 – Characteristics of cases and controls, according to potential predictors of percutaneous injuries. Ribeirão Preto, 2004

Variables	Cases		Controls	
	Nº	%	Nº	%
Recapping Needles				
Yes	132	66.0	29	14.5
No	68	34.0	171	85.5
Gender				
Female	170	85.00	170	85.00
Male	30	15.00	30	15.00
Age (years)				
20 29	52	26.00	32	16.00
30 39	83	41.50	83	41.50
40 49	57	28.50	70	35.00
≥50	08	4.00	15	7.50
Education (years)				
< 11	28	14.00	20	10.00
≥ 11	172	86.00	180	90.00
Professional Category				
Nurse	51	25.50	51	25.50
Nurse Technicians	18	9.00	18	9.00
Nurse Aides	131	65.50	131	65.50
Years in Nursing Practice				
≤ 05	42	21.00	19	9.50
06 10	66	33.00	52	26.00
11 20	67	33.50	89	44.50
≥ 21	25	12.50	40	20.00
Hours worked per Week				
≤ 39	75	37.50	107	53.50
40 49	85	42.50	77	38.50
≥ 50	40	20.00	16	8.00
Work Shift				
Day	74	37.00	72	36.00
Night	51	25.50	34	17.00
Mixed	75	37.50	94	47.00
Training				
Yes	123	61.50	155	77.50
No	77	38.50	45	22.50
Self-evaluation of risk				
High	67	33.50	153	76.50
Intermediate	94	47.00	39	19.50
Low	39	19.50	08	4.00
Previous percutaneous injuries				
Yes	121	60.50	54	27.00
No	79	39.50	146	73.00

Crude odds ratios and confidence intervals (95%) are shown in Table 3. At the phase of analysis, *recapping needles* had major odds ratio magnitude (OR=11.44; CI(95%): 7.00-18.69), and with exception of *work shifting* the odds ratio for variables classified as more than two categories (dummy variables) indicated some level of linear trend.

Table 3 – Unadjusted odds ratio and 95% confidence intervals (CI) according to the selected variables to be included in multivariate models. Ribeirão Preto, 2004

Variables	Odds Ratios (crude)	CI (95 %)
Recapping Needles		
Yes	11.44	7.00 - 18.69
No	1	
Age (years)		
20 29	3.04	1.16 - 7.99
30 39	1.87	0.75 - 4.66
40 49	1.52	0.60 - 3.85
≥50	1	
Education (years)		
< 11	1.46	0.79 - 2.69
≥ 11	1	
Years in Nursing Practice		
≤ 05	3.54	1.69 - 7.39
06 10	2.03	1.09 - 3.77
11 20	1.20	0.67 - 2.18
≥ 21	1	
Hours worked per Week		
≤ 39	1	
40 49	1.91	1.10 - 3.29
≥ 50	2.91	1.20 - 7.03
Work Shift		
Day	1	
Night	1.88	1.10 - 3.19
Mixed	1.28	0.82 - 2.01
Training		
No	2.15	1.39 - 3.33
Yes	1	
Self-evaluation of risk		
High	1	
Intermediate	5.50	3.43 - 8.81
Low	11.13	4.93 - 25.09
Previous percutaneous injuries		
Yes	4.14	2.71 - 6.31
No	1	

Multivariate analysis (final models) confirmed the independent effect of recapping needles (OR=9.48; CI(95%):5.29-16.69) related to percutaneous injuries, as well as the independent effect of five correlates based on the adopted criteria to compose the model: *years of nursing practice*, *hours worked per week*; *work shift*; *self evaluation of risk*, and *previous percutaneous injuries* (Table 4).

Table 4 – Adjusted odds ratio and 95% confidence intervals (CI) according to percutaneous correlates (final model). Ribeirão Preto, 2004

Variables	Odds Ratios (adjusted)	CI (95 %)
Recapping Needles		
Yes	9.48	5.29 - 16.96
No	1	
Years in Nursing Practice		
≤ 05	6.70	2.42 - 18.53
06 10	4.10	1.68 - 9.96
11 20	1.89	0.82 - 4.34
≥ 21	1	
Hours worked per Week		
≤ 39	1	
40 49	1.29	0.71 - 2.36
≥ 50	2.47	1.07 - 5.67
Work Shift		
Day	1	
Night	2.77	1.35 - 5.70
Mixed	2.32	1.22 - 4.41
Self-evaluation of risk		
High	1	
Intermediate	4.88	2.69 - 8.79
Low	10.19	3.67 - 28.32
Previous percutaneous injuries		
Yes	3.14	1.80 - 5.48
No	1	

DISCUSSION

The study results revealed that "recapping needles" was considered an important predictor of percutaneous injuries in nursing professionals. Some authors⁽¹²⁾ have found that the frequent manipulation of hollow-bore needles is considered a risk factor for percutaneous accidents (OR=1.02; CI(95%):1.01-1.03) among health professionals, while not recapping needles was identified as a protective factor (OR=0.74; CI(95%): 0.60-0.91), after adjustment for potential confounding variables. Another study⁽¹³⁾ showed that the chances of needlestick injuries increase 3.63 times in nurses who often recap needles (≥ 10 times/day) compared to those who never or rarely recap needles (0-2 times/day).

Despite the nursing professionals from the hospital where the study was carried out had been trained on standard precautions and accidents prevention, many of them admitted, during interviews, to recap needles. This information indicates that strategies employed should be reviewed for future trainings.

Some inherent limitations related to the present study need to be taken into consideration:

a) the study was conducted at a large tertiary hospital, which may limit the generalization of these results to other Health Institutions; b) although the Health Professional Accident Care Outpatient Clinic had good sensitivity for case's detection, other ways to select cases, such as those in a nested case control design, could have resulted in higher sensitivity levels to detect true cases.

On the other hand, the selection of recently diagnosed cases and face-to-face interviews with cases and controls are considered strengths, which contributed to accurate comparisons in case-control studies. Furthermore, all interviews were carried out by the same interviewer who spent similar amount time with both groups. Although individual interviews are more time-consuming and expensive, this technique was chosen in order to guarantee control of information quality. The reliability of the test and re-test questions related to precautions correlates was close to 100% (data not shown).

In a case-control study held in a community base, the authors⁽¹⁴⁾ concluded that interviews result in better quality of information about occupational exposure than mail questionnaires, being considered as the gold standard for data collection when this kind of exposure is considered.

In this study, the lower the number of years in the nursing practice the higher the odds ratio related to the outcome. These results are corroborated by literature⁽¹⁵⁾, as shown by an analysis of percutaneous injury predictors in which nurses with less than five years of clinical experience had greater chances of suffering those injuries (OR=1.48; IC (95%):1.06-2.20). In a case-control study conducted among veterinarians⁽¹⁶⁾, the authors found that professionals who had five years or less of professional experience had greater chances of suffering occupational accidents, after adjustment for some confounding factors (OR=3.1; IC(95%):1.4-6.8). It is thought that more experienced professionals, who are consequently better trained to manipulate piercing and cutting material, may be less susceptible to this kind of accident.

A long work week entailed greater chances of producing the outcome, which may result from the worker's longer exposure to risk situations, apart from the fact that long work days can produce fatigue, increasing the risk of injury⁽¹⁷⁾. In this study, working

50 or more hours per week increased the chances of needlestick injuries (OR=2.47; CI(95%): 1.07-5.67) and similar results were found for those working in mixed or in night shifts, as compared to those working only in regular daily shifts.

Studies on needlestick and sharp injuries, involving nursing professionals, also have reported that the chances of being victimized by this kind of injuries are higher in mixed shifts⁽¹⁸⁾.

In this study, the nursing workers who self-evaluated the risk of suffering percutaneous injuries as "low" and "intermediate" in their work had greater chances of suffering injuries compared to those who evaluated their work situation as "high risk". Divergent results in a case-control study were reported, showing that low risk perception was considered to be a protective factor for occupational injuries⁽¹⁶⁾. It should be taken into consideration that the perception of risk related to the veterinarian practice, very distinct from nursing practice, might be an explanation for these reported results. Despite of being subjective, the self-evaluation of occupational risks can be a useful guide in decision making related to adoption of safe practices.

The occurrence of needlestick injuries is not only or exclusively a matter of the individually related risk/protective factors. Those injuries are also heavily influenced by the environment in which the worker is inserted as well as by the organizational structure in the institution, which should provide appropriate conditions to implement the recommended and acknowledge safety measures for their employees. It is known that traditional training programs transmit information but does not always entice behavioral changes. One of the great challenges in the occupational injuries area is to make workers perceive risk situations and convince them to adopt safe behaviors in their daily practice.

A review⁽¹⁹⁾ that aimed to analyze the scientific production on percutaneous accidents published between 1985 and 2000 evidenced that most studies in this knowledge area are descriptive. Potential causes for this kind of accidents related to work conditions or individual behavior have been appointed, particularly emergency situations, lack of professional training, work overload and lack of adherence to standard precautions, including needle recapping.

Despite the lack of information from analytical studies and aiming to investigate associations of potential predictors of percutaneous accidents, this study presents the important role of six factors associated to the issue. Further research based on analytical methodology, like case controls, could corroborate these findings.

Finally, it is recommended to tertiary-care institutions to overcome limits imposed by conventional health promotion and prevention measures, considering the implementation of effective and rational programs based on management of independent predictors of percutaneous injuries.

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