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## Original article

# Danger in the streets: exposures to bloodborne pathogens after community sharp injuries in Rio de Janeiro, Brazil



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## ABSTRACT

**Objective:** Exposures to sharps injuries occurring in the community are relatively frequent. We describe characteristics of community sharp exposures reported in the city of Rio de Janeiro from 1997 to 2010.

**Methods:** A cross-sectional analysis of exposure reports to sharps in the community reported to a surveillance system, designed for health care workers, of the Municipal Health Department of Rio de Janeiro. The characteristics of exposed individuals analyzed included types of exposure, the circumstances of the accident, and the prophylaxis offered.

**Results:** 582 exposures were studied. Median age was 30 years and 83 (14%) involved children with less than 10 years of age. Two hundred and seventeen (37%) occurred with sharps found in the streets. The exposure was percutaneous in 515 (89%) and needles were involved in 406 (70%) of them. The sharps were present in the trash in 227 (39%) or in the environment in 167 (29%) of the reports. Professionals who work with frequent contact with domestic or urban waste were 196 (38%). The source was known in 112 (19%) of the exposures and blood was involved in 269 (46%). Only 101 (19%) of the injured subjects reported a complete course of vaccination for hepatitis B. Antiretroviral prophylaxis was prescribed for 392 (68%) of the exposed subjects.

**Conclusions:** Sharps injuries occurring in the community are an important health problem. A great proportion would be avoided if practices on how to dispose needles and sharps used outside health units were implemented.

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## Introduction

The major concern following needlestick injuries is the acquisition of bloodborne infectious diseases particularly human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV).<sup>1,2</sup> Although the viability of infectious particles in sharps decreases with time, bloodborne viruses can survive up to several weeks in the environment.<sup>3</sup> Consequently, there is a growing concern about bloodborne virus transmission after community needlestick injuries (CA-NSI).<sup>4–6</sup> CA-NSI create a very complex management challenge. Information about the moment of previous use of the sharp and the CA-NSI is frequently not available.

Additionally, as opposed to sharps injuries occurring in health care settings, reported experience with management of community incidents is scanty, the source of needles is usually unknown and postexposure prophylaxis (PEP) is rarely offered.

Recently, the number of subjects with acute or chronic diseases receiving home care has increased steadily.<sup>7,8</sup> In addition to regular teams of HCW providing home care, family members are frequently responsible for injections and other invasive procedures at home.

Consequently, an increased risk of exposure to blood among these non-health care workers, not aware of universal safety precautions, is expected. In addition, exposure to potentially contaminated needles happens in the streets, beaches or yards and often involve children.<sup>9</sup> Several of these exposures have been reported in areas with high prevalence of illicit drug use.<sup>9,10</sup> Occasionally, community-acquired needlestick injuries may occur during deliberate use of needles and syringes with fresh blood as a weapon.<sup>11</sup>

The risk of acquiring an infection following a CA-NSI is unknown and only a small number of case reports of infections have been described.<sup>12</sup> Strategies to reduce CA-NSI associated infections include the use of devices with minimal residual fluid in discarded needles (e.g. low dead-space syringes), syringe exchange programs, and access to safe needle disposal systems.<sup>13</sup>

A surveillance system of occupational exposure to bloodborne pathogens among healthcare workers (HCW) has been implemented in Rio de Janeiro, Brazil, since 1997.<sup>14</sup> Nevertheless, no specific monitoring system for CA-NSI is in use. Frequently, CA-NSI is reported to the municipality health system through the cited surveillance system. This study was planned to describe circumstances related to exposures to bloodborne pathogens after community-acquired needlestick injuries in Rio de Janeiro (Brazil) reported to this surveillance system from 1997 to 2010.

## Methods

This was a cross-sectional analysis of reports of potential exposures to bloodborne pathogens among children, family members, and non-healthcare workers. Data were collected in a validated form from all reports of exposures to bloodborne pathogens in these subjects sent to the STD/AIDS Program of Rio de Janeiro City Health Department (RJCHD) in a period of 14 years (1997–2010).<sup>15</sup> Variables collected included: sex,

age, place of occurrence, type of exposure, serologic status of source, circumstances of the exposure, blood or other body fluids involved, hepatitis B vaccination status of the exposed subject, and use of postexposures prophylaxis (immunoglobulin, hepatitis B vaccine and antiretroviral drugs). Univariate analyses were performed using chi-square or Fisher exact test for categorical variables, and Student t test or Wilcoxon test for continuous variables. Odds ratios (OR) and 95% CIs were determined. All reported *p*-values are 2-sided.

The institutional review boards of the Hospital Universitário Clementino Fraga Filho/School of Medicine of the Universidade Federal do Rio de Janeiro and of the Rio de Janeiro City Health Department (RJCHD) approved the study protocol.

## Results

### Study sample

Five-hundred and eighty two exposures to blood and body fluids in the community were reported to RJCHD from January 1997 to December 2010. Table 1 shows demographic information of the study sample.

Three-hundred sixty-seven (63%) subjects were male. Median age was 30 years and ranged from 3 to 75 years. Eighty-three (14%) subjects were younger than 10 years of age and 68 (12%) were between 10 and 20 years old. Three-hundred twenty nine subjects (57%) were between 21 and 39 years and 102 (17%) were 40 or more years. Occupational information was available for 512 (88%) of the subjects. One-hundred and ninety six (38%) of these subjects worked in settings where frequent contact with domestic or urban waste was present (garbage collectors, cleaners, house keepers, and doorkeepers).

Previous hepatitis B vaccination information was available for 532 (91%) of the exposed individuals. A hundred and one (19%) subjects reported a complete course of vaccination for

**Table 1 – Main characteristics of 582 subjects involved in community sharp injuries in Rio de Janeiro city (Brazil) from 1997 to 2010.**

Main characteristics	n (%)
Male gender	367 (63%)
Female gender	215 (37%)
Median age in years (range)	30 (30–75)
Subjects by age categories	
<10 years	83 (14%)
10–20 years	68 (12%)
21–39 years	329 (57%)
>39 years	102 (17%)
Occupation	
Garbage collector	93 (16%)
Student	92 (16%)
Janitor	70 (12%)
Housekeeping	19 (3%)
Police officer	18 (3%)
Doorkeeper	14 (2%)
Others	206 (36%)
Not informed	70 (12%)

hepatitis B. Nineteen (4%) and 15 (3%) subjects reported having received one or two doses of the vaccine, respectively. Three-hundred and thirty two (57%) reported not being vaccinated. Younger subjects reported higher rates of hepatitis B vaccination than older individuals. Fifty (60%) subjects with less than 10 years of age reported previous vaccination and 29 (35%) reported the full course of vaccination as opposed to 200 (40%) and 75 (15%), respectively, among subjects with 11 or more years of age.

### Exposure circumstances

Information about the circumstances of the exposures was available for 581 (99%) and is presented in Table 2. Percutaneous exposures were reported in 515 (89%) of the accidents and needles were involved in 406 (70%). Exposures involving mucous membranes and skin accounted for 42 (6%) of the reports. The sharp was reported to be in the garbage in 227 (39%) or discarded in the environment in 167 (29%) of the accidents. Aggression involving sharps were cited in 79 (14%) of the reports.

In 534 (92%) accidents information about the location was available. Two-hundred and seventeen (37%) occurred in the street and 70 (12%) in health units. Other locations cited were hospital grounds, hotels, beaches, parks, public transport, airports, jails, schools, malls, among others (Table 2). Eighty-three (14%) study subjects were children (<10 years old) playing in the street or deliberately hurting each other while playing.

Blood was cited to be present in the sharp in 269 (46%) of the accidents. It was not possible to establish the material involved in all other accidents.

**Table 2 – Circumstances of exposures to blood-borne pathogens after 582 community sharp injuries in Rio de Janeiro (Brazil), from 1997 to 2010.**

Circumstances of the exposures	n (%)
<i>Type of exposure</i>	
Percutaneous	515 (89%)
Mucous membrane	21 (3%)
Cutaneous	21 (3%)
Bite	24 (4%)
Not informed	1 (1%)
<i>Circumstances related to needlestick</i>	
Procedures	49 (8%)
Handling waste	227 (39%)
Aggression	79 (14%)
Syringes or needle discarded on environment	167 (29%)
Others	50 (8%)
Not informed	10 (2%)
<i>Location</i>	
Streets	217 (37%)
Residence	89 (15%)
Health units	70 (12%)
Beach	38 (7%)
School	18 (3%)
Mall	16 (3%)
Airport	6 (1%)
Others	80 (14%)
Not informed	48 (8%)

**Table 3 – Source characteristics of 582 community sharp injuries in Rio de Janeiro (Brazil) from 1997 to 2010.**

Source characteristics	n (%)
<i>Source patient</i>	
Unknown source patient	470 (81%)
Known source patient <sup>a</sup>	112 (19%)
<i>Human immunodeficiency virus (HIV) status</i>	
HIV-positive	56 (50%)
HIV-negative	15 (14%)
Unknown HIV status	18 (16%)
Not informed	23 (20%)
<i>Hepatitis B virus (HBsAg) status</i>	
HBsAg-positive	3 (3%)
HBsAg-negative	5 (4%)
Unknown HBsAg status	20 (18%)
Not informed	84 (75%)
<i>Body fluids</i>	
Blood	269 (46%)
Others	22 (4%)
Not informed	291 (50%)

<sup>a</sup> Serological status of the source patient already known at the moment of the exposure.

### Baseline source characteristics

In 470 (81%) exposures, the sharp source was not known. One hundred and twelve (19%) exposures involved known sources. Serological information (HBV and HCV) was not available for most of the known sources. In 56 (50%) exposures involving known sources, HIV infection was present and serological status was already known at the moment of the exposure. Baseline source characteristics are shown in Table 3.

### Post-exposure prophylaxis

Hepatitis B vaccine was recommended for 216 (37%) subjects. Vaccine and HBV immunoglobulin were prescribed for 118 (20%) subjects and HBV immunoglobulin alone was prescribed for 6 (1%) subjects. In 126 (22%) exposures, HBV post-exposure prophylaxis was not prescribed. No information about hepatitis B prophylaxis was available for 116 (20%) subjects.

Antiretrovirals were prescribed in 392 (68%) exposures. They were not prescribed for 130 (22%) subjects and for 60 (10%) subjects the information was missing. Regimens prescribed were: two nucleoside analog reverse transcriptase inhibitors NRTI (most zidovudine and lamivudine) for 299 (76%) of subjects; a protease inhibitor (most commonly nelfinavir, lopinavir or indinavir) combined with two NRTI for 78 (20%) subjects, and zidovudine monotherapy for 15 (4%) subjects.

Fifty-six exposures involved HIV infected known sources. Antiretroviral prophylaxis was prescribed for 50 (89%) subjects. A triple drug regimen was indicated for 23 (46%) and two nucleoside reverse transcriptase inhibitors for 25 (50%) subjects. Antiretroviral monotherapy was prescribed for two (4%) of these subjects. Antiretroviral prophylaxis was not indicated for four (7%), and no information was available for two (4%) of these exposures.

In fifteen 15 (13%) exposures with known sources, HIV infection was not present. One of these subjects received a prescription of antiretrovirals.

Among exposures involving unknown sources (470 cases), antiretroviral prophylaxis was initiated for 321 (68%) exposed individuals. Among those, an expanded regimen (three antiretrovirals) was prescribed in 46 (14%) exposures, two drugs in 264 (82%) cases, and monotherapy in 11 (3%) cases. Antiretroviral prophylaxis was not indicated for 98 (21%) subjects. No information was available for the remaining 51 (11%) reports.

## Discussion

The results of this study demonstrate the public health importance of sharp injuries occurring in the community. Using a non-mandatory, voluntary surveillance system designed for health care workers it was possible to capture 582 of these accidents in the city of Rio de Janeiro, Brazil.<sup>14</sup> The growing number of medical procedures performed outside the health-care setting, through practices of “home-care” and other outpatient treatment of various health conditions, including individuals self-injecting insulin, put these accidents as an emerging public health problem worldwide.<sup>16</sup> In addition, illicit drugs use in the community further compound the challenges of health systems to deal with this problem. A national surveillance system to detect exposures to sharp injuries among non-HCWs in Brazil is not in use. The exposures analyzed in this study probably under-represent the real magnitude of the problem as they were captured through a system designed for HCWs. Most of the published studies reporting sharp injuries outside health-care units are related to home care provided by qualified nurses and few reports focusing on exposure to contaminated medical instruments of non health care workers are available in the literature.<sup>17–19</sup>

A great proportion of the accidents (38%) reported in this study occurred among workers that have contact with domestic or urban waste. This probably reflects a lack of appropriate handling of sharps after use in the community. These data is concordant with the description by Dorevitch et al. (2010) analyzing data from sharp injuries at the Chicago O’Hare International Airport.<sup>20</sup> Thirteen of 14 sharp injuries reported involved subjects working in the cleaning process (garbage collectors, cleaners, and doorkeepers) in the airport. In addition, a study by Celenza et al. (2011) also reported that the most affected professions were cleaning workers and policemen.<sup>10</sup>

These accidents occur more frequently among men than women. Three-hundred and sixty-seven (63%) of the reports involved males. This is concordant with published data on community needlestick injuries.<sup>10,12,21–24</sup> Although the explanation for this gender difference is not clear it is possible to suggest that men are present in greater numbers in the military and in professional activities that require handling of waste.

A small proportion (19%) of the exposed subjects described in this study reported complete immunization schedule against hepatitis B. These data reflect Brazilian immunization policy as hepatitis B vaccine became part of the mandatory

schedule for children under one year of age only in 1996.<sup>25</sup> Around half (53%) of the accidents described in this study were reported to have occurred at streets or residences. No specific geographic location in the city (data not shown) was predominant. These data is discordant with other studies in developed countries in which most accidents were associated with the presence of intravenous drug users.<sup>21,26</sup> Although Brazil has a population of more than 100,000 IDUs, drug use is not associated with specific places, as described in North America and Europe.<sup>21,24,27</sup>

Most of the accidents occurred in situations where the ascertainment of the source was not possible. Three-hundred and ninety four (68%) accidents happened with sharps on the environment or in the trash. It is reasonable to speculate that blood was present. The source was described to be unknown for 470 (81%) reports.

Interestingly, 321 (68%) of these subjects were prescribed antiretroviral therapy. The decision to start antiretroviral therapy in this setting is controversial and was not indicated by Brazilian Guidelines at the time of the accidents.<sup>28</sup> According to these guidelines antiretrovirals should generally not be recommended following needlestick injuries of unknown source patient. The over-prescription of antiretrovirals was also described in other studies that analyzed CA-NSI and may reflect the stigma and fear of HIV-infection. This finding of our study is repeated to a greater or lesser extent in the literature. The few studies that describe accidents with biological material occurring in the community point out the prescription of antiretroviral prophylaxis in excess to the recommendations of local health Departments.<sup>11,23,29,30</sup>

A high frequency of antiretroviral prophylaxis with two antiretrovirals (mainly zidovudine and lamivudine) was observed. This regimen was prescribed for 299 (51%) of the accidents involving unknown sources and 25 (50%) of the accidents involving HIV-infected sources. This is not in line with published international reports and guidelines that recommend a triple-drug antiretroviral regimen. The period of the study was extended for more than a decade and guidelines changed during that period. At the beginning of the study period two antiretroviral drugs were acceptable locally.<sup>23,29–31</sup>

HCV and HBV infection risk was not a major concern among health professionals who attended the subjects. One-hundred and twelve accidents had a known source. Serological status for HBV and HCV were not reported for 84 (75%) and 112 (100%) subjects, respectively. This lack of concern about the risk of infections other than HIV have also been reported by Osowicki and Curtis.<sup>32</sup>

Current guidelines recommended that the majority of the subjects should have received prophylaxis against hepatitis B. In 366 (63%) accidents the exposed individuals were unvaccinated or had incomplete vaccination schedule. Hepatitis B vaccine (associated or not to HBIG) was prescribed in 334 (57%) accidents. The frequency of post-exposure prophylaxis for hepatitis B was lower than that of antiretroviral prophylaxis, albeit the risk of acquiring HBV after this type of exposure has been estimated to be around 10 times greater than for acquiring HIV.<sup>33</sup>

The risk of HIV infection often leads to greater concern by exposed subjects and professionals who treat them than the risk of contamination by HBV.<sup>34,35</sup>

In this study, 83 (14%) subjects were younger than 10 years of age. These accidents may cause great parental anxiety. A systematic review published recently found one case of possible HBV transmission after a CA-NSI and suggested that the risks for children reside in HBV transmission, which can be prevented through immunization.<sup>32</sup> Nevertheless, children do not have critical judgment to analyze a sharp in the streets as a potential hazard.

One limitation of this study is the retrospective design. In addition, data were collected in a form designed for exposures among health care workers. Data on the outcome and potential bloodborne infections as an outcome was also not available.

In summary, this study demonstrates the importance of CA-NSI. Public health actions can be valuable if directed to safe sharp disposal by persons legally using injections outside the health sectors. These actions include access to safe disposal containers and increase in the use of needless syringes and other safe devices. In addition, actions to prevent accidents caused by dispose of used needles, re-used and discarded by persons injecting intravenous illicit drugs are also urgently needed. Based on these results public health action should include training garbage collectors in work related safety and increasing education on sharp risks among students.

### Conflicts of interest

The authors declare no conflicts of interest.

### REFERENCES

- Lorentz J, Hill L, Samimi B. Occupational needlestick injuries in a metropolitan police force. *Am J Prev Med.* 2000;18:146–50.
- Russell FM, Nash MC. A prospective study of children with community acquired needlestick injuries in Melbourne. *J Paediatr Child Health.* 2002;38:322–3.
- Thompson SC, Boughton CR, Dore GJ. Bloodborne viruses and their survival in the environment: is public concern about community needlestick exposures justified? *Aust N Z J Public Health.* 2003;27:602–7.
- Nyiri P, Leung T, Zuckerman MA. Sharps discarded in inner city parks and playgrounds—risk of bloodborne virus exposure. *Commun Dis Public Health.* 2004;7:287–8.
- Paintsil E, Binka M, Patel A, Lindenbach BD, Heimer R. Hepatitis C virus maintains infectivity for weeks after drying on inanimate surfaces at room temperature: implications for risks of transmission. *J Infect Dis.* 2014;209:1205–11.
- Zamora AB, Rivera MO, García-Algar O, Caylà Buqueras J, Vall Combelles O, García-Sáiz A. Detection of infectious human immunodeficiency type 1 virus in discarded syringes of intravenous drug users. *Pediatr Infect Dis J.* 1998;17:655–7.
- Fox S, Duggan M, Purcell K. Family caregivers are wired for health. Washington, DC: Pew Research Center Internet & American Life Project; 2013.
- Gillick MR. The critical role of caregivers in achieving patient-centered care. *JAMA.* 2013;310:575–6.
- Makwana N, Riordan FAI. Prospective study of community needlestick injuries. *Arch Dis Child.* 2005;90:523–4.
- Celenza A, D'Orsogna L, Tosif S, et al. Audit of emergency department assessment and management of patients presenting with community-acquired needlestick injuries. *Aust Health Rev.* 2011;35:57–62.
- Papenburg J, Blais D, Moore D, et al. Pediatric injuries from needles discarded in the community: epidemiology and risk of seroconversion. *Pediatrics.* 2008;122:e487–92.
- O'Leary FM, Green TC. Community acquired needlestick injuries in non-health care workers presenting to an urban emergency department. *Emerg Med.* 2003;15:434–40.
- Zule WA, Cross HE, Stover J, Pretorius C. Are major reductions in new HIV infections possible with people who inject drugs? The case for low dead-space syringes in highly affected countries. *Int J Drug Policy.* 2013;24:1–7.
- Rapparini C, Saraceni V, Lauria LM, et al. Occupational exposures to bloodborne pathogens among healthcare workers in Rio de Janeiro, Brazil. *J Hosp Infect.* 2007;65:131–7.
- Rapparini C, Feijó Barroso P, Saraceni V, Artioli Machado A, Côrtes Fernandes G. Occupationally acquired infectious diseases among health care workers in Brazil: use of Internet tools to improve management, prevention and surveillance. *Am J Infect Control.* 2007;35:267–70.
- Jason J. Community-acquired, non-occupational needlestick injuries treated in US Emergency Departments. *J Public Health (Oxf).* 2013;35:422–30.
- Chalupka SM, Markkanen P, Galligan C, Quinn M. Sharps injuries and bloodborne pathogen exposures in home health care. *AAOHN J.* 2008;56:15–29.
- Haiduven D, Ferrol S. Sharps injuries in the home health care setting: risks for home health care workers. *AAOHN J.* 2004;52:102–8.
- Alexander D. Needlestick injuries continue to be a challenge in healthcare facilities. *Ohio Nurses Rev.* 2013;88:8.
- Dorevitch S, Lacey SE, Abelman A, Zautcke J. Occupational needlestick injuries in a US airport. *J Occup Environ Med.* 2010;52:551–4.
- Wyatt JP, Robertson CE, Scobie WG. Out of hospital needlestick injuries. *Arch Dis Child.* 1994;70:245–6.
- Slinger R, Mackenzie SG, Tepper M. Community-acquired needle stick injuries in Canadian children: review of Canadian Hospitals Injury Reporting and Prevention Program data from 1991 to 1996. *Paediatr Child Health.* 2000;5:324–8.
- Vives N, Almeda J, Contreras CA, García F, Campins M, Casabona J, Grupo de estudio NONOPEP. Use of non-occupational HIV post-exposure prophylaxis in Spain (2001–2005). *Enferm Infecc Microbiol Clin.* 2008;26:546–51.
- Butsashvili M, Kamkamidze G, Kajaia M, Kandelaki G, Zhorzholadze N. Circumstances surrounding the community needle-stick injuries in Georgia. *J Community Health.* 2011;36:1050–2.
- BRASIL; MINISTÉRIO DA SAÚDE. Programa Nacional de Imunizações – 30 anos. Brasília: Secretaria de Vigilância em Saúde; 2003. p. 19.
- Haber PS, Young MM, Dorrington L, et al. Transmission of hepatitis C virus by needle-stick injury in community settings. *J Gastroenterol Hepatol.* 2007;22:1882–5.
- Aceijas C, Stimson GV, Hickman M, Rhodes T, United Nations Reference Group on HIV/AIDS Prevention and Care among IDU in Developing and Transitional Countries. Global overview of injecting drug use and HIV infection among injecting drug users. *AIDS.* 2004;18:2295–303.
- BRASIL. Recomendações para terapia antirretroviral em adultos infectados pelo HIV – 2008: Suplemento III – Tratamento e prevenção. Brasília: Ministério da Saúde; 2010. p. 208.
- Thomas HL, Liebeschuetz S, Shingadia D, Addiman S, Mellanby A. Multiple needle-stick injuries with risk of human immunodeficiency virus exposure in a primary school. *Pediatr Infect Dis J.* 2006;25:933–6.
- Tissot F, Erard V, Dang T, Cavassini M. Nonoccupational HIV post-exposure prophylaxis: a 10-year retrospective analysis. *HIV Med.* 2010;11:584–92.

31. Babl FE, Cooper ER, Damon B, Louie T, Kharasch S, Harris JA. HIV postexposure prophylaxis for children and adolescents. *Am J Emerg Med.* 2000;18:282-7.
32. Osowicki J, Curtis N. A pointed question: is a child at risk following a community-acquired needlestick injury? *Arch Dis Child.* 2014;99:1172-5.
33. Werner BG, Grady GF. Accidental hepatitis-B-surface-antigen-positive inoculations. Use of e antigen to estimate infectivity. *Ann Intern Med.* 1982;97:367-9.
34. Gerberding JL. Incidence and prevalence of human immunodeficiency virus, hepatitis B virus, hepatitis C virus, and cytomegalovirus among health care personnel at risk for blood exposure: final report from a longitudinal study. *J Infect Dis.* 1994;170:1410-7.
35. Sepkowitz KA, Rivera P, Louthier J, Lim S, Pryor B. Postexposure prophylaxis for human immunodeficiency virus: frequency of initiation and completion of newly recommended regimen. *Infect Control Hosp Epidemiol.* 1998;19:506-8.