Transforming Intravenous Practices: Cost Savings, Better Patient Outcomes

Hartford HealthCare
Hartford Hospital

Lee Steere, RN, CRNI, VA-BC
Cheryl Ficara, RN, MS, NEA-BC, VP

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Introduction

Approximately 90% of hospitalized patients require a peripheral intravenous catheter (PIVC) during their stay, making it one of the most commonly performed invasive procedures in healthcare.[1] At 350 million, annual peripheral catheter sales exceed the estimated number of people in the United States (US). With only 37 million US hospital patient admissions per year, these data indicate an average usage of 9.4 PIVCs per patient admission. An estimated cost per IV insertion attempt is $35, thus the total US healthcare spend for PIVC insertions exceeds $12 trillion.[2]

Noted by Colleen Sweeney of the Patient Empathy Project, patients fear needlesticks more than prognosis.[3] Given that nursing students receive little to no training on appropriate PIVC selection criteria or insertion techniques, patients are receiving multiple—on average, 2.18 to 2.35[4]—insertion attempts leading to early catheter failure (due to poor placement and catheter selection), patient dissatisfaction, potentially harmful adverse events, use of more invasive vascular access devices, and increased healthcare costs. Once successfully placed, 63% of catheters fail due to five well studied and well understood preventable complications.[5]

Research has shown that by centralizing the PIVC procedure to an evidence-based approach within a vascular access specialty team (VAST), it is possible to achieve standard work flow among specialists who have a thorough understanding of vascular access issues and their impact on patient safety.[1]

This poster addresses the process that the VAST working with nursing leadership at Hartford Hospital, (867-bed, level one trauma center) used to transform infusion therapy practices.[1]

Evidence-Based Process Transformation

Inspired by a hospital-wide focus on eliminating waste and improving patient safety, the vascular access specialty team (VAST) wanted to improve PIVC care by changing from routine site replacement every 72–96 hours to replacement only when clinically indicated, thus reducing needlesticks. They proposed a prospective, comparative multimodal study that compared a VAST inserting PIVCs using a best practice bundle vs. the generalist model/current standard of care. The aim of the IRB-approved study was to achieve 1 PIVC per patient stay and demonstrate better patient outcomes, fewer IV-related complications, and overall cost savings.

A review of over 140 publications was conducted along with guidelines and best practice standards to develop a best practice bundle—called the PIV5Rights bundle (Figure 1)—to address the most common avoidable complications (infiltrations, phlebitis, infections, occlusions, and accidental dislodgement). Lean Six Sigma methodology was used to define, measure, analyze, improve, and control the implementation process of these best practices.

Fig 1. The PIV5Rights Bundle.

	The PIV Five Rights	Description	Evidence-Based Support
P	Right Proficiency	A skilled inserter who demonstrates 1st needlestick success at least 90% of the time and is proficient in ultrasound-guided peripheral catheter assessment and placement.	10 Publications*
I	Right Insertion	The use of ultrasound or vein viewer equipment for vessel selection and needle guidance to avoid "blind sticks." The use of an evidence-based aseptic no touch insertion technique (ANTT) to minimize site contamination.	52 Publications*
V	Right Vein	Place peripheral catheter in the forearm cephalic vein about 3" below the antecubital fossa and 2" above the wrist whenever possible to avoid joints and danger zones as well as optimize vessel health and adequate hemodilution.	22 Publications*
5	Right 5 Supplies & Technology	Procedural kit for protocol compliance; 22g/1.75" or longer catheter (forearm) to optimize the vein to catheter ratio; CHX Antimicrobial bordered securement dressing to reduce infection and dislodgement; Anti-reflux needleless connector designed to eliminate occlusions; Alcoholic chlorhexidine skin preparation and alcohol disinfecting cap to provide immediate bacterial reduction.	44 Publications*
R	Right Review	Routine assessment by proficient nurse to avoid unnecessary catheter replacements leaving in place until clinically indicated to remove. Hub disinfection with passive port protectors between access, routine pulsatile flushing, and dressing changes at 7 days for all catheters to maintain the life of the catheter.	13 Publications*

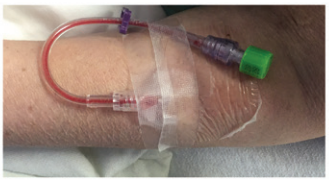
*See bibliography for full references.

The study design included key elements that would clearly illustrate to nursing leadership the clinical and financial benefits of the bundled VAST approach, including:

Photo Documentation

The VAST took photos during every assessment of every PIVC in the study to provide a side-by-side comparison between the 2 approaches.

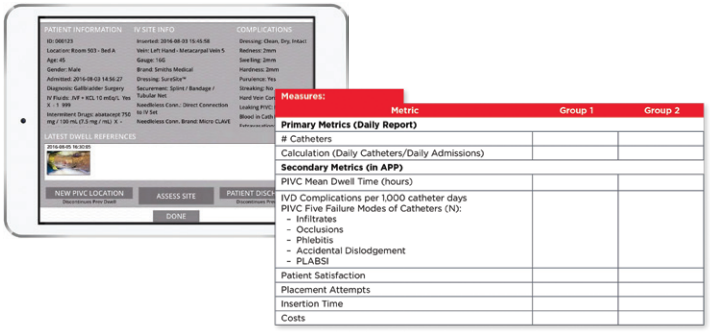
Group 1: Waste, Variability, Defects



Group 2: Standard Work, EVB-Best Practice

Data Collection & Analysis

The team developed HIPAA-compliant custom data collection forms for an iPad to allow for uniform collection of critical information about each PIVC and all team members were trained on their use. Custom data analysis forms were also created to allow for easy review.



Measures: Metric	Group 1	Group 2
Primary Metrics (Daily Report)		
# Catheters		
Calculation (Daily Catheters/Daily Admissions)		
Secondary Metrics (in APP)		
PIVC Mean Dwell Time (hours)		
IVD Complications per 1,000 catheter days PIVC Five Failure Modes of Catheters (N): - Infiltrates - Occlusions - Phlebitis - Accidental Dislodgement - PLABSI		
Patient Satisfaction		
Placement Attempts		
Insertion Time		
Costs		

Cost Analysis

The team developed a cost analysis to establish the cost basis per bed for IV therapy—a large cost most administrators do not understand in healthcare institutions around the world.

	GROUP 1 CATHETERS		GROUP 2 CATHETERS	
33,486 ADMITS 75% of 44,648 admits have an IV catheter placed	CATHETER USAGE (Admits Only)	CATHETERS PER PT VISIT	CATHETER USAGE (Admits Only)	CATHETERS PER PT VISIT
CATHETER USAGE	148,200 Catheters	4.4 148,200 ÷ 33,436	36,835 Catheters 89% Success Rate ÷ 1 Catheter 33,486 * 1.1	1.1
	Nurse Hours	FTE Equivalent	Nurse Hours	FTE Equivalent
TIME TO PLACE IV	49,400 148,200 x 20 minutes ÷ 60	23.75 2,080 h/yr. per FTE	12,278 36,835 x 20 minutes ÷ 60	5.9 2,080 h/yr. per FTE

	Labor	Supplies	Cost per IV	Total	Labor	Supplies	Cost per IV	Total
IV COSTS	$16.17 RN @ $48.50/hr	$11.80 Catheter, Tubing Connectors/ Caps, Kit	$27.97 $16.17 + $11.80	$4,145,154 148,200 x 27.97	$18.68 IV-trained RN @ $56.01/hr	$14.40 Adds better technology	$33.08 $18.68 + $14.40	$1,218,502 36,835 catheters x 33.08
PER BED				$4,781 $4.1M/867 beds				$1,405 $1.2M/867 beds

Results

After IRB approval, the study was conducted in a 47-bed medical unit from November 2016 through February 2018.

Variable	Group 1 (n=94)	Group 2 (n=113)
1st Time Success Rate	33%*	96%
Success Rate (therapy completed)	15%	89%
Dwell Time, Hours (mean ± SD, P<0.001)	29.6 ± 18.0	71.4 ± 58.8
Dwell Time, Hours (Upper End)	110.98	333.21
Complication Rate (%, P<0.001)	40%	11%
Cost/Bed/Year (2018 USD)	$4,781	$1,405
Saving/Bed/Year (2018 USD)	-	$3,376

*Study failed to capture number of attempts or percentage of success associated with Group 1; 33% is from the literature.[1]

Conclusion

- During the study, the hospital saw a 90% reduction in catheters purchased. Using the cost analysis, projected annual savings are $3376 per bed—$2.9 million overall—due to improved efficiency and less waste.
- As a result of the clinical and financial outcomes, the Chief Nursing Officer approved the proposal to centralize PIVC insertions with the VAST, which led to a three-fold expansion of the specialized vascular access team in less than four years.

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Evidence Supporting the PIV5Rights Bundle

Right Proficiency

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Right 5 Supplies & Technology

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