ASSOCIATION OF OCCUPATIONAL HEALTH PROFESSIONALS IN HEALTHCARE

Fall 2013

AOHP Commissioned National Survey on Blood Exposures Among Healthcare Workers

EXPO-S.T.O.P.: A national survey and estimate of sharps injuries and mucocutaneous blood exposures among healthcare workers in USA

By Terry Grimmond, FASM, BAgrSc, GrDpAdEd and Linda Good, PhD, RN, COHN-S

Abstract

Purpose: Blood exposure (BE) among healthcare workers (HCW,) either from percutaneous sharps injury (SI) or mucocutaneous (MC) exposure, is a serious occupational risk that healthcare facilities (HCF) strive to reduce. Large exposure-rate databases assist in benchmarking this goal; however, no nationwide, annual surveys are currently conducted in the United States. In 2012, The Association of Occupational Health Professionals in Healthcare (AOHP) commissioned a new Exposure Study of Occupational Practice (EXPO-S.T.O.P.) among its members to establish a nationally representative BE database and benchmark resource.

Design: A nine-item electronic survey was developed and distributed to AOHP members to ascertain BE incidence and denominator data.

Methods: 2011 data was requested on: Total SI and MC incidence in the HCF and during surgical procedures; full-time equivalent (FTE) staff; average daily census; adjusted patient days (APD;) teaching status; medical staff inclusion; and state. Incidence rates per 100 FTE, per 100 Occupied Beds (OB,) and per 1,000 APD were calculated and compared with relevant US databases. Best practices from the top 10 lowest-exposure teaching and non-teaching hospitals were also ascertained. Survey results were used to calculate a national estimate of BE exposures in hospital and non-hospital settings.

Findings: Responses from 125 hospitals in 29 states were received, making the survey the largest in the United States. Overall SI incidence rates were: 24.0/100 OB (17.8 in non-teaching and 27.4 in teaching hospitals;) 1.89/100 FTE; and 0.53/1,000 APD. Overall MC incidence rates were: 9.0/100 OB (7.1 in non-teaching and 10.1 in teaching hospitals;) 0.69/100 FTE; and 0.20/1,000 APD. Effective reduction strategies in low-incidence, "sharps aware" hospitals include: intense and repeated competency education; monthly institutional emails; easy incident reporting; management involvement; immediate action on "trends;" and zero as goal. Extrapolation of survey results indicate that in US hospital and non-hospital settings, 321,907 HCW sustain SI and 119,437 sustain MC; thus, 441,344 HCW sustain BE annually.

Key words

Blood exposure, Sharps injuries, mucocutaneous, needlestick, hospital, non-hospital, healthcare worker.

Introduction

HCF enumerate and categorize BE to better understand how BE occur, how they may be reduced and what resources are required to achieve their reduction. State, regional and national databases have the same purpose and in addition may allow HCF to benchmark their performance. National databases offer a broader benchmark capability and also allow more informed decision-making in formulating national BE prevention strategies; however, there is currently no active national BE data collection system in the United States.

Three multi-HCF databases are publicly available in the United States. The University of Virginia Health System's International Healthcare Worker Safety Center's Exposure Prevention Information Network (EPINet) pioneered BE data collection and has published multi-state data since 1993.[1] In 1995, the Centers for Disease Control and Prevention's (CDC) National Surveillance System for Healthcare Workers (NaSH) began collecting BE incident data from HCF.[2] Since 2002, the Massachusetts Department of Public Health (MADPH) Sharps Injury Surveillance System has annually published SI data mandatorily reported by all hospitals as required under MA legislation.[3]

Benchmarking and national information gathering is somewhat limited in the above three databases as: EPINet data is now gathered from hospitals chiefly in South East states, has retracted from a peak of 77 hospitals in 1997 to 32 hospitals in 2011 and uses "Occupied beds" (OB) as the rate denominator (bed denominators exclude outpatient, day surgery and research center workloads;) the MADPH database is from one state only and uses "Licensed beds" as the rate denominator; and the NaSH survey ceased in 2007 and did not collect rate denominator data.

Members of AOHP chiefly comprise occupational health professionals whose tasks include collection of BE data and, through AOHP, a unique opportunity arose to gather national BE data. This paper presents the results of AOHP's first EXPO-S.T.O.P. (**EXPO**sure **S**urvey of **T**rends in **O**ccupational **P**ractice) national survey of BE exposures among US hospitals.

Methods

A nine-item questionnaire (Table 1) pertaining to 2011 calendar year data was developed by the principle investigators and reviewed by a panel of occupational health experts and a data analyst/statistician for clarity. Exposure information was requested on SI and MC exposures in the hospital and during surgical pro-

cedures. In addition, participants were asked for their institution's FTE staff number, average daily inpatient census (ADC) (synonymous with OB), APD, their teaching status, whether non-employee medical staff (MD) were included in their exposure data, and their state.

The questionnaire was distributed via email to the members of AOHP using the electronic format Survey Monkey™. Accompanying the survey was an explanation of the purpose and goals of the survey, and investigator contact information. Participants were given the option of providing their contact information if willing to be contacted for further information about their hospital's exposure management program. AOHP provided a free annual national conference registration as the prize in an incentive drawing for those completing the survey by the specified deadline. Participants with contact details were contacted if their data was incomplete and also to confirm all "outlier" data. Survey responses were sorted by "Teaching" and "Non-teaching" facilities, and the five facilities with the lowest percutaneous exposure rates were identified for each category. Interviews were conducted with occupational health professionals from each of these exemplary facilities, and their best practices identified.

Incidence results were compared with EPINet[1] and MADPH 2010 survey results[3] (MADPH licensed beds converted to OB using American Hospital Association data relevant to Massachusetts hospitals in 2010[4].)

To estimate a national annual reported incidence of SI and MC, EXPO-S.T.O.P. SI and MC rates per 100 FTE (all hospitals) were extrapolated nationally using US Department of Labor (2010) healthcare workforce total FTE.[5] In a second methodology (using OB as denominator,) size differences between survey hospitals and hospitals nationally were factored into the estimate by multiplying EXPO-S.T.O.P. SI and MC rates per 100 OB for eight hospital size categories and total national OB in each of the size categories[6] (Table 6.) Both reported exposure estimates were converted to total exposures by dividing by a 60 percent reporting rate. Estimated totals of SI and MC for the United States nationally were then combined to estimate total BE annually in US hospitals. Data on proportion of registered nurses in hospital and non-hospital settings[7] was utilized to calculate total BE exposures in the combined sectors. WinPepi v11.26 was used to calculate Chi^2, log-transformation risk ratios (RR) and 95 percent confidence intervals (CI.) Statistical significance was set at $p \leq 0.05$.

Table 1. EXPO-S.T.O.P. Survey Questions

1. Number of sharps injuries from your 2011 calendar year OSHA Form 300?
2. Number of mucocutaneous blood or other potentially infectious material exposures (including bites) in 2011 calendar year?
3. Number of sharps injuries in surgical procedures (i.e. OR + Procedure Rooms + Labor & Delivery) in 2011 calendar year?
4. Average daily inpatient census (i.e. average daily Occupied Beds) for calendar year 2011?
5. Average number of employees as reported on your 2011 calendar year OSHA Form 300?
6. Total Patient Days for 2011 (if available)
   Total Patient Days = (Total Revenue/Inpatient Revenue) x Total Inpatient Days
7. Is your hospital a teaching hospital (Teaching = Affiliated with a medical school and serving as a practical education site for medical students, interns and residents)?
8. Are your non-employee medical staff included in the above exposure data?
9. In what state is your hospital located?

OSHA - Occupational Safety and Health Administration, Dept Labor United States; OR – Operating room.

Results

One hundred sixteen responses were received, encompassing 125 hospitals in 29 states, within which 5,932 SI and 2,169 MC were reported (Table 2.) Of the 125 hospitals: 125 included FTE data; 124 included surgical procedure SI data; 124 included their state; 101 included ADC; 112 included MD inclusion answer; 111 included teaching status; 33 included APD.

Incidence rates for SI and the percentage occurring during surgical procedures, together with an EPINet and MADPH comparison, are shown in Table 3. In survey hospitals, 37.2 percent of SI occurred during surgical procedures – a similar rate to that found in EPINet hospitals but significantly lower than that found in MA hospitals (Table 3.) Incidence rates for MC and a comparison with EPINet data are shown in Table 4. Successful reduction strategies in the top five EXPO-S.T.O.P. hospitals are shown in Table 5. National hospital FTE in 2010 was 5,695.900,[5] and using the survey incidence rates of 1.89 SI and 0.69 MC per 100 FTE, and a reporting rate of 60 percent, equates to 179,176 SI and 65,503 MC in hospitals nationally. Using OB as denominator, and factoring in hospital sizes and a 60 percent reporting rate, the respective estimates are 199,582 SI and 74,051 MC in hospitals nationally (Table 6.) Using the latter figures and nurse FTE as a surrogate indicator of total sharps-relevant workforce proportions (62 percent of nurses are employed in hospitals and 38 percent in non-hospital settings[7],) it is estimated that annually in US hospital and non-hospital settings, 321,907 HCW sustain SI and 119,437 sustain MC, thus 441,344 HCW sustain BE in US hospitals annually.

Table 2. EXPO-S.T.O.P. 2011 Survey Statistics

Total hospitals participating	Hospital size range (ADC)	Total BE exposures	Total sharps injuries	Total mucocutaneous exposures	Number of different US states participating
125	6 - 975	8,101	5,932	2,169	29

Table 3. EXPO-S.T.O.P. Percutaneous Sharps Injuries (SI) Incidence Comparison

Parameter	EXPO-S.T.O.P 2011	EPINet 2011	Massachusetts 2010
SI/100 Occupied Beds			
All hospitals	24.0*	19.5*	23.4
Non-teaching hospitals	17.8	16.5	Not available
Teaching hospitals	27.4+	20.7+	Not available
In hospitals recording non-employee MD exposures	23.4	Not available	Not available
In hospitals not recording non-employee MD exposures	24.0	Not available	Not available
SI/100 Full-time equivalent staff	1.89#	2.48 (2001-05)#	Not available
SI/1000 Adjusted patient days	0.53	Not available	Not available
% Surgical Procedure SI	37.2%^	39.9%	45.2%^

*p < 0.001; RR = 1.2; CI = 1.15-1.32. +p < 0.001; RR = 1.3; CI = 1.22-1.44; # p < 0.001; RR = 0.7; CI = 0.74-0.78; ^p < 0.001; RR = 0.8; CI = 0.78-0.87.
SI sharps injuries; MD medical doctor

Table 4. EXPO-S.T.O.P. Mucocutaneous (MC) Rate Comparison

Parameter	EXPO-S.T.O.P 2011	EPINet 2011
MCE/100 Occupied Beds		
All hospitals	9.0*	7.3*
Non-teaching hospitals	7.1	5.8
Teaching hospitals	10.1^	7.8^
In hospitals recording non-employee MD exposures	8.23	Not available
In hospitals not recording non-employee MD exposures	9.37	Not available
MCE/100 Full Time Equivalent staff	0.69	Not available
MCE/1000 Adjusted patient days	0.20	Not available

* p < 0.001; RR = 1.2; CI = 1.10-1.41. ^ p < 0.001; RR = 0.7; CI = 0.74-0.78
MCE mucocutaneous exposures; MD medical doctor

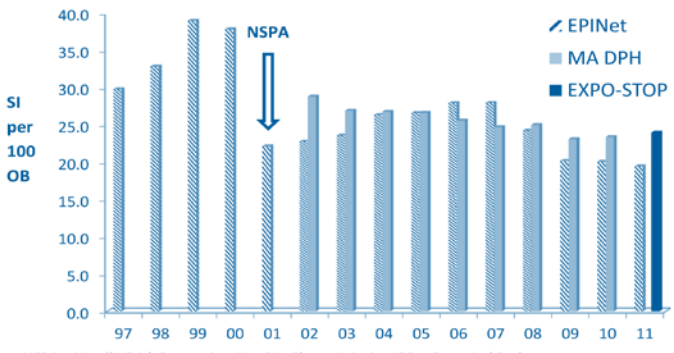


Figure 1. Comparison of EPINet, Massachusetts Department of Public Health (MADPH) and EXPO-S.T.O.P. sharps injury incidence rates.

NSPA = Needle Stick Prevention Act; SI = Sharps Injuries; OB = Occupied Beds

Discussion

National databases are valuable as benchmarking tools for individual hospitals, for determining national incidence rates, and for informed discussion on national issues such as prevention guidelines, resource allocation and legislation. Large, geographically widespread databases are particularly valuable for these purposes. The survey, from 125 hospitals in 29 states (Table 2,) is the largest annual survey conducted in the United States. The survey is intended as a broad overview of exposure incidence and not as a detailed database of exposure mechanisms. The survey tool was constructed to promote maximum response by asking minimal but valuable questions to enable a national BE incidence rate to be determined per 100 occupied beds, and for the first time, a national rate per 100 FTE. Twenty-six percent of participants were able to supply their 2011 adjusted patient days which, like FTE, measures inpatient and outpatient workloads.

Sharps Injury Incidence

The survey's SI incidence rate of 24.0 per 100 OB is significantly higher than EPINet's 2011 rate of 19.5,[1] and similar to MA hospitals' 2010 incident rate of 23.4[3] – see Table 4. The higher rate is graphically shown against EPINet and MADPH rates in Figure 1. Possible explanations for the higher rate may be: EXPO-S.T.O.P. hospitals reported more of their SI; EPINet hospitals reflect a regional-specific low incidence due to their early adoption of safety engineered devices;[8] and/or EXPO-S.T.O.P. hospitals reflect a true national incidence. The increased SI rate per 100 OB in EXPO-S.T.O.P. teaching hospitals over non-teaching hospitals mirrors that of EPINet hospitals and is indicative of procedure intensity and SI incidence in research (non-bed) departments in teaching hospitals. Of interest is that the incidence of SI in EXPO-S.T.O.P. teaching hospitals is significantly higher than that in EPINet teaching hospitals, and the reason is not readily apparent. However, as the numbers of EXPO-S.T.O.P. teaching hospitals and EPINet hospitals in 2011[1] were 38 and nine respectively, it is probable the survey results reflect more closely the national teaching hospital incidence.

Using FTE as a denominator to reflect hospital workloads, the incidence of 1.89 among EXPO-S.T.O.P. hospitals during 2011 is significantly lower than that in EPINet hospitals for 2001 to 2005[8] (Table 3.) We postulate that the lower rate is due to the higher percentage of teaching hospitals in the survey (38 percent) compared to the 22 percent among EPINet hospitals over the 2001-2005 period (more teaching hospitals equate to a higher FTE in denominator.)

The incidence of 0.53 per 1000 adjusted patient days was calculated as a second means (to FTE) of finding a workload denominator for meaningful benchmarking. As no other US or international database has used this denominator, the calculation was included for future reference purposes only.

Knowing that some hospitals include SI among non-employee MD (NEMD) in their databases, the authors expected to see a lower SI incidence in hospitals that did not include NEMD; however, no significant difference was found (Table 3.)

SI during surgical procedures in EXPO-S.T.O.P. hospitals (37.2 percent) has become an increasingly major SI setting, and this is likely due to more surgeons reporting their SI, and fewer SI occurring in non-surgical settings due to adoption of safety engineered devices (SED.) The reason for the lower incidence when compared to MADHP (Table 3) is not apparent but may reflect a higher rate of exposure reporting among MA surgeons.

When EXPO-S.T.O.P. hospitals were stratified into three ADC sizes (Figure 2,) the '"high-low-higher'" incidence per 100 OB mirrors that found in MA hospitals[3] and is likely due to procedure intensity and the higher likelihood of teaching hospitals being found in the larger hospitals; and the rate in hospitals <100 ADC may reflect better reporting, less use of SED, less repeated education sessions, and / or information "isolation" in rural areas.

Mucocutaneous exposure incidence

The survey's MC incidence rate of 9.0 per 100 OB is significantly higher than that of EPINet hospitals and the MC in-

Table 5. Best Practices in EXPO-S.T.O.P. Low Exposure Hospitals

Education: New Hires

- One-to-one interactive with every clinical new hire, discussing exposure vulnerability and strategies to work safely.
- Emphasize sharp safety during orientation.
- Require new clinicians to practice with and demonstrate competency on all devices—including students and float staff.
- "Safety Responsibility" pledge signed by each new hire—to which they are held accountable.

Education: Ongoing

- Building a bloodborne pathogen exposure event into the simulation lab training scenario.
- Mandatory review of sharp safety every two years.
- Use of a mandatory on-line program for education.
- Use vendor support and clinical educators to "stretch" resources; include weekend and off-shifts.
- Mandatory post injury education—some in the form of on-line module, some face-to-face with the Employee Health Nurse or the Workers' Compensation Nurse Case Manager.
- Monthly emailed "Sharps Safety Tips."

Management Involvement

- Hold managers accountable for the safety of their units, and publicly praise managers of occupationally safe units.
- Ensure that exposure data are "on the record" in committee reports that go up chain of command.
- Be transparent with injury trends—good or bad.
- Managers and the injured employee must be actively involved in the follow-up investigation and root cause analysis.
- Make reporting easy and available through an on-line or call-in system.

Employee Health Attitude

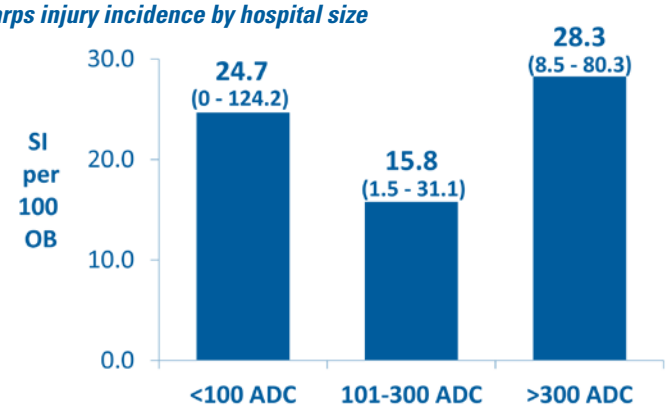
- Commitment to "drill down" on every exposure.
- Close attention to trends—with timely follow up; not waiting to end of reporting period.
- Refuse to be content with any goal but zero exposures.

cidence among teaching hospitals (Table 4,) and the reasons are likely those mentioned for the SI differences.

Best Practices Identified

The effective practices of hospitals with low SI incidence rates (Table 5) may be summarized as: intense (one on one) repeated competency education; making staff responsible for their safety; monthly institutional emails; easy incident reporting; post-incident re-education; management involvement at all levels; transparency with institutional results; immediate action on "trends;" and zero SI as the goal. Such HCF have a "sharps aware" culture where staff, managers and physicians have ownership of their SI risk, rate and reduction strategies.

Figure 2. Sharps injury incidence by hospital size



SI: Sharps Injury; OB: Occupied Beds; ADC: Average Daily Census

Table 6. Comparison of EXPO-S.T.O.P. hospital bed size with US national data and estimate of total annual sharps injuries and mucocutaneous exposures in US hospitals

Bed size	6-49	25-49	50-99	100-199	200-299	300-399	400-499	>500	Total
No. US community hospitals[6]	424	1167	970	1029	585	352	185	273	4985
% hospitals in category	8.5%	23.4%	19.5%	20.6%	11.7%	7.1%	3.7%	5.5%	100.0%
No. occupied beds in category (A)	2,345	16,776	38,278	89,446	91,274	82,059	56,219	143,255	519,652
No. EXPO-S.T.O.P. hospitals	11	10	18	25	15	7	5	10	101
% EXPO-S.T.O.P. hospitals	10.9%	9.9%	17.8%	24.8%	14.9%	6.9%	5.0%	9.9%	100.0%
EXPO-S.T.O.P. reported SI rate/100 OB (B)	44.9	38.0	18.6	16.3	15.3	23.9	18.2	32.7	24.0
EXPO-S.T.O.P. reported MC rate/100 OB (C)	57.5	15.8	5.9	6.4	7.2	6.3	6.0	12.1	9.0
Estimated SI reported nationally (A/100 x B)	1,054	6,381	7,139	14,552	13,949	19,571	10,242	46,862	119,749
Estimated total SI nationally (if 60% reported)	1,757	10,634	11,898	24,253	23,249	32,618	17,070	78,103	**199,582**
Estimated MC reported nationally (A/100 x C)	1,349	2,651	2,258	5,725	6,572	5,170	3,373	17,334	44,431
Estimated MC nationally (if 60% reported)	2,248	4,418	3,764	9,541	10,953	8,616	5,622	28,890	**74,051**
Estimated BE nationally	4,004	15,052	15,662	33,784	34,202	41,235	22,692	106,993	**273,633**

SI – sharps injuries; OB – occupied beds; MC – mucocutaneous exposures; BE – blood exposures (SI+MC)

National BE estimates

Previous estimates of the national total of SI occurring in US hospitals have ranged from: an upper limit of 756,000 (reported in 1995 using 1990 data;)[9] 295,082 (reported in 1998 using 1996 data;)[10]; and 384,325 (reported in 2004 using 1997-8 data.)[11] Estimates of SI among all HCW, including those in non-hospitals settings, have ranged from 503, 466 [12] to 590,164[10]. The extrapolation of EXPO-S.T.O.P. results enable a 2011 estimate to be made showing approximately 200,000 SI occurred in hospitals and 320,000 SI occurred nationally.

Estimates of MC exposures among HCW in hospital and non-hospital settings range from 196,721[10] in 1998 to 146,005 in 2003.[12] EXPO-S.T.O.P. results enable these figures to be updated to 74,000 MC in hospitals and 119,000 MC nationally. Previous estimates of total exposure (SI and MC) in US hospital and non-hospital settings range from 786,885 using 1996 data down to 649,471 using 1997-8 data.[12] Extrapolation from the 2011 survey shows total BE exposures are now estimated to be approximately 274,000 in hospitals, and 440,000 in hospital and non-hospital settings.

The OSHA Needlestick Safety and Prevention Act (NSPA,)[13] enacted in 2001, significantly reduced SI[8] (Figure 1,) yet no national SI or MC estimates have been published using post-NSPA data, and many publications still quote outdated estimates. The EXPO-S.T.O.P. survey now enables an updated (2011) national estimate to be calculated. Incident reporting rates are the Achilles heel of national SI incidence calculations, and the EXPO-S.T.O.P. estimate is no exception. Reporting rates were said to be 40 percent to 60 percent at a major hospital presentation at the recent 2013 AOHP national conference,[14] and without literature to the contrary, we adopted the conservative reporting rate of 60 percent. Published research on SI reporting rates in US hospitals is much needed.

To calculate BE exposure incidence in non-hospital settings is not straightforward, as there are no large databases in this setting. Extrapolation from hospital

settings using workforce FTE proportions in hospital and non-hospital sectors has been used,[10] as well as the non-hospital proportion of the nation's needle usage;[12] however, both models have limitations. We postulate that extrapolation using the proportion of nurses employed in each setting is appropriate for determining non-hospital BE exposures as SI to nurses are the most commonly reported in hospital[1,2] and non-hospital settings,[15-17] and in the non-hospital setting nurses are, almost exclusively, the employee group handling sharps.[15-17] We also believe it appropriate to conservatively utilize hospital incidence rates for the non-hospital setting as non-hospital SI incidence rates are equal to,[16] and commonly higher than, hospital rates.[15,17,18] Adopting a 60 percent reporting rate for the non-hospital setting is conservative, as several studies show exposure reporting in this setting to be less than 60 percent.[15-17]

The significant fall in SI following NSPA enactment is incontrovertible.[8] However, it is disturbing that the 2011 EXPO-S.T.O.P. incidence of 24.0 per 100 OB is higher than the 22.2 found among the 58 EPINet hospitals in 2001.[1] The lack of significant reduction in SI since 2001 (Figure 1) is of great concern. At the recent AOHP 2013 national conference,[14] three papers were presented showing that their switch to a passive safety engineered device (SED) significantly reduced SI over that with an active SED. These results confirm that simple compliance with OSHA NSPA law is not the yardstick – aggressive research into how and why SI are still occurring is essential in every institution. Zero exposure needs be placed back on the HCW safety radar.

Strengths and Limitations

Strengths of the survey were in the number of hospitals participating (125,) geographic dispersion (29 states,) hospital representiveness (includes all eight of CDC hospital sizes,) contemporary data (2011,) that most survey questions were from annual data required by OSHA law, and incidence rates were expressed using three denominators. Further strengths were the inclusion of successful reduction strategies and the factoring of national hospital size categories in calculating national estimates. Limitations were in: the reliance on voluntary reporting of exposure incidents and voluntary survey participation with its inherent selection bias; assumption of a 60 percent reporting rate in both hospital and non-hospital settings; the potential for misinterpretation of definitions; reliance on secondary data from departments in hospitals other than the participant's; that sample hospitals may not be representative of hospitals nationally; use of hospital nurse FTE to calculate non-hospital exposures nationally; and the use of databases (FTE, OB, nursing employment) from years other than the survey year.

Conclusions

The results of the EXPO-S.T.O.P. survey show a higher incidence than other contemporary surveys and that little reduction has occurred in SI rates in the last 10 years. The size and geographic coverage of the EXPO-S.T.O.P. survey allows new estimates of total BE exposures in the United States to be made. Although these estimates are considerably less than pre-NSPA national estimates, 320,000 HCW sustaining SI annually indicates that the mandated use of SED alone is not achieving our reduction goals. A new vigor must be found to protect these workers – it may be more intense education, staff ownership of their safety, or technology less dependent on human behavior, but a change must occur.

Acknowledgements

The authors wish to deeply thank all the AOHP members who participated, the AOHP Executive Board members for their support and Donna Agan, Director, Operations Integration, Scripps Mercy Hospital for her advice and analysis.

References

1. International Healthcare Worker Safety Center, University of Virginia. US EPINet Needlestick and Sharps Injury Surveillance Network. Sharps Injury Data Reports. http://www.healthsystem.virginia.edu/pub/epinet/EPINet2011-NeedlestickRpt.pdf. Accessed Mar 15, 2013.

2. The national surveillance system for healthcare workers (NaSH.) Summary report for blood and body fluids exposure. Data collected from participating facilities (June 1995 through December 2007.) Centers for Disease Control and Prevention. http://www.cdc.gov/nhsn/PDFs/NaSH/NaSH-Report-6-2011.pdf. Accessed Sept 10, 2013.

3. Massachusetts Department of Public Health, Occupational Health Surveillance Program. Sharps Injuries Among Hospitals Workers in Massachusetts, 2010. Findings from the Massachusetts Sharps Injury Surveillance. http://www.mass.gov/eohhs/docs/dph/occupational-health/injuries/injuries-hospital-2010.pdf. Accessed Mar 15, 2013.

4. AHA Hospital Statistics – 2013. American Hospital Association, Chicago IL, USA.

5. Industry-occupation matrix data, by industry. Employment Projections. Bureau of Labor Statistics, US Department of Labor. http://www.bls.gov/emp/ep_table_109.htm. Accessed Sept 20, 2013.

6. Table 106. Hospitals, beds and occupancy rates, by type of ownership and size of hospital: United States, selected years 1975–2010. National Center for Health Statistics, Health, United States. Centers for Disease Control and Prevention. http://www.cdc.gov/nchs/data/hus/2012/106.pdf. Accessed July 16, 2013.

7. The registered nurse population. Findings from the 2008 national sample of registered nurses. Sept 2010. Health Resources and Services Administration, US Department of Health and Human Services. http://bhpr.hrsa.gov/healthworkforce/rnsurveys/rnsurveyfinal.pdf. Accessed Sept 26, 2013.

8. Phillips E, Mark Conaway M, Parker G, Perry J, Jagger J. Issues in Understanding the Impact of the Needlestick Safety and Prevention Act on Hospital Sharps Injuries. Infect Control Hosp Epidemiol 2013;34(9):935-939.

9. Henry K and Campbell S. Needlestick/sharps injuries and HIV exposure among health care workers. National estimates based on a survey of US hospitals. Minn Med 1995;78(11):41-4.

10. Estimated Annual Number of US Occupational Percutaneous Injuries and Mucocutaneous Exposures to Blood or At-Risk Biological Substances. International Health Care Worker Safety Centre, University of Virginia Health Sciences Center. Adv Expo Prev 1998;4(1):3.

11. Panlilio AL, Orelien JG, Srivastava PU, Jagger J, Cohn RD, Carco DM, the NaSH Surveil¬lance Group; the EPINet Data Sharing Network. Estimate of the annual number of per¬cutaneous injuries among hospital-based healthcare workers in the United States, 1997-1998.Infect Control Hosp Epidemiol 2004; 25(7):556-62.

12. Perry J and Jagger J. Healthcare Worker Blood Exposure Risks: Correcting Some Outdated Statistics. . International Health Care Worker Safety Centre, University of Virginia Health Sciences Center. Adv Expo Prev 2003;6(3):28-31.

13. OSHA Bloodborne Pathogens Standard 1910.1030. US Department Labour, Occupational Safety and Health Administration. Jan 18, 2001. http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10051. Accessed Jun 24, 2012.

14. Association of Occupational Health Professionals in Healthcare (AOHP) 2013 National Conference, Sept 2013, Orlando, Florida.

15. Quin M, Markkanen P, Galligan C, et al. Sharps Injuries and Other Blood and Body Fluid Exposures Among Home Health Care Nurses and Aides. Amer J of Pub Health 2008;99(S3):S710-717.

16. Williams N, Ghosh t and Vogt R. Needlestick injury surveillance during mass vaccination clinics: Lessons learned and why more is needed - Tri-County (Denver Metropolitan) region, Colorado, 2009. AJIC 2012;40(8):768-770.

17.Lipscomb J, Sokas R, McPhaul K, et al. Occupational Blood Exposure Among Unlicensed Home Care Workers and Home Care Registered Nurses: Are They Protected? Am J Ind Med 2009;52:563–70.

18. Gershon R, Pearson J, Sherman M et al. The prevalence and risk factors for percutaneous injuries in registered nurses in the home health care sector. Am J Infect Control 2009;37:525-33.

Terry Grimmond, FASM, BAgrSc, GrDpAd-Ed is Director, Grimmond and Associates, Microbiology Consultants, Hamilton, New Zealand. Linda Good, PhD, RN, COHN-S is Director, Employee Occupational Services, Scripps Health, San Diego, CA. Both are long-time members of AOHP.

Corresponding author: tg@gandassoc.com