

Healthcare Worker Blood Exposure Risks: Correcting Some Outdated Statistics

In the last few years, statistics on needlestick injuries have become more precise; several benchmark numbers are lower than previously thought

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THE AVAILABILITY OF DATA ON OCCUPATIONAL exposures to bloodborne pathogens has increased dramatically during the last decade. Articles in the medical literature on needlestick injuries and blood exposures have proliferated, as numerous researchers have reported results of single institution or multicenter studies, or focused studies of specific occupational groups and clinical settings.¹⁻¹⁷ There are two ongoing large-scale surveillance programs in the United States (U.S.) that collect data on sharps injuries: the Exposure Prevention Information Network (EPINet) Multi-hospital Needlestick and Sharp-Object Injury database, established in 1993 and maintained by the International Healthcare Worker Safety Center at the University of Virginia; and the National Surveillance System for Health Care Workers (NaSH), established in 1995 by the Division of Healthcare Quality Promotion at the Centers for Disease Control and Prevention (CDC). (Other countries, including Italy, Canada, Japan, and Spain, conduct national-level needlestick surveillance as well.)

In the U.S., the most accurate national estimates to date of the number of percutaneous injuries (PIs) sustained by hospital-based healthcare workers (HCWs) have been derived by combining data from the EPINet and NaSH net-

works. Researchers have also been able to estimate more precise underreporting rates for PIs. And large-scale surveillance of HCWs sustaining blood exposures to hepatitis C-infected source patients has provided a more accurate picture of hepatitis C transmission risk from occupational exposures.

Outdated figures on needlestick injuries and blood exposures continue to circulate in the medical literature, however. One recent article on needlestick injuries that appeared in a nursing journal stated: "It's estimated that up to 96% of all needlestick injuries go unreported. That figure is staggering when you consider that 600,000 to 800,000 percutaneous injuries occur each year."¹⁸ A 2002 report from the Sharps Injury Control Program of California's Department of Health Services cited similar statistics.¹⁹ Such numbers are picked up and cited elsewhere, and eventually regarded as fact. Thus, it is important to review the latest figures on occupational blood exposures, particularly where recent data differ significantly from those previously available. We will review revised estimates for: (1) the annual number of PIs in the U.S. for hospital-based HCWs; (2) underreporting rates for needlestick injuries; and (3) occupational transmission rates for hepatitis C virus (HCV).

Annual Number of Percutaneous Injuries in the U.S.

Estimates of 600,000 to 800,000 needlestick injuries in the U.S. each year (or 800,000 to 1 million) were frequently cited in journal and newspaper articles during the last decade. In 1999, in an effort to develop more precise estimates, the CDC conducted an in-depth analysis in which data from 15 hospitals in the NaSH network and 45 hospitals in the EPINet network were combined. Critical to developing better national estimates for PIs was establishing an accurate underreporting rate (discussed in detail below). It was also important to determine significant variables, such as number of hospital beds, inpatient days, and employees. To account for these variables, researchers weighted and stratified data for each hospital proportionate to its size. NaSH hospitals tend to be large (the average number of hospital beds is 592), while EPINet hospitals tend to be comparatively smaller (average number of hospital beds is 315). EPINet hospitals are mostly located in the southeast and northwest, while a significant proportion of NaSH hospitals are in the northeast, with others scattered across the U.S. Thus the two data sources are complementary and, when combined, provided a balanced statistical sample of U.S. hospitals.

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In 2000, based on this study, the CDC published a national estimate for PIs in U.S. hospitals for a one-year period.²⁰⁻²² This figure was cited by the Occupational Safety and Health Administration (OSHA) in its preamble to the revised Bloodborne Pathogens Standard: **“The [CDC] has estimated that healthcare workers in hospital settings sustain 384,325 percutaneous injuries involving contaminated sharps annually” (95% CI 311,091 to 463,922).**²³

The CDC estimate did not include PIs occurring outside of hospital settings, nor the number of mucocutaneous blood exposures occurring in any healthcare setting. Estimates for these two missing pieces can be supplied from existing sources.

Market data indicating the facilities to which needles were sold in 2001 show that 31% of needles were sold to nonhospital buyers (personal communication, Ned Weller, Health Products Information Services, March 2002). This suggests that 31% of needlesticks remain unaccounted for in the CDC estimate. This would increase the estimated annual number of PIs from 384,325 to 503,466.

Non-percutaneous exposures should also be taken into account to assess the full spectrum of blood exposure risk—specifically, mucocutaneous contact with blood and at-risk body fluids. EPINet data for 1999 indicated that .29 mucocutaneous blood or body fluid exposures were reported for each PI reported. (There is no generally accepted underreporting estimate to apply as a correction factor for mucocutaneous exposures, and none has been applied here.) On this basis, we assumed that .29 mucocutaneous exposures occurred for each reported PI (503,466 x .29 = 146,005). This

Author/Year/Publication	Country	Study design	Population/# responses	Underreporting Rate (%)
Hamory 1983 (24)	U.S.	Survey	1 univ. hospital, 726 respondents	75%
Jagger et al. 1988 (25)	U.S.	Questionnaire	1 univ. hospital, 326 NSIs	39%
McGeer, et al. 1990 (26)	Canada	Survey	1 univ. hospital, 88 med. students, residents, interns, 372 PIs	95%+
Mangione et al. 1991 (27)	U.S.	Cross-sectional survey, 1988-1989	3 teaching hospitals, 86 residents/interns, 103 PIs	70%
Tandberg et al. 1991 (28)	U.S.	Survey	1 univ. hospital, 259 respondents (emergency MDs, RNs, EMTs), 643 PIs	65% overall 87% ED MDs 34% ED RNs 33% EMTs
O'Neill et al. 1992 (29)	U.S.	Survey	1 univ. hospital, 550 med. students & residents	91%
Albertoni et al. 1992 (30)	Italy	Validation study	1 teaching hospital	85% (MDs) 69% nurses
Lynch & White 1993 (31)	U.S.	Comparison of blood exposure incident reports with data from OR study	3 hospitals, OR personnel	96% (OR personnel)
Chamberland M et al. 1995 (32)	U.S.	1993-94 survey	6 hospitals, HCWs performing phlebotomy	68% residents 60% med. students 35% nurses 11% phlebotomists
Roy & Robillard 1995 (33)	Canada	1-year survey (1991-92), compared to incident reports	5 hospitals, 838 exposures (PIs & BBF)	47% (range 29%-61%)
Henry & Campbell 1995 (34)	U.S.	1990 survey	65 hospitals, 100 infection control officers at randomly selected U.S. hospitals	18.5%
EPINet 1997 (survey for NIOSH study, unpublished data)	U.S.	Survey	6 hospitals, 2,544 respondents	38.6%; Range: 25.8%, housekeepers; 72.7%, MDs
Osborn et al. 1999 (35)	U.S.	7-year (1990-96) longitudinal study	1 univ. hospital, 119 med. students, 129 PIs	Range: 55%-35% (decreased over study)
Haiduven et al. 1999 (36)	U.S.	Survey (1992-95)	1 teaching hospital, 549 HCWs	46%
CDC study 2000 (A. Panlilio, personal communication)	U.S.	2-year survey (1997-1998)	12 hospitals, 23,738 HCWs	56.6%

PIs = percutaneous injuries; HCWs = healthcare workers; BBF = blood or body fluid

brings the total estimated number of percutaneous and mucocutaneous exposures occurring annually in hospital and nonhospital settings in the U.S. to 649,471. This is the most recent complete estimate available of the annual number of at-risk blood exposures to U.S. HCWs.

Underreporting Rates

The problem of needlestick underreporting was first documented by Hamory in 1983²⁴; numerous studies conducted over the last decade cited a wide range of underreporting rates (see **Table 1**).²⁵⁻³⁶ Studies yielding the highest underreporting rates involved

physicians and medical students; many were conducted at a single institution and thus had small sample sizes. For example, in 1990 McGeer et al. conducted a study of 88 medical students, residents and interns at a university hospital, and found an underreporting rate of greater than 95%.²⁶ Similarly, a 1991 study by Tandberg et al. of emergency department workers found an underreporting rate of 87% for ED physicians.²⁸ A 1992 study by O'Neill et al. of 550 medical students and residents at a university hospital found an underreporting rate of 91%.²⁹

The best overall data on PI underreporting for U.S. HCWs

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comes from a survey conducted by the CDC in 1998 in 12 hospitals participating in the NaSH network.³⁷ In this survey, 14,215 HCWs indicated if they sustained a percutaneous injury or injuries in the previous year, how many they reported, and their reasons for not reporting. The survey documented an overall underreporting rate of 58%, with a high of 73% for surgeons and 52% for all other HCWs. (Results from two years of CDC survey data, with 23,738 HCWs responding, have not yet been published, but yielded a similar underreporting rate of 56.6%. A. Panlilio, CDC, personal communication, 2002.) The 1998 survey had a much larger sample size than previous studies, and researchers were able to estimate standard errors and give confidence intervals for the rates, which had not been done before. The CDC study also determined the factors significantly affecting reporting rates, such as hospital size, location, and occupation of the healthcare worker.

HCV Transmission Rate

The average risk of HCV transmission has been most commonly reported as 1.8% in the medical literature, with a range of 0-7% (or sometimes 0-10%), based on studies from the early 1990s.³⁸ More recent data, including follow-up of more than 11,000 HCV-exposed healthcare workers in six countries, have yielded significantly lower transmission rates (see **Table 2**).³⁹⁻⁵² The average transmission rate for all reports cited in the table is 0.5%, a rate similar to that for occupational HIV transmission.

Such findings should be taken into account when deciding whether to perform HCV RNA testing after an occupational exposure to an HCV-positive source patient. Current CDC guidelines for HCV

Table 2. Infection Rates Among HCV-Exposed Healthcare Workers*

Source	Country	# exposed	# infections	Infection Rate, % (95% CI)
Hernandez 1992 (39)	Spain	81	0	0 (0-4.4)
Mitsui 1992 (40)	Japan	68	7	10.3 (3.0-17.5)
Sodeyama 1993 (41)	Japan	90	2	2.2 (0.2-7.8)
Lanphear 1994 (42)	US	50	3	6.0 (1.2-16.5)
Zuckerman 1994 (43)	UK	24	0	0 (0-14.2)
Monge 1995 (44)	Spain	603	2	0.3 (0.04-1.2)
Arai 1996 (45)	Japan	56	3	5.4 (1.1-14.9)
Serra 1998 (46)	Spain	443	3	0.7 (0.1-2.0)
Takagi 1998 (47)	Japan	250	4	1.6 (0.4-4.0)
Hasan 1999 (48)	Kuwait	24	0	0 (0-14.2)
Kidouchi 1999 (49)	Japan	4836	15	0.3 (0.1-0.5)
Petrosillo 2001 (50)	Italy	4292	19	0.4 (0.2-0.6)†
Baldo 2002 (51)	Italy	68	0	0 (0-5.3)
Evans 2002 (52)‡	UK	439	1	0.2 (0.006-1.3)
Total		11,324	59	0.5 (0.39-0.65)

*Only the most recent report by the same group of investigators was included. HCV = hepatitis C virus; CI, confidence interval.

†Percutaneous exposure infection rate, 0.5%; mucocutaneous infection rate, 0.4%.

‡Evans B, Communicable Disease Surveillance Centre. Public Health Laboratory Service, written communication, April 24, 2002.

Table from: Jagger J, Puro V, De Carli G. Occupational transmission of hepatitis C virus [letter]. *JAMA* 2002 (9/25/02); 288:1470. Reprinted with permission. © Copyright 2002, American Medical Association.

postexposure follow-up recommend an ALT activity test at baseline and at four to six months, and state that an HCV RNA test may be performed at four to six weeks if earlier diagnosis of HCV infection is desired.³⁸ Given a 0.5% average infection rate, if performed routinely, 99.5% of such tests would have negative results. Thus, selective testing of cases with a higher-than-average transmission risk may be an alternative strategy.

Conclusion

The most recent data for the annual number of PIs in the U.S., underreporting of PIs, and occupational transmission of HCV help to define more accurately occupational exposure risk, and will be especially useful for future comparisons as we seek to measure progress in preventing occupational blood exposures. It is also good news for healthcare

workers who sustain needlesticks from HCV-positive source patients: those workers can be told that the transmission risk for HCV is substantially lower than once believed.⁵³ □

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