



Vocera Communications:

Vocera Benefits Study at St. Agnes Hospital



Executive Summary

Inpatient healthcare delivery involves a complex set of processes that requires interdisciplinary teamwork and frequent communication among physicians, nurses, unit secretaries, and ancillary staff. Many healthcare organizations are aware that their current communication processes are inefficient and provide numerous opportunities for miscommunications and errors. As a result, these organizations have started to undertake enterprise-wide clinical redesign projects. However, new processes that allow caregivers to focus first on their primary job functions require new technology to support their interactions. Often these interactions are not at a nursing unit, or near a phone, and the new technology must support them, wherever they are.

Significant improvements in voice recognition, wireless technology, connectivity, and identity management now make intelligent communications a practical reality. Recognizing the power of applying this technology to health care, Vocera has developed a wearable hands-free communications system using the existing wireless local area network (WLAN) to support instant mobile voice communications and messaging. The system has been implemented in a number of acute care delivery facilities, and initial feedback from care providers has been very positive.

Though the potential benefits of this solution are self-evident, the impact had not been measured. To close this gap, Vocera and St. Agnes Healthcare agreed to undertake such a benefits study, using data collection tools and detailed analysis to understand where and how this technology impacts workflow, communications, and care giver satisfaction. First (FCG) was engaged to lead the effort, with

assistance from the clinical staff, members from the hospital site's Information Services and Process Redesign departments, and a clinical operations consultant from Gresham Smith and Partners (GS&P), an architectural design firm.

St. Agnes Healthcare in Baltimore, MD, was selected as the study site because it had recently implemented the Vocera Communications System on several units and could provide both the "before Vocera" and "after Vocera" units for the study. St. Agnes also has an enterprise-wide wireless LAN, a key requirement for Vocera communications with ancillary staff who need to travel outside of the nursing unit while maintaining real time communications.

Data collection was done using several methods: direct observation, tracking logs, nurse shadowing, interviews, surveys, and data extracted from the Vocera system. Call volume and user data from the Vocera system and the data collected during the time motion studies were used as input to model the before and after workflows using iGrafx Process 2003 software provided by GS&P to calculate annual savings

Results from the study identified a number of significant findings.

- **Nursing and Unit Secretary time savings is substantial** with an overall communication time difference on a unit between the Vocera and non-Vocera nursing units of more than 3,400 hours annually, or the equivalent of **1.7 FTEs**. Specifically, Unit Secretaries saved 1,650 hours, nurses saved 1,146 hours, and nurse techs saved 626 hours per unit per year. These findings were confirmed by the users, a majority of whom believed they save more than 30 minutes a day.

- **Using the Vocera system for communications was more than five times faster than other communication methods.** Vocera enables mobile and direct communications, thereby eliminating frequent communication hand-offs and reliance upon the Unit Secretary as the communication hub.
- **Communications between staff on the Vocera-enabled nursing unit improved.** Having the capability to directly connect with other nurses to answer questions and provide care assistance is facilitated with Vocera.
- **Overhead paging decreased by more than 94 percent** on the Vocera unit.
- **Nursing believes Vocera improves workflow and the ability to deliver quality patient care.** Almost 80 percent of the nurses agreed that Vocera has positively improved workflow; only 16 percent reported that communication without Vocera was effective.

The full spectrum of Vocera capabilities has not yet been implemented at St. Agnes. The study identified several areas where the Vocera system was not currently used that will further increase overall workflow efficiencies and savings when implemented.

The impact of Vocera on improving workflow, saving time, and increasing satisfaction across the users is measurable and is significant. Expanding both the number and types of users, using more of the advanced functionality, and further integration of Vocera will continue to have a positive impact upon workflow, decreasing delays and speeding care delivery.



Background and Overview

The Vocera Communication System consists of two main components: the Vocera Communications Server Software and the unique Vocera Communications Badge (Figure 1). This badge is a small, wearable device, weighing less than two ounces that permits quick, one-button voice access to other users on the system, or connects to outside phones through PBX integration. Features of the badge include:

- Voice controls, providing hands-free ability to answer incoming calls
- Ability to designate the party to be called by name, title, function, or group eliminating the need to know phone numbers or who is on duty
- Conference calling, broadcast messages and voice mail messaging, facilitating group announcements
- Ability to call to and from the badge through the PBX to other phones inside and outside the hospital.

The Vocera Communications System takes advantage of three converging technologies: wireless LAN, VoIP, and speech recognition software and leverages a hospital's 802.11b wireless

network to allow in-building mobile workers to communicate instantly with one another while working, without relying upon wired phones and other communication systems.

Vocera and St. Agnes Healthcare in Baltimore, MD, one of the early Vocera adopters, decided to conduct a study to quantify the impact of the Vocera Communications System on inpatient care workflow and communications. FCG was engaged to lead the effort. Other members of this team included Gresham Smith & Partners for process modeling and clinical expertise, St. Agnes Process Redesign analysts, and clinical analysts from St. Agnes Information Services. Besides being one of the first sites to install Vocera (installed on the study nursing unit since May 2003), St. Agnes was selected because a high availability wireless infrastructure was already in place to allow instant communications throughout the hospital campus. The study was conducted in December 2003 and the analysis completed in January 2004.



[Actual Size]

Figure 1: Vocera Badge



About St. Agnes Healthcare

St. Agnes HealthCare is a 299-bed non-profit healthcare organization, serving the Baltimore/Washington D.C. area. It is a full-service community teaching hospital with residency programs in a number of medical/surgical specialties.

Services at St. Agnes HealthCare include: The St. Agnes Cancer Center, The Chest Pain Emergency Center, Cardiovascular Services, Women's Health Services, The Joint Connection, The Center for Minimally Invasive Surgery and Telemedicine, and the St. Agnes Emergency Department, which includes pediatric, adult, and urgent care emergency centers.

St. Agnes recognized early the benefits of a mobile workforce and began deploying a solid, secure, highly available wireless infrastructure in late 1990's. A separate virtual local area network (VLAN) was created on the network for transport of wireless voice calls, along with quality of service (QoS) mechanisms ensuring clear call transmission.

Approach

Understanding the value of Vocera required collecting both quantitative and qualitative data. Assessing the return on investment required evaluating multiple factors including time savings, reduction in overtime, improved patient care, etc. However, tools that cannot be assimilated into workflow and are not deemed useful by the caregiver will not be adopted. Therefore, it was important to capture and quantify how well staff accepted the technology, and to what extent they considered it an important tool for improving workflow and completing care delivery tasks. Tools and methods for data collection and analysis were created that would address both aspects of value.

During the time of the study, St. Agnes was in the process of rolling out Vocera to the inpatient units so both “pre” and “post” units that were comparable in terms of size, patient case mix, and physical layout could be studied. The two 32-bed, study units studied were:

- 6 South, which used traditional communications methods including phone, pager, overhead pager, and face-to-face conversations, and
- 6 North, which had all of these methods plus Vocera.

During the observation period, nurse and nurse tech staffing for the two units was the same: seven nurses on the day shift, five on the evening shift, and four on the night shift. There were three nurse techs on all three shifts. Six North had two unit secretaries on the day shift and the first half of the evening shift and one the rest of the time. Six South had one unit secretary on all three shifts.

Although the two units had slightly different case mixes, the floor layouts, ward environments, and work practices are very similar, providing a relatively controlled environment for the study. Census during the study period was approximately the same.

Data collection was focused on only the most prevalent communications processes, which included inbound communications from physicians, patients, patient family, Pharmacy, and Laboratory and outbound communications to physicians, IV Therapy services, and ancillary departments. Process flows for each were developed using VISIO to depict the pre- and post-Vocera impact and identify the data capture requirements. An example is depicted in figure 2.

Nursing Unit Highlights:



- Both 6 North and 6 South are Medical Surgical nursing units, although more than 90 percent of the patients are medical patients.
- The average census during the study was 31 patients with a minimum of 29 and a maximum of 32.
- Same general layout consisting of a central nursing station with a corridor of patient rooms on each side.
- A few touch-down areas are located within each area providing access to computer, phone and open workspace.
- Clinical documentation by the staff occur in several areas with progress notes contained in folder at entrance to patient room, medication administration documented in binder on pharmacy cart, and patient record located at central nursing station.
- Basic nurse call systems operate on both units providing both audible and visible alerts at the patient room and central nursing station.
- Intercom paging system used on each unit for broadcast messages



Nurse to External Department Communication e.g. Pharmacy, IV Therapy, Laboratory

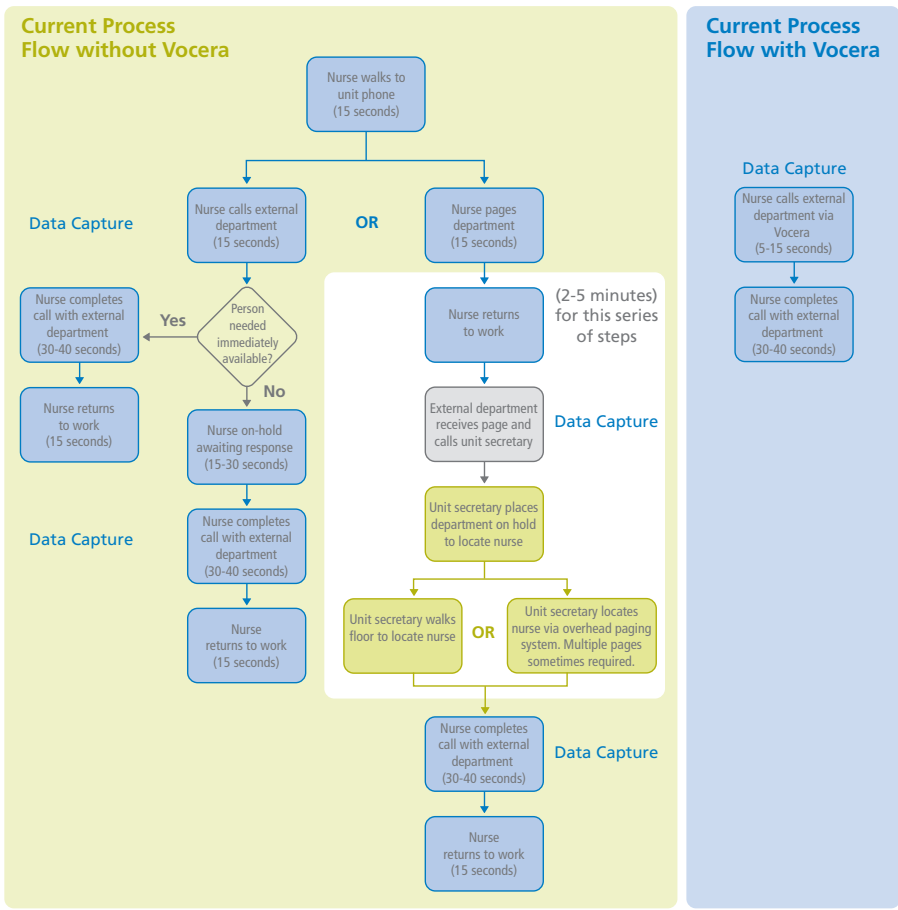


Figure 2: Communication Process Flow

Study Findings

Both the observations on the units and the surveys demonstrated positive impacts of Vocera. Time savings from using Vocera over traditional communication methods on one nursing unit netted a time savings of more than 3,400 hours a year or the equivalent of 1.7 FTEs. **Average communication time using Vocera was more than five times faster than other methods.** In addition, nurses and unit secretaries reported that Vocera had a positive impact on workflow and their ability to deliver quality patient care.

Analysis of Process Flow Modeling

Using the Process 2003 modeling application to determine the annual impact of Vocera on one nursing unit required the team to load all of the process flows and then enter times for each step based on the data collected during the study. For each step, an average time was entered with a high and low range. The software model varied communication volumes for the different shifts and the days of the week.

In order to demonstrate the differences between the Vocera and non-Vocera units, the following assumptions and process decisions were made and built into the model:

- The Vocera call log volumes were used as the baseline for comparison for both units. Since the team was not able to track all nurses and unit secretaries, the most reliable volumes were from the Vocera system.
- The analysis was focused on calls initiated by the nursing unit. This was done to show a direct correlation between the communications made by a unit and the savings. Communications were grouped into the following categories:
 - Unit Secretary to RN communications
 - Unit Secretary to Internal staff

Data capture points identified within each flow became the input requirements for the unit secretary and nursing data collection worksheets and logs used to record volume of activity and the duration of specific steps.

To analyze the level of end user satisfaction and perception of how the current communications tools impact the end user's ability to be efficient and provide quality care, customized surveys were developed and distributed to nurses and unit secretaries. Separate surveys were created for Vocera and non-Vocera users.

Data Collection

The team used two approaches to capture the frequency and time elements of communication workflows. First, a log file on the Vocera server was created capturing

every call placed and received by the Vocera Communication System over a four-day period—Wednesday through Saturday—24 hours a day. This provided a baseline for modeling the communication workflows. Second, to support the baseline data, as well as identify differences between the two units, three registered nurses and one unit secretary were shadowed by study participants for the same four days on both nursing units. During the four observation days, all three shifts were observed, with emphasis on the first shift because it has the highest communication volume.

Surveys were distributed on each unit during the days the team was on site and asked to be completed within one week. Completed surveys were collected by St. Agnes Process Design staff and sent to FCG for analysis.

- Nurse Tech to internal staff
- Nurse Tech to external departments
- RN to internal staff
- RN to external departments
- Unit secretary to external department communications were not modeled because there was little or no difference in time between the Vocera call and prior phone call processes since the unit secretaries were already next to a phone.
- Average communication process times were calculated from the direct observation data on the non-Vocera unit and from the system call logs for the Vocera units.

The results are summarized in the following table. At all levels and all types of communications, Vocera is at least five times quicker than other methods. Project these results over a year yields 3,477 hours—time that normally would be lost and can now be spent on patient care. Assigning a dollar value to the time savings, the model used average salaries for each position and calculated the result to be more than \$74,000/unit/year.

How the hospital actually experiences this value depends upon how much overtime can be averted and/or unit staffing adjusted. At a minimum though, the time freed can be devoted to more time with patient care.

Survey Findings

The surveys focused on understanding more about the specific impacts:

- reduction in overhead pages,
- more efficient workflow, and
- preferred communication method to support care delivery on the unit.

The surveys also asked participants to quantify the changes in number of interruptions and the number and duration of wait times before and after Vocera was implemented as a way to cross-check the results of time-motion studies.

The following results were based on 24 completed nursing/nurse tech surveys from 6 North (Vocera) and 19 received from 6 South (non-Vocera) and five unit secretary completed surveys from each unit.

Process 2003 Modeling Analysis Results

	Volume Statistics	Avg Communication Process Time (in minutes)	Total Labor Hrs Required to Complete Communication Process	Total Labor Hrs Saved
UC to RN Communication*				
With Vocera	27,017	0.32	144	639
Without Vocera	27,017	1.74	783	
UC to Internal Staff*				
With Vocera	26,950	0.42	189	1011
Without Vocera	26,950	2.67	1199	
Nurse Tech to Internal Staff				
With Vocera	11,555	0.43	83	431
Without Vocera	11,555	2.67	514	
Nurse Tech to External Dept				
With Vocera	4,739	0.37	29	195
Without Vocera	4,739	2.84	224	
RN to Internal Staff				
With Vocera	23,621	0.42	165	886
Without Vocera	23,621	2.67	1051	
RN to External Dept				
With Vocera	7,674	0.51	65	315
Without Vocera	7,674	2.97	380	
The Bottom Line				3,477

Table 1: Modeling 2003 Analysis Results

Overhead Paging

Field data reported a dramatic decrease in the use of overhead paging between the two units with an average decrease of more than 94 percent. For example, on one 7 a.m. – 3 p.m. daytime shift, 6 South had 29 overhead pages compared to two on 6 North.

- To validate that the Vocera Communication System reduces the noise caused by overhead paging, the following question was asked of 6 North staff with both nurses (83 percent Agree/Strongly Agree) and unit secretaries (80 percent Agree) confirming emphatically.

Survey Question: Has the overhead paging noise and disruption been reduced since the implementation of Vocera?

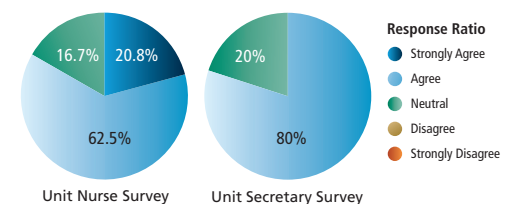


Table 2: Reduced Overhead Paging Due to Vocera



Communication Tool of Choice

Survey results show Vocera was the most frequently selected communication tool of choice, displacing overhead paging, which went from the primary tool to the third most frequently used. This validates that Vocera is not only easy to use but beneficial to unit secretaries whose job it is to facilitate smooth communication across a multi-disciplinary team.

Survey Question: Rank the following approaches to locate personnel in the unit and hospital. Place a 1 by approach most used and 4/5 by approach least used.

Unit Secretary Survey Question Non-Vocera:		
	Average Responses	Response Ranking
Walk and Find Person 1.	2.83	3
Call Pager 2.	2.17	2
Call Via House Phone 3.	3.67	4
Call Via Overhead Page 4.	1.34	1

Unit Secretary Survey Question Vocera:		
	Average Responses	Response Ranking
Walk and Find Person 1.	4.33	4
Call Pager 2.	2.33	2
Call Via House Phone 3.	4.67	5
Call Via Overhead Page 4.	2.67	3
Use Vocera Badge 5.	1	1

Table 3: Communication Approaches to Locate Personnel

The above two survey responses also validate our assumption that the overall communication volume is the same between the units—only the tool has changed. In this case the change was from overhead paging to Vocera.

Do you agree that current communications support efficient nursing workflow?	
Non Vocera Unit:	15.8 %
Vocera Unit:	79.2 %

Improved Workflow

To gauge the effectiveness of current communication methods, survey respondents were asked if current methods positively impact workflow and patient care. Only 15.8 percent of

nurses on the non-Vocera unit felt that communications supported efficient workflow compared to 79.2 percent on the Vocera unit. The responses from unit secretaries did not show as much change with Vocera, probably since they are not as mobile as the nurses.

Support the Delivery of Quality Care

When asked if the current communication methods have a positive impact on their ability to provide quality patient care, only 15 percent of the nurses and 40 percent of the unit secretaries on the non-Vocera unit agreed. The level of satisfaction **doubled** on the Vocera unit with two-thirds of the nurses and 80 percent of the unit secretaries responding that the current communications do provide positive impact on the ability to provide quality care.

Estimated Time Savings

The survey results confirmed the finding of time savings from the time and motion studies. Over 56 percent of the nurse respondents believe they saved over 30 minutes of time per eight-hour shift and 78 percent experienced at least 15 minutes per shift. Seventy-five percent of the unit secretaries also believed they had saved at least 30 minutes per shift.

Survey Question: The time savings resulting from less wait time and less interruptions using Vocera is:

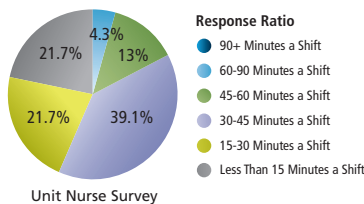


Table 4: Reduction in Non-Productive Time

Other Observations

Overall nurses, nurse techs, and unit secretaries at St. Agnes were using Vocera to communicate internally within the unit. However, there are other available Vocera functions that can further improve workflow and decrease wait time. Specifically,

- **Internal phone communications.** Vocera has the capability of contacting hospital departments by phone by simply stating “Call department or group name” such as “Call Pharmacy.”
- **External phone calls.** Vocera has the capability to connect to the telecommunication network outside of the hospital campus to allow users to call external phone numbers such as doctors’ offices, pharmacies, and allied health facilities directly from the Vocera badge. Vocera also allows calls from the outside to be transferred directly to the Vocera badge.
- **Paging using Vocera.** Vocera offers a paging function that allows the user to page directly from the Vocera badge and then direct the response back to the Vocera badge.

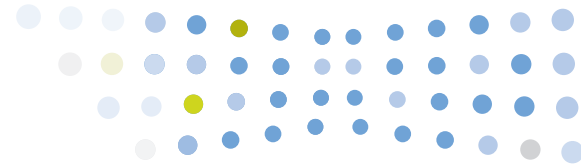
Conclusion

The study at St. Agnes Healthcare demonstrated time savings and workflow improvements that were measurable and significant. Nurses, nurse techs, and unit secretaries rated Vocera as the communication tool of choice and a majority believed Vocera positively impacted their ability to provide quality care.



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