

Successfully Reducing Wingset-related Needlestick Injuries: A combination of institutional culture, staff commitment and semi-passive safety device

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Introduction

Robert Wood Johnson University Hospital (RWJUH) strives to continuously reduce needlestick injuries (NSI.) A staff-member conversion to hepatitis C after a phlebotomy-related NSI (PNSI) using a safety-engineered device (SED) galvanized RWJUH staff into investigation of PNSI and evaluation of safer phlebotomy-related SED (PSED.) I am pleased to share with members the journey our facility undertook in our vigilant pursuit of employee safety, beginning with background information and continuing with the details of our work, resulting in a successful outcome.

Background on Needlestick Injuries

In the late 1980s and 1990s, needlestick injuries (NSIs) garnered the attention of occupational health professionals (OHPs,) labor unions, medical technology companies, politicians and regulators. High-profile cases of healthcare workers suffering exposure to deadly bloodborne pathogens after coming into contact with contaminated needles helped bring together this unlikely coalition to advocate for change that culminated in passage of the Needlestick Safety and Prevention Act (NSPA) of 2000.

The success has been dramatic thanks to the intense focus on reducing NSIs by health professionals and regulatory agencies, as well as development and adoption of safety-engineered medical devices. According to new research from the University of Virginia's International Center for Healthcare Worker Safety, the United States has reduced NSIs by more than a third, or 100,000 annually, since 2000, which translates into \$415 million in yearly cost savings to the U.S. healthcare system.¹ This does not

include the significant reduction in the immeasurable personal and professional tolls that NSIs exact on healthcare workers and their families each year.

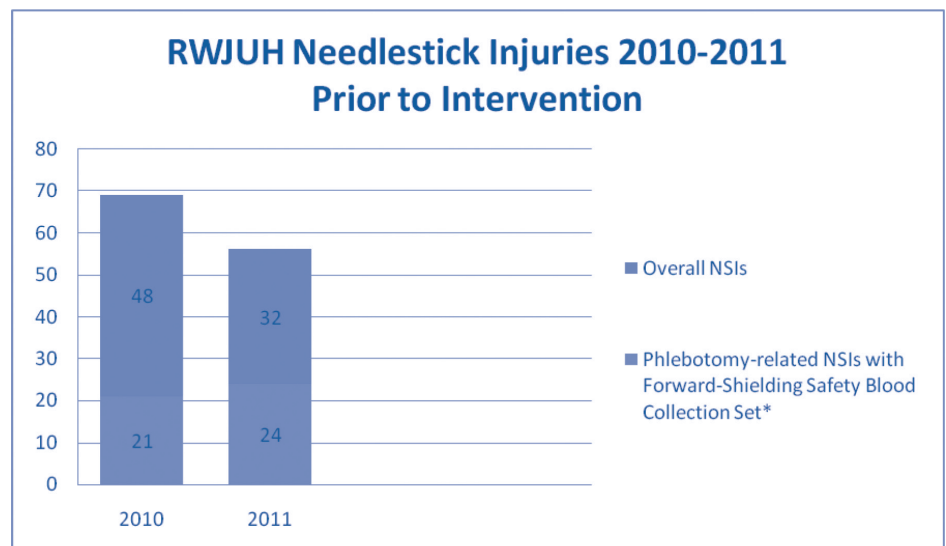
Despite these gains, NSIs still occur in alarming numbers, with an estimated 300,000 to 400,000 healthcare workers suffering injuries each year.^{2,3} As many OHPs unfortunately learn, it only takes one high-risk NSI to bring the problem back to the forefront, draw the attention of senior management and derail progress on many other initiatives. For OHPs to enjoy sustained NSI reductions, we must remain vigilant –taking a systematic, data-driven approach to monitoring their occurrence and serving as a forceful change agent with a true goal of achieving ZERO needlestick injuries.

The Needlestick Event that Started Our Pursuit

Founded in 1884, Robert Wood Johnson University Hospital (RWJUH) is a nationally recognized, 600-bed academic trauma one medical center in New Bruns-

wick, NJ that employs more than 5,000 people. Its annual academic programs host 300-400 medical residents from Rutgers-Robert Wood Johnson Medical School and more than 500 nursing students affiliated with five schools. For six consecutive years, RWJUH has ranked among *U.S. News and World Report's* list of America's best hospitals and has been recognized as a Magnet Hospital for Nursing Excellence for more than 10 consecutive years.

In 2008, an employee acquired hepatitis C (HCV) from PNSI from a forward-shielding safety winged blood collection set, which focused and galvanized RWJUH on reducing overall NSIs. The hospital was experiencing NSIs at an unacceptable rate – 69 injuries in 2010 and 56 in 2011. Over the same timeframe, the staff experiencing these injuries remained consistent, with nurses, clinical care technicians (CCTs) and surgical technicians suffering the most (in order.) Deeper investigation showed that phlebotomy procedures involving forward-



shielding winged blood collection sets accounted for a significant number of those injuries (30% in 2010 and 43% in 2011.)

The following case study demonstrates how the Employee Health and Wellness Department at RWJUH tackled a specific PNSI issue and the success the hospital achieved when it brought to bear the right focus, the right approach, the right engineering controls, and the right commitment and accountability throughout the organization.

The Search for Answers to Injuries

To determine the issues causing wing-set-related PNSIs with Device A, the RWJUH Employee Health staff collected and analyzed incident reporting and tracking using the OSHA Sharps Log. By analyzing monthly trend data, the staff was able to identify PNSIs early and perform a deeper dive into their root causes.

Investigation revealed that only CCTs and lab phlebotomists perform phlebotomy, and all but one PNSI involved CCTs. Nearly 83% of these PNSIs occurred after the Smiths Saf-T® Blood Collection Sets (Device A) were removed from the patients' veins, but before safety shield activation. The injured staff members reported three primary contributing factors to their injuries:

- Recoil effect of the tubing while activating the safety device.
- Forward motion of hand toward the sharp when engaging the safety device.
- Non-activation of the safety mechanism.

Assessing Options

Like many hospitals with an NSI problem, our first instinct in 2010 was to re-train on Device A. The RWJUH Employee Health staff provided a device review at the time of injury assessment. The current vendor was asked to conduct on-site, individual post-injury instruction. In addition, the hospital's clinical nurse educators followed up with even more training. The result: the hospital experienced three additional NSIs in 2011. It

became clear that retraining – although important – was not the solution, and that the current engineering control was, in fact, the problem. Device A's specific characteristics were contributing directly to the injuries.

Evaluating Engineering Controls

One critical responsibility of the RWJUH Employee Health Department, in concert with the SHARPS Safety Committee, is to annually evaluate new safety-engineered devices. It is also a required element of the hospital's Exposure Control Plan. To find an acceptable safety product with an intuitive safety mechanism and demonstrated ability to improve activation rates and reduce PNSIs, the RWJUH Employee Health Department partnered with the hospital's Purchasing Department to identify different safety solutions and analyze their clinical evidence.

The search turned up several brands of safety blood collection sets. RWJUH invited the respective vendors to participate in a Vendor Fair to demonstrate their product offerings and allow end users an opportunity to provide feedback on which devices were ultimately trialed.

Most of the safety blood collection sets identified possessed similar forward-shielding mechanisms as the one RWJUH clinicians currently used. Since our analysis had determined that forward-shielding safety mechanisms had been on the market for more than 20 years, the RWJUH staff decided it was necessary to trial at least one product with a different safety mechanism.

Device B (BD Vacutainer® Push Button Blood Collection Set) offered a retracting safety needle that could be activated with one hand while the cannula was still in the patient's vein. If used properly and activated in the patient's vein, the product's safety feature virtually eliminated the potential for a PNSI. The product's tubing also appeared to possess less memory, reducing recoil that could pull the needle from a patient's vein and present a PNSI risk.

Importantly, the product had credible third-party evidence that demonstrated its ability to reduce PNSIs over forward-shielding safety blood collection sets. One study documented how Device B reduced PNSIs at a 500+ bed hospital by 88%, with zero injuries in the last 21 months of the study.⁴ Another study from the University of Nebraska Medical Center reported high levels of clinician satisfaction and compliance in activating the safety mechanism as compared to forward-shielding safety blood collection sets.⁵

To determine whether Device B would be clinically acceptable and preferred by end users, RWJUH conducted a two-week trial across eight units/floors (including the clinical laboratory) and approximately 15 clinicians. Each trial participant was asked to use the product 20 times and complete a brief 14-question survey which rated the safety feature, the product's ease of use, and the clinician's overall comfort and satisfaction with the device, as well as whether he or she would recommend that RWJUH purchase Device B. The survey results demonstrated that the trial participants favored Device B and recommended that RWJUH provide it to them for venous blood collection procedures.

When it came time to implement Device B, RWJUH utilized the vendor, clinical nurse specialists and clinical nurse educators to educate the CCTs on proper device use. In the past, new CCTs were supported by peers who frequently had adopted work-a-rounds resulting in less than ideal safe work practices. To counteract this practice, RWJUH instituted on-going formalized training.

Quantifying the Costs

To gain support for making a change, especially when it potentially involves a more expensive engineering control, it is important to build a business case – putting the hospital's NSI rate into a financial context that a management committee or chief financial officer would accept. However, determining the exact cost of NSIs to a facility can be difficult. Precise data are often hard to find, with many costs being absorbed by an institution

without a clear paper trail of invoices that document the costs of testing and prophylactic treatment that accompany NSIs from source-positive or source-unknown NSIs. Figure 1 estimates the direct costs and administrative burden for both types of NSIs.

For RWJUH, the 2008 HCV seroconversion and the hospital's self-insured workers' compensation program provide an ongoing reminder of how costly these injuries can be to institutions and, more importantly, to the clinicians who suffer these injuries. To date, the hospital has spent more than \$81,000 on anti-viral medications and infectious disease medical care for this employee, not including absorbed costs. Excellent and continuous specialized care supports this employee's health, but the risk of future health complications is always a concern – up to and including a potential liver transplant. Should that occur, it could bring the lifetime treatment cost for this individual into the millions of dollars.

Another way to assess the financial impact of NSIs is to consider how much revenue an organization would have to earn to cover the associated costs. To calculate the needed revenue, the institution can divide the total of direct costs and indirect costs (three to four times direct costs^{6,7}) by its profit margin. Figure 2 illustrates that RWJUH would have to

earn \$10.8 million to pay for its HCV seroconversion.

For an NSI from a source-negative patient with an average direct cost of \$800 and \$2,400 in indirect costs (\$3,200 total per NSI,) RWJUH needed to generate \$106,700 in revenue to cover its costs. With the number of NSIs RWJUH was experiencing in 2011 and 2012 (69 NSIs and 56 NSIs respectively,) the hospital would have needed to earn an estimated \$13.3 million in revenue to cover its costs.

Results

Once hospital-wide training on Device B was complete, the RWJUH Employee Health Department monitored progress daily. With focus on reducing injuries and the right engineering control, RWJUH was able to reduce wingset-related PNSI injuries from 42% of all NSIs in 2011 to only 17.6% in 2012. In 2012, RWJUH experienced 51 contaminated NSIs, with nine wingset-related PNSIs due to clinicians' failure to activate the retracting needle safety mechanism in-vein as intended. In 2013, 60 contaminated NSIs occurred, with five involving wingsets (8.3% of overall NSIs) that also resulted from clinicians not activating the device as intended.

In 2010 and 2011, RWJUH used Device A (forward-shielding winged blood collection set,) purchasing 287,997 and

317,468 in those years respectively. In these two years, Device A was associated with 45 NSIs. In 2012 and 2013, RWJUH used 254,347 and 274,509 respectively. During those periods combined, Device B was associated with 14 PNSIs. The relative risk (RR) of a PNSI with Device A versus Device B is 2.81, with a 95% confidence interval of 1.64 to 5.68. The confidence interval excludes a relative risk of 1.0. Thus, Device A presented a significantly higher PNSI risk than Device B. See Figures 3 and 4.

Lessons Learned

While the new engineering control (Device B) afforded RWJUH clinicians better PNSI protection, the key to driving this change and ensuring the success of this safety initiative was involving end users in the process and the solution. At every point, RWJUH clinicians were involved in the process, from participating on the Sharps Safety Committee to inclusion on actual NSI investigations, product reviews, trials and the ultimate product selection.

When this training was complete across all users and departments, RWJUH recommended to leadership that employees be accountable for best practices. Previously, little post-injury remediation or training occurred, and there was a lack of institutional awareness regarding the scope of the problem. Now, every NSI is communicated to the employee's director for follow-up on best practice. Aggregate NSI data are shared with all leadership to provide an organizational risk overview to avoid silos of information and a potential under appreciation of the problem's seriousness. RWJUH formed a collaborative team to trial post-injury follow-up remediation to demonstrate and document competency in an employee's education record. Staff members are then expected and accountable for future safe best practice.

The RWJUH philosophy is that good outcomes as a result of safe work practices are noted in an employee's professional file and performance evaluation. Lapses in best practice are also documented, thereby tying performance to accountability and outcomes. This is a change

Figure 1.

Costs per NSI	Source-Positive Patient*	Source-Negative Patient**
Direct Cost	\$6,000	\$400 - \$800***
Administrative Burden	\$175	\$175
-Initial Assessment	(0.5 hours x \$50 = \$25)	(0.5 hours x \$50 = \$25)
-Reporting/investigation/follow-up	(3 hours x \$50 = \$150)	(3 hours x \$50 = \$150)
*Not including ongoing laboratory testing, Infectious Disease specialist follow-up visits and medications		
**Not including lost productivity or emotional impact		
***\$400 assumes only employee underwent testing; \$800 assumes patient and employee underwent HIV, HCV and HBV baseline testing		

Figure 2.

Total Direct Costs	\$81,000
Estimated Indirect Costs (3x Direct Costs)	\$243,000
Subtotal	\$324,000
RWJUH Profit Margin Goal	3%
Estimated Revenue Needed to Offset HCV Seroconversion	\$10,800,000

Figure 3.

	2010-2011	2012-2013
	Device A	Device B
Total NSIs	125	111
Total Phlebotomy-related (wingset) NSIs	45	14
Percent Wingset PNSIs of Total NSIs	36%	13%
Total Devices Purchased	605,465	528,856
Wingset PNSI Rate per 100,000 Purchased	7.43	2.65
Percent PNSI Rate Reduction	N/A	-64.38%

in mindset that is critical to the Accountability Cycle in Linda Galindo's book, *The 85% Solution*.⁸ The mindset is one of responsibility, self-empowerment and accountability for outcomes before the outcome is known.

No excuses, no shame, no blame. It is driven by a clear understanding or agreement of what is expected. In the case of an NSI, a clinician should expect education and training in which he/she must demonstrate proper use of the specific device. This training is expected to be utilized every time to deliver safe outcomes. When that does not happen, a "look back" or root cause analysis must take place to determine why expectations were not achieved. Everyone involved is 100% accountable for the outcomes and improvement. In this mindset, everyone is responsible for ongoing and sustainable safe practice. Personal responsibility is the only thing that will sustain change.

Conclusion

Preventing NSIs is a serious matter requiring our full commitment. Our goal can be nothing less than 100% accountability resulting in ZERO injuries. Part of a strong organizational and institutional safety culture is the willingness to take a systematic, data-driven approach to investigating and addressing these issues. It also takes forceful change agents that recognize when current practices, training programs and tools are actually contributing to the problem versus helping to reduce it. These strategies enabled RWJUH to successfully and significantly reduce wingset-related PNSIs. Despite the increase in device cost, RWJUH

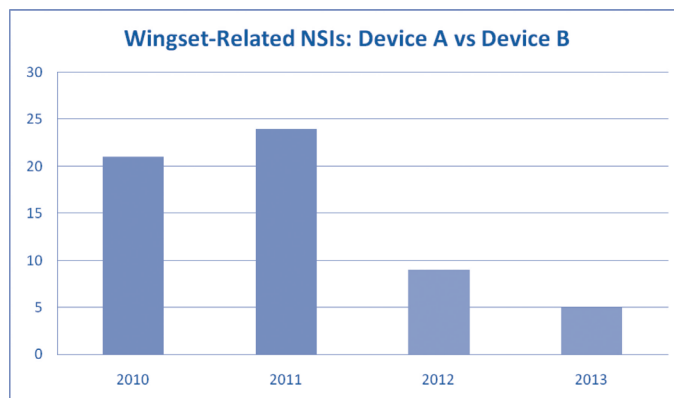
elected to do what is right for the clinicians who perform the procedures in question and live with their associated risks every day. Protecting and saving their lives was the focus, and RWJUH is now beginning to see the cost savings.

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Figure 4.



* 2010-2011 (Pre-Conversion) – Device A; 2012-2013 (Post-Conversion) – RWJUH used Device B.

Keys to Sustaining Success

- Educate and sustain awareness of risk.
- Monitor progress daily.
- Investigate all injuries for root cause.
- Include all stakeholders on follow up.
- Conduct mandatory hands-on re-training post injury.
- Report de-identified data monthly to leaders.
- Engage and empower SHARPS Safety Committee.
- Accountability for choices and outcomes.
- Constant Vigilance—Goal is ZERO needlesticks.

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