Healthcare Worker Blood Exposure Risks: Correcting Some Outdated Statistics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 networks. 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Outdated figures on needlestick injuries and blood exposures continue to circulate in the medical literature, however.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, in-patient 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.

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]

Estimates of Missing Components

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 sought from existing sources.

Market data indicating the facili-

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ties 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). If we accept the assumption that needlestick rates are directly related to needle usage, this suggests that 31% of needlesticks remain unaccounted for in the CDC estimate, and 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. This would bring 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 a first attempt to identify the missing pieces of the full exposure spectrum and contains untested assumptions. The most accurate figure available is still the CDC estimate cited above.

Underreporting Rates

The problem of needlestick underreporting was first documented by Hamory in 1983[24]; 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 underreport-ing 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 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

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Table 1. Rates of Underreporting of Percutaneous Injuries in Healthcare Workers

Author/Year/ Publication	Country	Study design	Population/ # responses	Under-reporting Rate (%)
Hamory 1983 (Am. J. Infect. Control)	U.S.	Survey	1 univ. hospital, 726 respondents	75%
Jagger et al. 1988 (N. Engl. J. Med.)	U.S.	Questionnaire	1 univ. hospital, 326 NSIs	39%
McGeer, et al. 1990 (J. Infect. Dis.)	Canada	Survey	1 univ. hospital, 88 med. students, residents, interns; 372 PIs	95%+
Mangione et al. 1991 (Am. J. Med.)	U.S.	Cross-sectional survey, 1988-1989	3 teaching hospitals 86 residents/interns, 103 PIs	70%
Tandberg et al. 1991 (Ann. Emerg. Med.)	U.S.	Survey	259 respondents (emergency MDs, RNs, EMTs), 643 PIs, 1 univ. hospital	65% overall 87% ED MDs 34% ED RNs 33% EMTs
O'Neill et al. 1992 (Arch. Intern. Med.)	U.S.	Survey	1 univ. hospital, 550 med. students & residents	91%
Albertoni et al. 1992 (Infect. Control Hosp. Epidemiol.)	Italy	Validation study	1 teaching hospital	85% (MDs) 69% nurses
Lynch & White 1993 (Am. J. Infect. Control)	U.S.	Comparison of blood exposure incident reports with data from OR study	3 hospitals, OR personnel	96% (OR personnel)
Chamberland M et al. (Needlestick Surveillance Group, CDC) 1995 [Conf. on Bloodborne Infections, Paris]. Abstract pub'd in Adv. Exp. Prev. 1995 1(4):11.	U.S.	1993-94 survey	6 hospitals, HCWs performing phlebotomy	68% residents 60% med. students 35% nurses 11% phlebotomists
Roy & Robillard 1995 [Conf. on Bloodborne Infections, Paris] Abstract pub'd in Adv. Exp. Prev. 1995 1(4):11.	Canada	1-year survey (1991-92), compared to incident reports	5 hospitals in Montreal, 838 exposures (PIs & BBF)	47% (range 29%-61%)
Henry & Campbell 1995 (Minn. Med.)	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 (Ann. Intern. Med.)	U.S.	7-year (1990-96) longitudinal study	1 univ. hospital (UCSF), 119 med. students, 129 PIs	Range: 55%-35% (decreased over study)
Haiduven et al. 1999 (J. Hosp. Infect.)	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

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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 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] ❐

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‡	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.

References

1. Ippolito G, Puro V, Petrosillo N, et al, Studio Italiano Rischio Occupazionale da HIV (SIROH) group. Surveillance of occupational exposure to bloodborne pathogens in health care workers: the Italian national programme. *Eurosurveillance* 2002; 4(3):33-36.
2. Monge V, Mato G, Mariano A, et al. (GERABTAS Working Group). Epidemiology of biological-exposure incidents among Spanish healthcare workers. *Infect Control Hosp Epidemiol* 2001;22(12):776-780.
3. Whitby RM. McLaws ML. Hollow-bore needlestick injuries in a tertiary teaching hospital: epidemiology, education and engineering. *Med J Aust* 2002;177(8):418-22.
4. Ng LN. Lim HL. Chan YH. Bin Bachok D. Analysis of sharps injury occurrences at a hospital in Singapore. *Int J Nurs Pract* 2002;8(5):274-81.
5. Newsom DH, Kiwanuka JP. Needle-stick injuries in an Ugandan teaching hospital. *Ann Trop Med Parasitol* 2002;96(5):517-522.
6. Memish ZA, Almuneef M, Dillon J. Epidemiology of needlestick and sharps injuries in a tertiary care center in Saudi Arabia. *Am J Infect Control* 2002;30(4):234-41.
7. Khuri-Bulos NA, Toukan A, Mahafzah A, et al. Epidemiology of needlestick and sharp injuries at a university hospital in a developing country: a 3-year prospective study at the Jordan University Hospital, 1993 through 1995. *Am J Infect Control* 1997;25(4):322-9.
8. Ippolito G, Petrosillo N, Puro V, et al. The risk of occupational exposure to blood and body fluids for health care workers in the dialysis setting. Italian Multicenter Study on Nosocomial and Occupational Risk of Infections in Dialysis. *Nephron* 1995;70(2):180-184.
9. Phipps W, Honghong W, Min Y, et al. Risk of medical sharps injuries among Chinese nurses. *Am J Infect Control* 2002;30(5):277-282.
10. Shiao JS, Mclaws ML, Huang KY, et al. Student nurses in Taiwan at high risk for needlestick injuries. *Ann Epidemiol* 2002;12(3):197-201.
11. Lee CH. Carter WA. Chiang WK. Williams CM. Asimos AW. Goldfrank LR. Occupational exposures to blood among emergency medicine residents. *Acad Emerg Med* 1999;6(10):1036-1043.
12. Osborn EH, Papadakis MA, Gerberding JL. Occupational exposures to body fluids among medical students: A seven-year longitudinal study. *Ann Intern Med* 1999;130:45-51.
13. Perry J, Parker G. Percutaneous injuries in home health care settings. *Adv Exp Prev*. 2000;5(3):32-33.
14. Dale JC, Pruett SK, Maker MD. Accidental needlesticks in the phlebotomy service of the Department of Laboratory Medicine and Pathology at Mayo Clinic Rochester. *Mayo Clin Proc* 1998; 73(7):611-615.
15. Jagger J, Bentley M, Tereskerz P. A study of patterns and prevention of blood exposures in OR personnel. *AORN J* 1998; 67(5):979-974, 986.
16. Greene ES, Berry AJ, Jagger J, Hanley E, Arnold WP, III, Bailey MK et al. Multicenter study of contaminated percutaneous injuries in anesthesia personnel. *Anesthesiology* 1998; 89(6):1362-1372.
17. Folin AC. Nordstrom GM. Accidental blood contact during orthopedic surgical procedures. *Infect Control Hosp Epidemiol* 1997;18(4):244-246.
18. Metules T. What if you're stuck by a needle? *RN* 2002;65(11):34ns2-34ns12.
19. California Department of Health Services, Occupational Health Branch. Sharps Injury Control Program Report. Oakland, CA: January 2002, pg. 8. Available online at: www.dhs.ca.gov/ohb/SHARPS/sharps.pdf
20. Panlilio AL, Cardo DM, Campbell S, et al. Estimate of the annual number of percutaneous injuries in U.S. healthcare workers [abstract]. *Infect Control Hosp Epidemiol*, 2000;21:157.
21. Staff report. Latest data show drop in needlestick injuries. *Hosp Employee Health*. 2000;19(6):67.
22. Perry J. CDC releases national needlestick estimates. *Adv Exp Prev*. 2000;5(2):19.
23. Occupational Safety and Health Administration. Occu-

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pational exposure to bloodborne pathogens; needlesticks and other sharps injuries; final rule (29 CFR Part 1910.1030). *Fed Reg*, 2001;66(12):5318-5325.
24. Hamory BH. Underreporting of needlestick injuries in a university hospital. *Am J Infect Control*, 1983;11:174-177.
25. Jagger J, Hunt EH, Brand-Elnaggar J, et al. Rates of needle-stick injury caused by various devices in a university hospital. *N Engl J Med*, 1988;319:284-288.
26. McGeer A, Simor AE, Low DE. Epidemiology of needlestick injuries in house officers. *J Infect Dis* 1990;162(4):961-964.
27. Mangione CM, Gerberding JL, Cummings SR. Occupational exposure to HIV: Frequency and rates of underreporting of percutaneous and mucocutaneous exposures by medical housestaff. *Am J Med*, 1991;90:85-90.
28. Tandberg D, Stewart KK, Doezema D. Under-reporting of contaminated needlestick injuries in emergency health care workers. *Ann Emerg Med*, 1991;20:66-70.
29. O'Neill TM, Abbott AV, Radecki SE. Risk of needlesticks and occupational exposures among residents and medical students. *Arch Intern Med* 1992;152:1451-1456.
30. Albertoni F, Ippolito G, Petrosillo N, et al. Needlestick injury in hospital personnel: A multicenter survey from central Italy. The Latium Hepatitis B Prevention Group. *Infect Control Hosp Epidemiol* 1992;13:540-544.
31. Lynch P, White MC. Perioperative blood contact and exposures: A comparison of incident reports and focused studies. *Am J Infect Control*, 1993;21:357-363.
32. Chamberland M, Short L, Srivastava P et al. (Needlestick Surveillance Group, Centers for Disease Control and Prevention). Implementation, impact and compliance with use of safety devices to reduce percutaneous injuries during phlebotomy. Poster presented at "Bloodborne Infections: Occupational Risks and Prevention," Paris, France, June 8-9, 1995. Printed in *Adv Exp Prev* 1995;1(4):11.
33. Roy E, Robillard P (Public Health Direction, Montreal, Canada). Underreporting of accidental exposures to blood and other body fluids in health care settings = an alarming situation. Poster presented at "Bloodborne Infections: Occupational Risks and Prevention," Paris, France, June 8-9, 1995. Printed in *Adv Exp Prev* 1995;1(4):11.
34. Henry K, Campbell S. Needlestick/sharps injuries and HIV exposure among health care workers. National estimates based on a survey of U.S. hospitals. *Minn Med* 1995;78(11):41-44.
35. Osborn EH, Papadakis MA, Gerberding JL. Occupational exposures to body fluids among medical students. A seven- year longitudinal study. *Ann Intern Med* 1999;130(1):45-51.
36. Haiduven DJ, Simpkins SM, Phillips ES, Stevens DA. A survey of percutaneous/ mucocutaneous injury reporting in a public teaching hospital. *J Hosp Infect* 1999;41(2):151-154.
37. Alvarado F, Panlilio A, Cardo D, NaSH Surveillance Group. Percutaneous injury reporting in U.S. hospitals, 1998 [abstract]. *Infect Control Hosp Epidemiol* 2000;21(2):106.
38. Centers for Disease Control and Prevention. Updated U.S. Public Health Service guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for postexposure prophylaxis. *MMWR* 2001;50(RR11):1-42.
39. Hernandez ME, Bruguera M, Puyuelo T, et al. Risk of needle-stick injuries in the transmission of hepatitis C virus in hospital personnel. *J Hepatol* 1992; 16(1-2):56-58.
40. Mitsui T, Iwano K, Masuko K, Yamazaki C, Okamoto H, Tsuda F et al. Hepatitis C virus infection in medical personnel after needlestick accident. *Hepatology* 1992; 16(5):1109-1114.
41. Sodeyama T, Kiyosawa K, Urushihara A, et al. Detection of hepatitis C virus markers and hepatitis C virus genomic- RNA after needlestick accidents. *Arch Intern Med* 1993; 153(13):1565-1572.
42. Lanphear BP, Linnemann CC, Cannon CG, et al. Hepatitis C virus infection in healthcare workers: risk of exposure and infection. *Infect Control Hosp Epidemiol* 1994; 15(12):745-750.
43. Zuckerman J, Clewley G, Griffiths P, et al. Prevalence of hepatitis C antibodies in clinical health-care workers. *Lancet* 1994; 343(8913):1618-1620.
44. Monge V, Insalud (Grupo Español de Registro de Accidentes Biológicos en Trabajadores de Atención de Salud). Accidentes Biologicos en Profesionales Sanitarios. Madrid, Spain: 1995.
45. Arai Y, Noda K, Enomoto N, et al A prospective study of hepatitis C virus infection after needlestick accidents. *Liver* 1996;16(5):331-334.
46. Serra C, Torres M, Campins M. Riesgo laboral de infeccion por el virus de la hepatitis C despues de una exposicion accidental. *Medicina Clinica* 1998;111:645-649.
47. Takagi H, Uehara M, Kakizaki S, et al. *J Gastroenterol Hepatol* 1998;13(3):238-243.
48. Hasan F, Askar H, Al Khalidi J, et al. Lack of transmission of hepatitis C virus following needlestick accidents. *Hepatogastroenterology* 1999; 46(27):1678-1681.
49. Kidouchi K, Aoki M, Oka S, et al. Surveillance of blood and body fluid exposures in Japan: international comparisons. 4th International Conference on Occupational Health for Health Care Workers. September 30, 1999; Montréal, Canada.
50. Petrosillo N, Puro V, De Carli G, et al. Occupational exposure in healthcare workers: an Italian study of occupational risk of HIV and other blood-borne viral infections. *Br J Infect Control* 2001; 2(2):15-17.
51. Baldo V, Floreani A, Dal Vecchio L, et al. Occupational risk of blood-borne viruses in healthcare workers: a five-year surveillance program. *Infect Control Hosp Epidemiol* 2002;23:325-327.
52. Evans B, Communicable Disease Surveillance Centre, Public Health Laboratory Service, United Kingdom, written communication, April 24, 2002.
53. Jagger J, De Carli G, Perry J, Puro V, Ippolito G. Occupational exposure to bloodborne pathogens: epidemiology and prevention. Chapter 28 in: Wenzel R, ed., *Prevention and Control of Nosocomial Infections* (4th edition). Baltimore, MD: Lippincott, Williams and Wilkins. Forthcoming, 2003.

EPINet Network Hospitals, 2001

In 2001, 58 hospitals participated in a voluntary EPINet data-sharing network coordinated by the International Healthcare Worker Safety Center. The research data published in *AEP* come largely from this network. Each year we publish an updated list of the participating hospitals; we gratefully acknowledge their efforts and contributions.

Florida Hospital Orlando (Orlando, FL); **Martha Jefferson Hospital** (Charlottesville, VA); **Saint Joseph Hospital** (Omaha, NE); **St. Vincent Indianapolis Hospital** (Indianapolis, IN); **Saint Vincent Health Center** (Erie, PA); **University Hospitals of Cleveland** (Cleveland, OH).

Sisters of Providence Hospitals, JH Marsh & McLennan, Seattle; Eileen Bradshaw, Janet Swapp, network coordinators:
Providence Centralia Hospital (Centralia, WA); **Providence Child Center** (Portland, OR); **Providence Medford Medical Center** (Medford, OR); **Providence Milwaukie Hospital** (Milwaukie, OR); **Providence Newberg Hospital** (Newberg, OR); **Providence Portland Medical Center** (Portland, OR); **Providence St. Vincent Medical Center** (Portland, OR); **Providence Toppenish Hospital** (Toppenish, WA); **Providence Yakima Medical Center** (Yakima, WA).

PHTS Hospitals, South Carolina; Amy Aull and Ed Hall, network coordinators:
Abbeville County Memorial Hospital (Abbeville, SC); **Allendale County Hospital** (Fairfax, SC); **Anderson Area Medical Center** (Anderson, SC); **Bamberg County Memorial Hospital** (Bamberg, SC); **Barnwell County Hospital** (Barnwell, SC); **Beaufort Memorial Hospital** (Beaufort, SC); **Cannon Memorial Hospital** (Pickens, SC); **Carolinas Hospital System Lake City** (Lake City, SC); **Chester County Hospital** (Chester, SC); **Conway Medical Center** (Conway, SC); **Edgefield County Hospital** (Edgefield, SC); **Fairfield Memorial Hospital** (Winnsboro, SC); **Georgetown Memorial Hospital** (Georgetown, SC); **Greenville Memorial Hospital and Medical Campus/ Greenville Hospital System** (Greenville, SC); **GHS-Allen Bennett Memorial Hospital**, Greer, SC; **GHS-Hillcrest Hospital** (Simpsonville, SC); **GHS-Marshall I. Pickens Hospital** (Greenville, SC); **GHS-Roger Huntingdon Nursing Center** (Greenville, SC); **Hampton Regional Medical Center** (Varnville, SC); **Kershaw County Medical Center** (Camden, SC); **Laurens County Hospital** (Clinton, SC); **Lexington Medical Center** (West Columbia, SC); **Lexington Richland Alcohol & Drug Abuse Council** (Columbia, SC); **Loris Community Hospital** (Loris, SC); **Marion County Medical Center** (Mullins, SC); **Mary Black Memorial Hospital** (Spartanburg, SC); **McLeod Regional Medical Center** (Florence, SC); **Mercy Care** (Myrtle Beach, SC); **Newberry County Memorial Hospital** (Newberry, SC); **Oconee Memorial Hospital** (Seneca, SC); **Palmetto Health Baptist** (Columbia, SC); **Palmetto Health Baptist Easley** (Easley, SC); **Palmetto Health Richland** (Columbia, SC); **The Regional Medical Center of Orangeburg and Calhoun Counties** (Orangeburg, SC); **Roger C. Peace Rehabilitation Hospital** (Greenville, SC); **Saint Eugene Medical Center/McLeod Health** (Dillon, SC); **Self Regional Healthcare** (Greenwood, SC); **Spartanburg Hospital for Restorative Care** (Spartanburg, SC); **Spartanburg Regional Medical Center** (Spartanburg, SC); **Tuomey Regional Medical Center** (Sumter, SC); **Wallace Thomson Hospital/Union Hospital District** (Union, SC); **Williamsburg Regional Hospital/Carolinas Hospital System** (Kingstree, SC)**; Women's Center of Carolinas Hospital System** (Florence, SC) ❐