

# Evaluating the economic value of using Vscan



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# Evaluating the resource utilization and economic value of Vscan within UPMC Cardiology Services

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This Quality Improvement (QI) Project was approved by the University of Pittsburgh Medical Center (UPMC) Presbyterian Shadyside Total Quality Council.

## Executive summary

A prospective pilot QI (Quality Improvement) Project was completed assessing the economic impact of the use of Vscan™ pocket-sized ultrasound by attending cardiologists as an adjunct to the standard cardiac physical exam. The study was conducted at UPMC Presbyterian Shadyside Hospital with Vscan ultrasound products and product training provided by GE Healthcare. The rate of echocardiogram referrals, length of stay and readmission rates in three cardiology service areas at a single UPMC hospital (UPMC Presbyterian Hospital campus) were measured over four (4) months. In this two (2) month pre-post QI Project, we found that the use of Vscan led to significant decreases in echocardiogram referrals when used in the cardiac consult and cardiology CCU services. A non-significant increase in these referrals was noted in the Cardiac Pavilion group. Additionally, we saw a statistically significant overall 1.23 day decrease in mean length of stay with no difference in 30-day readmission rates with use of Vscan.

This QI Project provides promising preliminary data on the potential value of Vscan, which will be confirmed by UPMC in an expanded QI project.

## Introduction

A cornerstone of the initial evaluation of patients referred to cardiology services within the hospital is the physical examination. However, its accuracy has recently been challenged by Sztajzel and colleagues who discovered in a study that only 20-70% of major valvular diseases were correctly identified during a physical exam through auscultation, exemplifying the inaccuracies of the traditional physical examination for these patients.

Echocardiography has played a central role in cardiologic practice and is essential in the evaluation of many patients with suspected or known cardiovascular disease. Vscan, a noninvasive diagnostic tool, provides low cost, detailed morphologic and functional information of the heart and great vessels, significantly impacting diagnostic accuracy, therapeutic orientation, and prognosis (Cardim).

In the past decade, hand-carried ultrasound devices like Vscan have become available and studies have demonstrated that adding a quick visual ultrasound examination at the point of care can increase diagnostic accuracy, detect disease earlier, improve triaging and referral, and impact healthcare efficiency, thereby significantly impacting health care costs (Cardim, Badano, Giansteffani, Trambaiolo).

Clinicians at UPMC Presbyterian Hospital campus hypothesized that the use of Vscan in their cardiology services to quickly scan patients could impact echo referrals as well as patient length of stay. Therefore, to better understand the value of Vscan as an adjunct to the physical exam, UPMC Presbyterian Shadyside Hospital conducted a pilot QI Project to measure the clinical utility and potential economic impact of physicians using Vscan as part of their physical examinations. The Project's objective was to measure and report the rates of referrals for full echocardiograms with and without the use of the Vscan device by attending cardiologists and fellows during routine examinations in three different cardiac use settings: Consultation (low risk patients), Pavilion (non-stratified patients/intermediate risk patients) and Intensive Care Units (high risk patients). Secondary exploratory endpoints were length of stay and 30-day readmission rate. This QI Project was approved by the UPMC Presbyterian Shadyside Total Quality Council.

## Methods

A pre-post Project design was used to assess the impact of the use of Vscan. Data on patients who underwent assessment using just the physical examination (pre) were compared with those from patients who received both a physical and Vscan ultrasound examinations (post). Data on patients seen at the UPMC Presbyterian Shadyside Hospital in any of the three use settings described earlier undergoing only physical examination were collected over a 2-month period from March 1 through April 30, 2013. After this data was collected, each physician was then trained on the use of the Vscan device. Then from May 1 to June 30, 2013, post-Vscan data was collected in the same cardiology settings utilizing the same collection form used during the first two-month period of the study.

### Data collection

Clinicians developed a one-page data collection form to record whether an echo referral was ordered. Baseline demographics, diagnoses, case-mix index, severity index, and risk of mortality, were extracted electronically from UPMC's electronic health record. Length of stay and readmission rate data were collected retrospectively using the same electronic record.

Additionally, qualitative data on workflow (Vscan exam time, usefulness, ease of use, etc.) were gathered at the end of the study through a short survey and face-to-face interviews of the Vscan users.

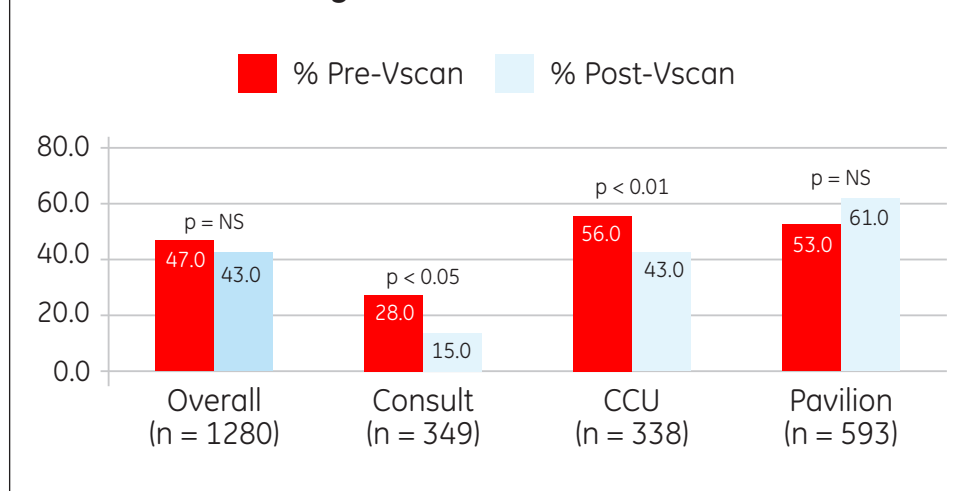
### Vscan users

The Vscan users were ten cardiology fellows and attending physicians. To minimize user variability and bias, the same ten Vscan users participated in the pre- and post-Vscan periods.

### Vscan training

A half-day training course on the use of the Vscan was conducted by a GE clinical manager and access was granted to an online Vscan reference course leveraging already developed training materials.

Figure 1: Echo Referrals



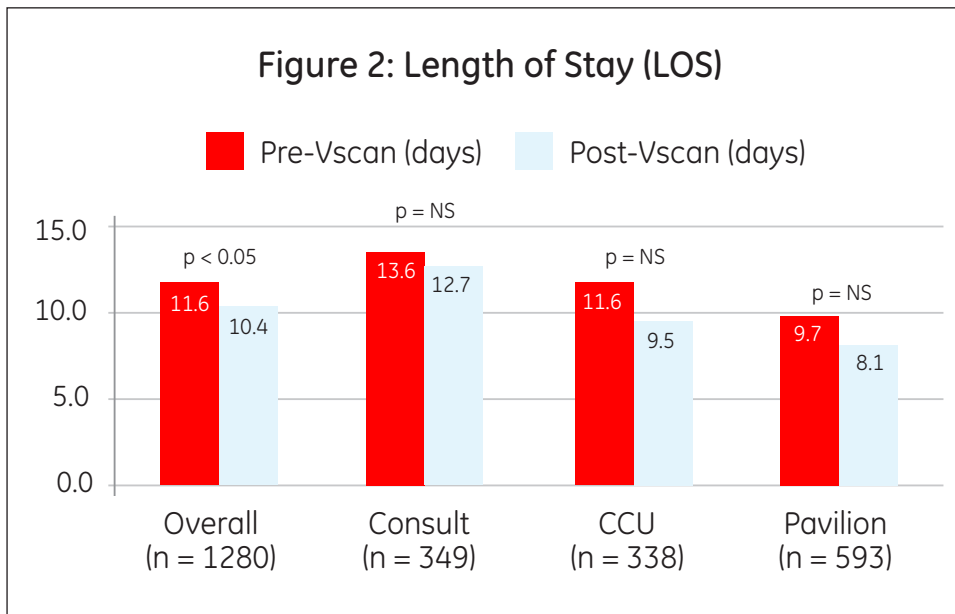
## Statistical Analysis Plan

Analyses, supported by GE Healthcare health economists, evaluated differences in rates of referrals for full echocardiograms, length of stay (LOS), and percentage of patients readmitted prior to and following use of Vscan. Descriptive analysis of age was conducted using t-tests and gender was analyzed using chi-square test. Case-mix index, severity of illness, and risk of mortality were compared using Mann-Whitney U-test. Multivariate analyses evaluated mean LOS and likelihood of readmission using log-linear GLM and logistic regression techniques, respectively.

## Results

### Percent of patients with an echo referral

The overall combined results of 1280 patients resulted in a statistically non-significant decrease in the number of echos when Vscan was utilized by cardiologists. However, when the results were analyzed in each of the three use-settings separately, significant reductions in echo referrals were reported in 2 of the 3 (Consult and CCU) settings with Vscan use. The Pavilion setting resulted in a non-significant increase in the number of echos post Vscan use. (Figure 1)



Adjusted for age, gender, CMI, illness severity, mortality risk

### Length of stay

Mean length of stay was also analyzed between the two cohorts, pre- and post-Vscan. After adjustment for age, gender, CMI, illness severity, and mortality risk, all LOS measures decreased in the post-Vscan groups with differences in length of stay ranging from 0.88 to 2.09 days in length. While these measures all trended in reduced LOS, none of these results were found to be statistically significant. (Figure 2)

### Thirty-day readmission rates

Readmission rate data were also analyzed and adjusted for age, gender, CMI, illness severity, and mortality risk. All readmission rate results were found to be non-significant, indicating that the use of Vscan in this population did not impact readmission rates.

Table 3: Thirty (30) Day Readmission Rate

Odds of Readmission Adjusted	Post-Vscan (vs. pre-Vscan)	95% CI	p-value
Overall	0.96	(0.64, 1.46)	NS
CCU	1.02	(0.41, 2.57)	NS
Pavilion	1.03	(0.53, 1.98)	NS
Consults	0.94	(0.45, 1.95)	NS

Adjusted for age, gender, CMI, illness severity, mortality risk

### User surveys

At the end of the study, a survey was administered to Vscan users to assess user utility and satisfaction with Vscan.

One hundred percent (100%) of survey respondents found the use of Vscan improved their diagnostic confidence; 45% had increased confidence 'some of the time' while 55% found Vscan improved their confidence 'often'. Physicians also indicated a high likelihood (82%) that they would recommend Vscan to their colleagues.

In addition, each of the 10 users was interviewed to gather more specific feedback on the clinical use and both clinical and economic benefits of using Vscan in their daily practice.

The top areas of clinical utility were:

1. Pericardial effusion
2. Qualitative ejection fraction
3. Valve function
4. IVC evaluation
5. Pump placement
6. Chest pain evaluation (ED)

The key benefits were (in rank order by mention):

1. Ease of use
2. Immediate clinical information/speed to diagnose
3. Patient satisfaction
4. Portability
5. Teaching tool

The users believed that the use of Vscan might have an economic impact in the reduction of inappropriate studies, costs to patients, costs to the healthcare system and repeat exams, as well as improving physician and patient satisfaction. Other anecdotal feedback from the users suggested Vscan may have improved physician and patient satisfaction. Other than as noted above, these factors were not objectively measured.

## Economic implications

### Annualized potential cost savings projects

In this pilot QI Project using a small, select population of cardiac patients, the use of Vscan during a physical examination resulted in a non-significant reduction in the number of overall referrals. If this reduction was monetized for the UPMC Health System, it could result in a decrease of 26.8 echo referrals every 2 months or 154 echos per year translating to a cost savings of \$62,720 per year (see Additional Resources for calculations).

Length of stay was also measured in this study. Although in this pilot study the LOS differences were not statistically significant for each individual cardiac service, they were significant for the overall cohort, with an average decrease of 1.2 days in the 735 patients who were admitted to the hospital. If this same decrease was seen over the remainder of the year in the three cardiovascular settings, the use of Vscan could result in a total cost savings in length of stay of \$4,498,200 assuming the cost of a bed-day is \$1,700 (see Additional information for calculations).

This QI Project did not assess costs associated with the time spent by providers in training and performing the ultrasound examinations, or assess the amortized cost of the ultrasound equipment.

## Discussion

This short-term QI Project adds to existing literature indicating potential benefit of portable ultrasound examination as an adjunct to the traditional cardiac physical exam, indicating the potential to impact both echocardiogram referrals as well as patient length of stay. Echo referrals did decrease among two groups of patients who underwent examination using Vscan, while those seen in the Pavilion setting had an increase in echo referrals. This might be explained due to the different patient illness levels in each setting. In this pilot QI Project, the observed benefits of Vscan use were most pronounced in the settings where patients were known to have a cardiac problem and were critically ill (CCU – high cardiac risk), or when patients were admitted for non-cardiac issues and a cardiology consultation was obtained (cardiology consults – low cardiac risk). In these patient groups where there may have been higher confidence among clinicians that patients either had or did not have cardiac disease, the use of Vscan may have provided enough additional information to confirm a decision not to order an echo. However, in the middle patient group (Cardiac Pavilion – intermediate cardiac risk), it is possible that physicians using Vscan identified issues that required additional testing or had enough diagnostic uncertainty to warrant further investigation.

This QI Project also suggests a trend toward shorter inpatient lengths of stay in every treatment setting among patients undergoing Vscan examination, without an increase in readmissions. While the observed findings of this QI Project are promising, they should be corroborated in a larger study, given the relatively small sample size of the study. Further QI projects addressing the impact of Vscan on these different metrics on larger populations are needed in order to understand the full impact of this technology.

## Conclusions

Patients in two of the three settings of cardiac care within the UPMC Presbyterian Hospital campus undergoing examination using Vscan experienced significant decreases in echo referrals. In addition, the overall length of stay for all three services combined showed a significant 1.23 day decrease, although the decrease was not statistically significant in any of the individual cardiac services in the pilot study. This pilot QI Project suggests that use of this technology may reduce the cost of care. Future longer-term QI Projects with larger patient populations are needed to confirm these findings.

## Additional information

### Echos

- 301 echos ordered pre-Vscan
- 638 patients seen pre-Vscan
- 276 echos ordered post-Vscan
- 642 patients seen post-Vscan
- 640 used to normalize patient volume (avg. of 638 and 642)
- Multiply by 6 months to annualize it because the difference of 25 fewer echos was seen in 2 months
- \$390 (CMS Reimbursement rate as of Dec. 2013)
- Calculation:  
$$= (301/638) - (276/642) \times 640 \times 6 \text{ mon} \times \$390 = 62,719$$

### LOS

- 1.2 mean decrease LOS difference between pre- and post-Vscan
- 735 patients with inpatient stay (in both pre- and post-Vscan periods over the 4 month period)
- According to an April 2012 report by Becker's Hospital Review, the average 2010 cost of an inpatient hospital stay is \$1700
- Calculation:  
$$1.2 \times 735 \times 3 \text{ four-month periods to annualize} \times \$1700 = \$4,498,200$$



## References

Badano LP, Nucifora G, Stacule S, et al. Improved workflow, sonographer productivity, and cost-effectiveness of echocardiographic service for inpatients by using miniaturized systems. *European Journal of Echocardiography* Feb 2009;10(4):537-42.

Cardim N, Golfin CF, Ferreria D, et al. Usefulness of a New Miniaturized echocardiographic system in outpatient cardiology consultations as an extension of physical examination. *J Am Soc Echocardiogr* Nov 2010;24(2):117-24.

Gianstefani S, Catibog N, Whittaker AR, et al. Pocket-size imaging device: effectiveness for ward-based transthoracic studies. *Eur Heart J Cardiovasc Imaging* May 2013.

Sztajzel JM, Picard-Kossofsky M, Lerch R, Vuille C, Sarasin FP. Accuracy of cardiac auscultation in the era of Doppler-echocardiography: a comparison between cardiologists and internists. *Int J Cardiol.* 2010;138:308-10.

Trambaiolo P, Papetti F, Posteraro A, et al. A hand-carried cardiac ultrasound device in the outpatient cardiology clinic reduces the need for standard echocardiography. *Heart* 2007;93(4):470-475.

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