

Impact of near infrared (NIR) vein visualization technology on costs associated with peripheral intravenous access: development of a return-on-investment (ROI) tool

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Background

Up to 90% of inpatients will require a peripheral intravenous catheter (PIVC) during their hospitalization.^{1,2} On average, 1.37-2.35 attempts are required to place each PIVC,^{3,4} and up to 90% fail prior to intended removal, requiring replacement.¹ The average cost of first attempt PIVC placement is roughly \$28 to \$35, and this cost increases exponentially with repeated access attempts.⁵ Each PIVC attempt failure is associated with increased supply and staff costs. Reducing PIVC attempts could contribute to cost savings.^{2,4,6,7} For example, at an 867-bed, Level 1 trauma center with approximately 105,000 patients entering the emergency department (ED) annually; achieving a 96% first-attempt success rate resulted in cost savings of \$3,376 per bed per year, or \$2.9 million annually.⁶ Near infrared (NIR) vein visualization technology has been shown to improve PIV assessment for cannulation, decrease the overall procedure time, and decrease the number of required attempts.⁸⁻¹⁰ However, there is limited data on the cost effectiveness and financial feasibility of the widescale adoption of NIR vein visualization technology.

Purpose

To develop an easy-to-use, multi-dimensional return-on-investment (ROI) model that can assist healthcare institutions to evaluate the economic benefits of NIR vein visualization technology.

Implementation / Methods

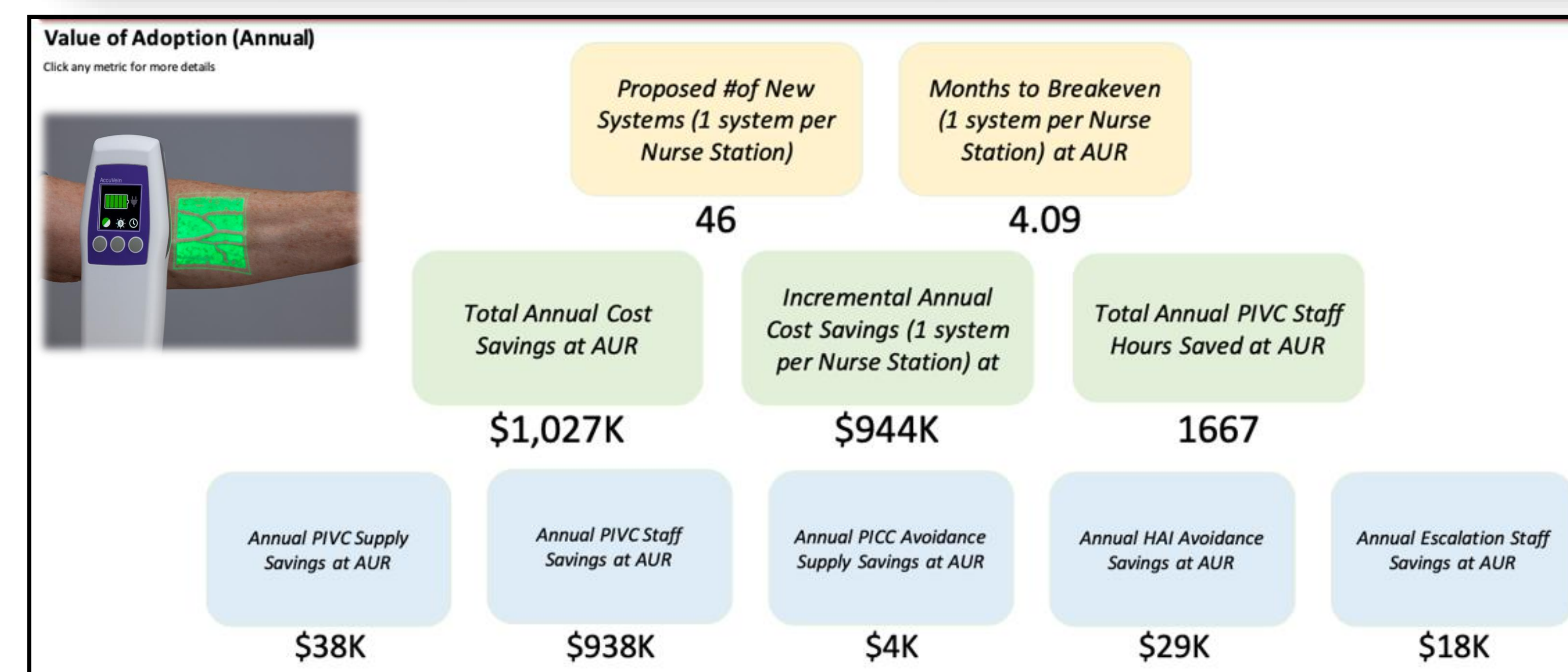
An interactive ROI tool was designed to estimate the finance and resource implications of the widescale adoption of NIR vein visualization technology. The tool was developed from a comprehensive synthesis of the literature.

Implementation / Methods contd.

Findings were used to inform the development of algorithms that predicted finance and resource implications. Application of the ROI tool to a 500-bed hospital that utilizes a NIR vein visualization device (AccuVein Inc., Medford, NY) is presented below.

Results – What were the findings?

The ROI tool was applied to a 500-bed hospital with an existing total of four NIR devices and a utilization rate of 25%. An investment of \$322,000 was required to purchase 46 additional NIR devices. The ROI tool estimated that that at a utilization rate of 25%, annual hospital cost and time savings would be >\$1 million with 1667 staff hours saved annually. Furthermore, annual supply savings were estimated as >\$35,000; annual staff savings as >\$930,000; annual escalation avoidance savings as \$22,000; and annual infection avoidance savings as \$29,000. The estimated total per unit savings was \$20,532. If a 50% utilization rate is reached, the savings would double (>\$2 million on hospital costs, 3334 staff hours saved annually, >\$70,000 annual supply savings, >\$1.8 million staff savings etc.).



Limitations

The ROI tool was developed based on a review of the literature. However, the tool should be empirically validated across several institutions to confirm algorithms and enhance accuracy and validity. Furthermore, the tool accounts for the cost of purchasing NIR technology only. Ongoing costs for NIR device cleaning or repair should be considered in future versions of the ROI tool.

Metric	Total Savings	Per Unit Savings	% of Total
Annual PIVC Supply at AUR	\$37,507	\$750	4%
Annual PIVC Staff at AUR	\$937,676	\$18,754	91%
Annual PICC Avoidance Supply at AUR	\$4,125	\$83	0%
Annual HAI Avoidance Savings at AUR	\$29,172	\$583	3%
Annual Escalation Staff at AUR	\$18,144.00	\$363	2%
Total	\$1,026,624	\$20,532	100%

Conclusions and Future Directions

Safe, efficient, and effective PIVC placement is critical to providing high-quality care in the post COVID19 era. First-attempt success can be optimized with the assistance of NIR vein visualization technology, which decreases overall procedure time, the number of required attempts and costs. This ROI tool can be used to evaluate the financial impact of investment in NIR vein visualization technology and demonstrate any potential cost savings. A key component of successful adoption of NIR vein visualization technology is ensuring that devices are readily accessible, and that the device is routinely used as an assessment tool rather than an escalation tool.