An Evaluation of VistA-Office EHR in the Small Practice Setting:

Functional Performance, Economic Costs, and Implementation/Support Processes

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Sujansky & Associates, LLC

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1. Executive Summary

VistA Office EHR (VOE) was developed by the federal government as a low-cost electronic health record (EHR) for small physician practices. Over the past nine months, VOE has been tested in a variety of physician practices, using a public-private model for implementation and support of the software. The goal of this test has been to determine whether the software and the distribution model are ready for widespread use or whether further refinements and enhancements are needed before VOE is likely to succeed in the private sector.

To evaluate the results of this beta test, Sujansky & Associates collected extensive data via structured interviews with the ten physician practices and six commercial vendors participating in the testing. The goal of the data collection was to answer a specific set of questions:

- Is the current release of the VOE application generally suitable for use as an electronic health record in small physician practices and does it deliver the envisioned benefits of an EHR?
- What are the "success factors" for the initial implementation and sustained clinical use of VOE in a small physician practice?
- What are the financial costs to a practice of implementing and operating VOE under the envisioned distribution model?
- Can the combined public-private model effectively distribute and support VOE?

The data showed mixed success in achieving implementation and use of VOE at the test sites. Only half of the sites have achieved physician use of VOE in the course of clinical care, and only at three sites are physicians using the system to a substantial degree, i.e. using most of the core functionalities to document most of their patients' care. The core functionalities of VOE least likely to be used include the maintenance of active-medication lists, the review of lab results, the writing of prescriptions, the performance of drug-drug interaction checking, and the submission of DOQ-IT reports. These features are underutilized for a variety of reasons, including the absence of a complete medication list, a lab interface, and a useful prescription writer. The functionalities most likely to be used include note generation (with and without the use of templates), the documentation of vital signs, and the maintenance of active-problem lists. The users of VOE report substantial improvements in accessibility to important patient data and the efficiency of information-processing tasks through the use of these features.

Based on the variable levels of user adoption and the specific feedback from the practice sites, several factors stand out as critical to the successful implementation and use of VOE in small-office settings. The first is the need for customization to the clinical content that is provided with the base VOE system, including templates, medication lists, billing codes, and clinical reminders. Practices that received substantial help from their vendors in customizing this content were much more likely to achieve successful use of VOE than those that did not. Secondly, clinical and administrative personnel at the practice sites need a significant amount of on-site training before they can effectively use VOE, even those that have prior experience with VistA software. The packaged training materials, such as CD-ROMs and user manuals, are insufficient in the absence of instructor-led on-site training. Lastly, the absence of data interfaces and the means to efficiently implement them have impeded the implementation and use of VOE to a certain degree at all of the practice sites. In particular, interfaces to practice management systems and clinical laboratories are very important for achieving widespread use of VOE in community practices and in approaching the realization of paperless medical records. It is questionable whether VOE can ultimately provide a low-cost EHR solution without improving the technologies or standards available to facilitate interface development.

A cost analysis at the beta test practices was somewhat inconclusive, in that most of the practices experienced costs far below the commercial rates that they will likely face after the beta-test period. Nevertheless enough data were collected to formulate an approximate range of costs that practices will realistically face for VOE implementation and ongoing support and to identify the key drivers of those costs.

Feedback regarding the public-private model for implementation and support of VOE suggests that this model is feasible, but that more resources may be required to enable the VistA-Office Vendor Support Organization (VVSO) to adequately assist the commercial vendors in their efforts to implement and support VOE.

2. Introduction

In January, 2006, the Centers for Medicare and Medicaid Services (CMS) concluded development of an initial "beta-test" version of the VistA Office EHR (VOE) software application. CMS funded the development of VOE as a low-cost electronic health record (EHR) system for small-office practices and community clinics. VOE is based on the OpenVista code base, an open-source version of the Veterans Health Administration's *VistA* system that is in use at hundreds of V.A. hospitals and clinics around the world. The VOE development effort entailed adapting OpenVista for use in small practices in the private sector. The goal of this adaptation was to remove extraneous elements of VistA that are not relevant in the private sector and to add missing elements to VistA that are needed in the private sector.

Given that the implementation and support of an EHR at hundreds of community practice sites is outside the scope of CMS's mission, the distribution of VOE to the private sector has been delegated to a community of commercial vendors with the required expertise and business incentives. A number of such vendors have emerged since 2003, when the VistA code base was made available to the public. To assist these vendors, CMS has established the VistA-Office Vendor Support Organization (VVSO) to provide technical assistance, training materials, and software updates. The envisioned model for distributing VOE is that physician practice sites will contract with commercial vendors for implementation and support services, the vendors will receive various forms of assistance from the VVSO, and the V.V.S.O will receive updates to the VOE code base from the V.A.

To assess the suitability of the VOE software and the effectiveness of the envisioned distribution model, CMS selected 10 small practice sites and six commercial vendors to participate in a beta-test program beginning in early 2006. The beta-test program involved the implementation and use of VOE at the practice sites, with a subsequent evaluation of the successes, challenges, and lessons from the process. The intent of the test was to inform the next steps in the VOE program. Sujansky & Associates, LLC was engaged to perform the evaluation and provide the results to CMS. This report describes the process by which the evaluation was performed and the findings of the evaluation across a number of areas.

3. Evaluation Objectives and Methodology

3.1. Objectives

The goal of the evaluation was to investigate several specific aspects of the VOE software application and the VOE implementation/support model:

1. Is the beta release of the VOE application generally suitable for use as an electronic health record in small physician practices? Is VOE acceptable to clinician users and their staff with respect to functionality, efficiency, and safety? Does VOE provide, in actual use, the decision-support and quality-reporting benefits that are envisioned?
2. What are the "success factors" for the initial implementation and sustained clinical use of VOE in a small physician practice? Are there certain characteristics of physician practices that facilitate or prevent successful implementations and sustained use? Are there significant differences among the vendors, and how do they affect the success of VOE implementations and sustained use?
3. What is the approximate financial cost (direct and indirect) to a small practice for VOE installation, configuration, training, support, and ongoing use under the current vendor-support model?
4. Is the current vendor-support model effective in supporting the implementation and use of VOE in small physician practices? Do the vendors receive adequate support from the VVSO, and is the combined vendor/VVSO model appropriate for supporting VOE implementations?

3.2. Methodology

The methodology of the evaluation consisted of (1) collecting relevant data from each of the practice sites and each of the vendors via self-administered surveys and interactive interviews, and (2) performing a qualitative analysis of the data to discern patterns and draw conclusions related to the evaluation questions.

Data Collection: Data was collected via survey instruments specific to the various areas of inquiry. Table 1 shows the list of surveys to which the practice sites and vendors responded. The actual surveys that were administered are included in the addendum to this report.

Table 1. Data Collection Surveys Used

Respondent	Survey	Topics Addressed
Practice Site	Background	Practice Demographics
		Goals of VOE Adoption
		Patient Mix and Workflow
		Computing Environment and Interoperability Requirements
	Implementation	Installed Hardware/Software Configuration
		Content Customizations (templates, med list, etc.)
		Interface Development
		Implementation Experience Vs. Expectations
	Training	Nature of Training
		Duration/Extent of Training
		Effectiveness of Training
	Use and Functionality	Current VOE Use in Clinical Practice
		Perceived Benefits of VOE Use
		Perceived Difficulties of VOE Use
	Cost	Upgrades to Computing Infrastructure (Hardware/Networking)
		Installation and Configuration of VOE Software
		Interface Development
		Staff Time and Lost Productivity
		Ongoing Maintenance Costs
		Actual Costs Vs. Expectations
Vendor	Background	General Corporate Information
		Past Experience with VistA and VOE Software
		Configuration and Customization Services Offered
		Support Services Offered
	Pricing Model	Implementation Pricing
		Maintenance/Support Pricing
	Vendor Support	Satisfaction with Vendor Support Services (VVSO)
		Suggestions for Additional Services

These surveys were administered consistently across the practice sites and vendors, to develop a comparable body of data. Much of the survey information was collected via telephone interviews, which maximized the opportunity to clarify responses and seek follow-up information.

In addition to survey information, Sujansky & Associates also visited one of the beta test sites and received an extensive demonstration of the VOE system.

Data Analysis: Given the relatively small number of practice sites at which the VOE software was actually implemented (seven) and the smaller number of sites at which the software was used extensively in the course of clinical care (three), statistical analysis of the data was not possible. The analysis, therefore, sought to identify

general patterns in the data that suggested answers to the evaluation questions. In assessing the findings of the evaluation, the reader should keep in mind the small sample size and its possible effect on the validity of these findings. Nevertheless, even the anecdotal nature of the evaluation provides important information about the prospects for widespread acceptance of the VOE software and the steps required to achieve such acceptance.

4. Profiles of the Practice Sites and Vendors Participating in the Beta Test

The help assess the generalizability of the evaluation findings, it is useful to review the characteristics of the practice sites and vendors that participated in the beta test.

4.1. Practice Sites

Table 2 and Table 3 list the ten practice sites that were selected to participate in the VOE beta test and provide background information about each site.

There are several noteworthy characteristics and patterns among the selected beta test sites:

- Even within the category of small physician practices, all of the beta sites were relatively small The largest practice consisted of 6 physician FTEs and the smallest consisted of 1 physician FTE (4 sites were of this size). The average size was 2.2 physician FTEs.
- Seven of the sites were independent private practices, two were community clinics, and one was a hospital-affiliated residency training program. The private practices included primary care physicians (internal medicine, family practice) as well as specialists (Ob/Gyn, otolaryngology, nephrology). Interest in VOE as an EHR solution clearly extends to practices operated as small business by owner-physicians, both generalists and specialists.
- All of the sites required interoperability between their EHRs and legacy information systems. Each of the sites used a practice management system for scheduling, registration, and/or billing prior to the installation of VOE. Each of the sites also received laboratory test results from off-site labs in local hospitals or reference laboratories.
- The mix of payers among physician practices participating in the beta test was highly variable. The proportion of Medicare patients ranged from 0% to 90% (averaging 31%) and the proportion of commercially insured patients also ranged from 0% to 90% (averaging 42%). The proportion of "safety net" patients (medicaid + uninsured) was smaller at the independent private practices (11% on average) than at the community clinics (55% on average), as one might expect. This variability, however, suggests that typical community physicians, as well as those that treat underserved populations, are interested in VOE as an EHR solution.
- Nine of the ten practices cited "low cost" as the primary reason they selected VOE as their EHR.
- Physicians at four of the practices had prior experience using the VistA EHR at a V.A. facility. All of these practices cited "familiarity with VistA" as one of their top-three reasons for selecting VOE as their EHR solution, suggesting that their experiences with VistA were positive and their expectations for using VOE in their private practices were relatively high.

Table 2. List of Practice Sites Participating in the VOE Beta Test (1 of 2)

	PRACTICE SITE				
	Clinical site 101	**Clinical site 102**	**Clinical site 103**	**Clinical site 104**	**Clinical site 105**
Location	Pendleton, OR	Washington, DC	Mililani, HI	St. Charles, MO	Midwest City, OK
Practice Type	Independent private practice	Independent private practice	Hospital-affiliated clinic, family medicine residency program	Independent private practice	Independent private practice
Medical Specialty	Obstetrics/Gynecology	Obstetrics/Gynecology	Family Practice	Otolaryngology	Nephrology
Physician FTEs [Total # of Physicians]	3 [3]	6 [9]	4 [30]	1 [1]	1 [1]
PA/Nursing/MA FTEs	4	17	3.5	1	3
Patient Visits per Day per Physician FTE (average)	25	25	12	10	20
Pre-Existing Physician Practice Management System	YES [Medical Manager]	YES [Protologics]	YES [CPSI]	YES [Medical Manager]	YES [Visionary]
Clinical Laboratory(ies) Used	InterPath (Ref) - 100%	LabCorp (ref) - 70% Other ref. lab - 20% In office 5%	DLS Lab (ref) - 80% In office - 15% Local Hospital - 5%	LabCorp (ref) - 75% Quest - 25%	LabCorp (ref) - 95% Quest - 5%
Patient Mix					
Medicare	0%	10%	25%	10%	90%
Medicaid	47%	0%	28%	0%	0%
Commercially Insured	47%	90%	40%	70%	10%
Uninsured	6%	0%	7%	0%	0%
Previous Physician Experience with VistA at a VA facility	NO	NO	YES	NO	YES
Reason(s) for selecting VOE (ranked)					
#1	Low Cost	Low Cost	Low Cost	Low Cost	Low Cost
#2	Government support for the system (longevity)	Government support for the system (longevity)	Anticipated better support as an early adopter	Liked features better than other EMRs	Familiarity with VistA
#3	Proven track record of VistA at the VA	Liked features better than other EMRs	Familiarity with VistA		Liked features better than other EMRs

Table 3. List of Practice Sites Participating in the VOE Beta Test (2 of 2)

	PRACTICE SITE				
	Clinical site 106	**Clinical site 107**	**Clinical site 108**	**Clinical site 109**	**Clinical site 110**
Location	Sikeston, MO	Smithville, MS	Aberdeen, MD	St. Louis, MO	Houston, TX
Practice Type	Independent private practice & rural health clinic (2 sites)	Community Health Clinic	Independent private practice	Independent private practice	Community Health Clinic
Medical Specialty	Family practice	Internal Medicine	Internal Medicine	Ophthalmology	Family Practice
Physician FTEs [Total # of Physicians]	1 [1]	2 [2]	1 [1]	2 [2]	1.2 [2]
PA/Nursing/MA FTEs	4	5.8	3.5	1	7.4
Patient Visits per Day per Physician FTE (average)	35-40	30	45	40	23
Pre-Existing Physician Practice Management System	YES [Medical Manager]	YES	YES	YES [Medical Manager]	YES [VistA FOIA]
Clinical Laboratory(ies) Used	Local Hospital - 100%	Memphis Path Lab (ref) - 100%	Quest 45% Local Hospital 45% LabCorp 10%	Local Hospital - 100%	LabCorp (ref) - 100%
Patient Mix					
Medicare	74% (at rural clinic) 10% (at private practice)	25%	37%	55%	2%
Medicaid	24% (at rural clinic)	45%	15%	0%	8%
Commercially Insured	90% (at private practice)	20%	47%	45%	0%
Uninsured	2% (at rural clinic)	10%	0%	0%	90%
Previous Physician Experience with VistA at a VA facility	NO	YES	YES	NO	NO
Reason(s) for selecting VOE (ranked)					
#1	Low Cost	Familiarity with VistA	Low Cost	Low Cost	Low Cost
#2		Low Cost	Like quality-reporting capabilities	Longtime association with vendor	
#3			Familiarity with VistA		

4.2. Vendors

Table 4 lists and describes the vendors that were selected to implement and support VOE during the beta test period. Several characteristics of the vendors are noteworthy:

- Most of the firms engaged in the VOE program are quite small (< 10 full-time equivalent employees). Even the two larger firms have but a handful of personnel engaged in VOE activities. These numbers are not surprising given the nascent stage of the VOE program, but the limited resources of small firms can create risks that key personnel may become unavailable or limit the scalability of these enterprises as the VOE program expands.
- Most of the firms employ personnel with significant experience in VistA software, and most have been involved in at least a few VistA implementations prior to their experiences with VOE. Nevertheless, the task of providing a small physician practice with implementation, clinical customization, training, and support services require skills beyond technical knowledge of VistA. As seen in the surveys and in the experiences of the pilot sites, certain of the vendors have those skill sets, whereas others do not.
- The vendors are geographically dispersed, which may allow them to serve a larger overall area and avoid competing with each other in the early stages of the VOE program. At the same time, several of the vendors resided at some distance from the practice sites they served, suggesting that geographical proximity is certainly not a requirement and not necessarily an advantage.

Table 4. List of Vendors Participating in the VOE Beta Test

	VENDOR					
	Vendor H	**Vendor J**	**Vendor L**	**Vendor M**	**Vendor P**	**Vendor R**
Corporate Headquarters	Honolulu, HI	Juno Beach, FL	Friendswood , TX	Rockville, MD (VOE group in HI)	St Louis, MO	St. Petersburg, FL
Length of existence under current management	1.5 Yrs	14 Yrs	20 Yrs	36 Yrs	21 Yrs	1.5 Yrs
Type of Entity	For-profit corporation	For-profit corporation	For-profit corporation	For-profit corporation	For-profit corporation	For-profit corporation
Number of Employee FTEs	7	108	7	160	5	3
Number of Employee FTEs Engaged in VOE Implementation and Support	2	4	4	5	2	3
Number of VistA implementations prior to participation in VOE Beta Test	3	n/a	1	3	2	5
Time organization has been working with VistA	1.5 years	12 Yrs	2.5 Yrs	7 Yrs	1.5 Yrs	2 Yrs
Time organization has been working with VOE	1.5 years	2 Yrs	1.25 Yrs	1 Yr	1 Yr	2 Yrs
Comments on VistA/VOE experience	Individuals have much longer experience, up to 20 years		60 + man years of VistA experience among employees			The owners all have over 12 years experience with VistA

5. Current Status of VOE Beta-Test Implementations

The beta-test program began in the spring of 2006, with the release of the Beta 1.0 version of VOE in March (although one site installed a "pre-beta" version of the software in the fall of 2005). Over the past nine months, the practice sites have endeavored to install, configure, and begin using the software in the course of their clinical activities. However, the ten practices have achieved varied success in this endeavor.

Table 5 and Table 6 show the degree of implementation and use of VOE at the beta-test practices. Seven of the ten practices have installed the software to date. Physicians at five of the practices (listed in Table 5) are using the software to any degree, with the remaining sites (listed in Table 6) not yet seeing any clinical use. Finally, physicians at only three of the practices are using the software to a significant degree, i.e. using most of VOE's core features to document most of their patients' care. Even among these sites, however, numerous core features remain unused and only a minority of the physicians are using the system.

The reasons for the limited use of VOE thus far are multiple and vary from site to site. Certain of the reasons are summarized in Table 5 and Table 6, but a more extensive discussion of VOE's perceived suitability for small, private-sector practices appears in Section 6, and an analysis of the most important "success factors" for VOE adoption and use appears in Section 7.

Table 5. Beta-Test Practices Using VOE

	PRACTICE				
	Clinical site 101	**Clinical site 102**	**Clinical site 103**	**Clinical site 104**	**Clinical site 105**
Installation Date	July 2006	September 2005	June 2006	March 2006	May 2006
Practice was selected as a VOE Beta Test Site					
Practice has installed VOE					
Physicians using VOE to document some care					
Physicians using VOE to document most care					
Software installation	Complete	Complete	Complete	Complete	Complete
Content customization	Complete	Complete	Complete	Complete	
Interface to practice management system		Complete			
Interface to laboratory system(s)					
Number of physician users [total number of physicians in practice]	1 [3]	2 [9]	30 [30]	1 [1]	1 [1]
% of patient visits documented using VOE (among those physicians using the system)	75%	95%	100%	2%	100%
% of core VOE functionalities used* (among those physicians using the system)	50%	50%	60%	40%	5%
Nature of usage	- Documenting progress notes, vital signs, problem lists - Using encounter forms and clinical reminders	- Documenting progress notes, vital signs, problem lists - Using encounter forms and clinical reminders	- Documenting progress notes, vital signs, problem lists, med lists - Reviewing some lab results - Using encounter forms	- Physician is documenting only a handful of patients to test out VOE capabilities; VOE not used in day-to-day practice	- Physician dictates notes and cuts-and-pastes transcribed copy into VOE notes; no other features are used
Reason(s) for incomplete installation/usage	- Many Ob/Gyn medications lacking - Templates needed for certain obstetrics patients not yet available - Other physicians are awaiting lab and PMS interfaces	- Many Ob/Gyn medications lacking - Other physicians are awaiting lab interface and more experience with the system	- Prescription finishing and lab interface unavailable - Clinical reminders were too obtrusive	- Absence of electronic interface to lab and imaging is preventing routine use	- Absence of electronic interface to lab, PMS - Insufficient time/support to customize templates, med list, and billing codes

* See Section 6.2.1

Table 6. Beta-Test Practices Not Using VOE

	Clinic site 106	Clinic site 107	Clinic site 108	Clinic site 109	Clinic site 110
Installation Date	March 2006	April 2006	NOT INSTALLED	NOT INSTALLED	NOT INSTALLED
Practice was selected as a VOE Beta Test Site					
Practice has installed VOE					
Physicians using VOE to document some care					
Physicians using VOE to document most care					
Software installation	Complete	Complete			
Content customization					
Interface to practice management system					
Interface to laboratory system(s)					
Number of physician users [total number of physicians in practice]	0 [1]	0 [2]	0 [1]	0 [2]	0 [2]
% of patient visits documented using VOE (among those physicians using the system)	0%	0%	0%	0%	0%
% of core VOE features used* (among those physicians using the system)	0%	0%	0%	0%	0%
Nature of usage	No Usage	No Usage	No Usage (VOE Not Installed)	No Usage (VOE Not Installed)	No Usage (VOE Not Installed)
Reason(s) for incomplete installations/usage	- Insufficient time/support to learn system and customize templates	- Absence of PMS interfaces requires duplicate data entry [not feasible for this practice]	- Decided to install a vendor's proprietary product instead of VOE	- Absence of electronic interfaces - Insufficient time/support to customize templates - VOE lacks ability to flowchart and graph ophthalmology data	- Reluctance to replace site's previous installation of VistA FOIA (installed pre-VOE)

* See Section 6.2.1

6. Suitability of VOE Software in Non-VA, Small-Practice Settings

The current status of the various beta-test sites and their experiences in using VOE over the past 6-12 months provide important information regarding the suitability of the VOE system for use in small practices outside of the V.A. environment. In evaluating the suitability of VOE for these settings, we endeavored to ascertain not whether the technology is perfect or has all the features that users desire, but whether it meets a level of functionality, efficiency, reliability, and safety that is *acceptable* to physicians seeking EHR solutions for their small practices. Data to answer these questions was collected from those practices that are currently using VOE (to any extent), as well as from those practices that never installed or began using the system.

6.1. Practices Not Using VOE: Why not?

As shown in Table 6, the five beta-test sites that never reached the point of actually using VOE failed in their adoption of the system for a variety of reasons. Some of these reasons were unrelated to the suitability of VOE for their practices, for example insufficient time for training and content customization or a reluctance to replace similar legacy technology. Other practices, however, looked closely at VOE and even implemented the system, but ultimately failed to use it because of perceived functional deficiencies. Most notable among these was the absence of an electronic interface to the existing practice management system. Although four of the five practices that are using VOE also lack such an interface, this deficiency was cited by three of the five "non-using" practices as at least part of the reason they could not begin to use VOE. The data suggests, therefore, that a PMS interface, while not absolutely required to initiate use of VOE in every small-office practice, is very important for the acceptability of VOE in many practices.

6.2. Practices Using VOE: Is it Acceptable?

Among the practices at which physicians are using VOE, the physicians completed surveys to assess the use, value, and acceptability of VOE along several dimensions. The following sections address each of these dimensions.

6.2.1. Functionality

Based on the collected data, physicians at the practices using VOE are using only a subset of the core functionalities of the system. Table 7 shows the usage of core functionalities at these practices.

Table 7. Usage of Core VOE Functionalities by Practice Site

	Practice Site				
Core Functionality	Clinic site 101	Clinic site 102	Clinic site 103	Clinic site 104	Clinic site 105
Create Notes					
Create Notes Using Templates					
Document Vital Signs					
Maintain Active Problem List					
Maintain Active Medication List					
Review Recent Lab Results					
Use Clinical Reminders					
Generate Medication Orders					
Perform Drug-Drug Interaction Checking					
Generate Lab Orders					
Populate Encounter Forms					
Perform DOQ-IT Registration/Reporting					

The following sections list the core functionalities that are not being used by most or all of the sites and discuss the reported reasons for this. (Note: Clinic site 105 has abandoned use of the system except to store its dictated and transcribed progress notes due to the absence of data interfaces and required medications and billing codes.)

Maintain Active Medication List: The two Ob/Gyn practices are not populating the medication list because many of the agents they use do not appear in the list that is included with the standard VOE release. Clinic site 103 and Clinic site 105 also reported that many of the medications they need are missing or are difficult to locate by their generic names (brand names are entirely absent from the standard VOE medication list).

Review Recent Lab Results: None of the practices has a functioning lab interface, so they are unable to view lab results in VOE unless the results are manually entered. Clinic site 103 is the only

site that is manually entering certain lab results into VOE, a time-consuming and tedious process that necessitates use of the "roll-and-scroll" interface.

Use Clinical Reminders: Clinic site 103 has turned off the reminders entirely because they were receiving too many false-positive reminders. The two Ob/Gyn sites, however, have found the clinical reminders to be useful and accurate (although one of the sites turned off certain of the reminders that were not relevant to its patient population).

Generate Medication Orders: The absence of the prescription-finishing feature has precluded any of the sites from prescribing medications within VOE.

Perform Drug-Drug Interaction Checking: None of the practices are availing themselves of this feature, because they are not using VOE to prescribe medications.

Generate Lab Orders: The sites did not indicate why they are not ordering lab tests via VOE, but presumably it is due to the absence of a lab-reporting interface, as well as the need to customize the list of orderable lab tests to correspond to the specific tests and panels available at the labs they use.

Perform DOQ-IT Registration and Reporting: This feature requires interaction with the roll-and-scroll interface to generate and submit a report in the correct format for DOQ-IT reporting. None of the practices has even tried to use this feature, given the time they have needed to learn the basic clinical-documentation features of the system. Also, most of the vendors seem unaware of this feature and how to use it (it does not seem to be part of their training process).

Although a number of core functionalities are not widely used, the practices are deriving significant benefit from the functionalities they have been using. Specifically, most of the sites have reported that the following benefits of VOE use are "significant" or "dramatic":

- The patient chart is more frequently available at the time it is needed
- Information in the chart is more legible
- Important summary information about patients is easier to locate (e.g., problem list)
- Important summary information about patients is more complete (e.g., problem list)
- Detailed information from previous encounters is easier to locate (e.g., information in progress notes)
- Use of templates reduces the time required to write visit notes/progress notes
- Use of templates reduces the time required to write referral notes
- Progress notes/visit notes are more complete (e.g., due to prompts in templates)

Nevertheless, the practices are unable or unwilling to use approximately 50% of the core functionalities of VOE because of perceived deficiencies in the system's content, interfaces, or ease of use. In terms of functionality, therefore, it may be difficult to assert that VOE is acceptable and suitable for use in the typical small practice until at least some of these deficiencies are addressed.

6.2.2. Efficiency

Several of the functional benefits of VOE that the beta test sites reported result in greater efficiency for the practices:

- The inherent availability of electronic records at the time and place they are needed reduces staff and physician time spent locating wayward paper charts.
- The fact that important summary information about patients and detailed information from previous encounters is easier to locate within an electronic record reduces the physician time spent searching through paper charts.
- The use of templates reduces the time required to write visit notes and referral notes in many cases

At the same time, many of the practices complained that use of VOE entails duplicate data entry on the part of staff and/or physician personnel, a problem perceived as a "significant difficulty" at three of the

five practices using VOE, and a "minor difficulty" at one of the others. The reasons for duplicate data entry included:

- The absence of an interface to the practice management system, necessitating the registration of patients twice (Note: the only site that reported no issues with duplicate data entry was the sole site that has an interface between its practice management system and VOE).
- The inability to finish prescriptions in VOE necessitates the duplicate recording of prescribing information to generate both a prescription for the patient and an entry in the patient's active medication list (Note: the same problem exists in the paper-based documentation process, but it is perceived as something an EHR should address).
- The lack of a feature to automatically populate the patient's problem list with the problems entered into a visit note (Note: Again, the same problem exists in the paper-based documentation process, but it is perceived as something an EHR should address).

The absence of practice-management interfaces and prescription-finishing capabilities may create prohibitive inefficiencies for some practices. Indeed, two of the practices that were ultimately unable to participate in the beta testing of VOE cited these inefficiencies as largely responsible for their withdrawal from the program. Additionally, it is uncertain whether the five practices currently using VOE will continue to do so if these inefficiencies persist (two of these practices are already using the system sparingly because of the lack of interfacing). To achieve widespread acceptance among and suitability in small practice, it appears these sources of inefficiency must be addressed. When they have been, the reported improvements to efficiency will remain and will create compelling incentives to adopt the technology.

6.2.3. Reliability

None of the practices reported any substantive issues with reliability of the VOE software. In fact, the beta test site that has been using the system the longest (since September 2005) reported that it has been incredibly stable since its installation. The only reliability issues reported related to local wireless networking problems and operating system upgrades, both unrelated to the VOE software, itself. As with any EHR system, proper on-site administration of the computing and networking environment is required to keep the system functioning properly.

6.2.4. Safety

VOE has the potential to enhance patient safety through automated decision support, particularly in relation to medication prescribing. However, none of the beta-test sites are currently using the drug-utilization review functionalities of VOE, because the absence of the prescription-finishing and prescription-printing capabilities have prevented the sites from generating prescriptions within the EHR (the practices continue to generate paper prescriptions by hand). Therefore, we were unable to evaluate the acceptability or performance of this feature. Such an assessment should be part of a future evaluation, because electronic-prescribing and drug-interaction-checking systems vary in effectiveness and physician acceptance. There is no reason to believe that the VOE drug-interaction-checking capability will be unacceptable, but an evaluation in practice would be useful.

The only detriment to patient safety that was reported by any test site in the course of using VOE was related to the population of the active-medication list. Because VOE has no facility to record the medications that a patient may already be taking without specifying a complete prescription, users must specify the strength, dosage form, frequency, and duration for every medication added to a patient's active list, even if the correct values of those parameters are not known. This creates the potential to record inaccurate information in the patient record, which other clinicians may subsequently view and use as a basis for decision making. It would be preferable to allow users to populate the active-medication list by specifying only the identity of the medication, without requiring detailed prescription information.

7. Success Factors for VOE Implementation and Use

Given the variations seen in the implementation and use of VOE among the beta test sites, it is useful to consider whether any patterns exist suggesting specific "success factors" for VOE adoption at small physician practices. Although the absence of VOE adoption at a few sites resulted from idiosyncratic factors, the data from the remaining sites did point to a small set of critical success factors, which are discussed in the following sections.

7.1. Definition of "Success"

In the context of the VOE beta test, one may reasonably define "successful" adoption as the achievement of all of the following milestones:

- The VOE software is installed and functioning properly
- At least one physician at the practice is using VOE in the course of his/her clinical duties
- The physician(s) using VOE are documenting most or all of their patient visits using the system
- The physicians using VOE are availing themselves of most or all of the core functionalities of the system

By the definition above, only three of the ten practice sites achieved success during the beta test[1]: Clinic site 101, Clinic site 102, and the Clinic site 103, (see Section 5). At the remaining sites, VOE was never installed, never used, or used in only a very limited capacity. This section analyzes the most prominent factors that distinguished the successful sites from the less successful one.

7.2. Factors Contributing to Success

For most of the practices, multiple factors determined whether they achieved a successful level of implementation and use. However, three of the practices dropped out of the beta test program because of clear and single reasons.

- **Clinic site 108** elected to implement a proprietary version of the VistA FOIA system upon the recommendation of a vendor. This decision was unrelated to the practice's perceptions of or experiences with VOE.
- **Clinic site 110** has been using another version of the VistA FOIA system since 2004 and elected to keep this system in place, rather than transfer its existing customizations and patient data to a new VOE implementation.
- **Clinic site 107** installed VOE but found that the absence of an interface to its practice management system resulted in a prohibitive degree of redundant data entry for its administrative staff. The problem was compounded by the fact that the clinic was performing double data entry already for patients it sees from a nearby V.A. hospital. The clinic abandoned its implementation at that point before any clinicians were trained or began using the system.

Because of the unusual nature of these situations, these three practices were excluded from further analysis of success factors (although the absence of interfaces was cited as a barrier by several other practices). Survey data from the remaining seven practices was analyzed to identify prominent factors contributing to their successful or unsuccessful adoption of VOE. This analysis identified three key factors correlated with success or failure: Content customization, end-user training, and data interfaces.

[1] Note that a successful implementation during the beta-test period does not require that all of the physicians in the practice be using VOE, nor that the practice has dispensed with its previous paper-based documentation system. Although these are the ideal end-points in the adoption of any EHR system, few practices achieve this universal paperless state within the first 6-12 months of use, regardless of the system implemented.

7.2.1. Content Customization

"Content" in the VOE application consists of templates, medication lists, billing codes, and clinical reminders. VOE comes with a built-in set of these resources, which may be modified to suit a practice's or a user's preferences. Many of the practice sites reported that the built-in content of VOE was inadequate or inappropriate for them and that customizations were needed. Table 8 shows the correlation between the implementation/usage of VOE and the degree of content customization that took place at each practice. The data suggests that the ability of a practice to make these customizations (typically, with the help of its vendor) is a significant determinant of its success in using VOE. The possible reasons for this dependency are discussed below, specific to each type of content.

Templates. All of the successful sites had significant template customization done, to either create new templates that were not available from the V.A. (e.g., pediatrics and Ob/Gyn) or to streamline existing templates. Several of the sites that were unable to successfully use VOE cited the length, complexity, or inappropriateness of the existing templates and their inability to modify these templates as a significant reason for their lack of success (Clinic site 105, Clinic site 106, Clinic site 109).

Medication List. All of the successful sites had at least some modifications performed to their medication lists to augment the built-in set of drugs. Nevertheless, the two Ob/Gyn sites still reported that too many drugs remained missing and they were unable to populate the active-medication lists of their patients. Similarly, the absence of relevant drugs and the inability to locate drugs by their brand names have contributed to the unwillingness of Clinic site 105 to use VOE for most documentation tasks.

Billing Codes. The set of billing codes (both CPT4 and ICD9) provided with the VOE beta-test system were outdated, and all of the practices needed to update these lists by downloading and installing a patch from the American Medical Association. The three practices whose vendors performed this service were able to use these codes to populate the encounter form. Other practices (notably, Clinic site 104 and Clinic site 105) did not use the encounter form feature of VOE.

Clinical Reminders. Two of the three sites that were successful had their vendors inactivate at least some of the clinical reminders to prevent irrelevant or false-positive reminders from interfering with their normal work flow. Although the third successful site reported no problems with the built-in set of reminders, the desire to modify or inactivate certain reminders may be exist at many practices.

For most practices, changes to the medication list, billing codes, and clinical reminders are highly technical operations that require the assistance of their vendors. Hence, the ability and willingness of vendors to make these customizations are important success criteria for VOE. In the early stages of VOE use, many practices will also require the assistance of their vendors to customize templates. Later, practice personnel may be able to customize templates themselves, provided that adequate end-user training has been provided.

7.2.2. End-User Training

The type and amount of end-user training that a practice receives also appears to be a significant success factor. This is unsurprising given that VOE is a fully-functional and complex system that is intended to be used by a variety of practice personnel. Table 9 shows the correlation between the degree of implementation and usage of VOE at each practice and the type and extent of end-user training received there. Several aspects of these data are noteworthy:

- The three successful practices are the only ones that received on-site training directly from their vendors. Per their survey responses, these practices felt that this training prepared them "very well" or "perfectly" to use VOE.
- Two of the practices that relied exclusively on written or pre-recorded (CD-ROM) training materials from the VVSO indicated that these materials were inadequate sources of training and that they felt quite unprepared to use VOE after reviewing the materials.
- A third practice that relied exclusively on the CD-ROM training materials from the VVSO (Clinic site 109) expressed frustration at lacking the knowledge to modify templates after completing this

mode of training. The clinician at Clinic site 109 was interested in modifying templates himself to avoid the cost and delay of relying upon a vendor for this service. This may be a common desire among small practices (see the Cost Analysis in Section 8).

- Even the practice that had previous experience using VistA at the VA (Clinic site 105) was unable to learn the VOE system from the VVSO training materials alone.

7.2.3. Data Interfaces

As described earlier, one of the practices (Clinic site 107) was unable to use VOE solely because it lacked an interface to its practice management system. Among the other unsuccessful practices, four also cited the absence of interfaces as a significant reason that they could not use the system as intended (Clinic site 104, Clinic site 105, Clinic site 106, and Clinic site 109). Even at two of the three successful practices (Clinic site 101 and Clinic site 102), physicians stated that they would have trouble convincing their practice partners to use VOE until additional interfaces were in place.

This is clear evidence that the availability of data interfaces is an important success factor in the initial adoption of VOE in small practices. Although some practices have achieved the successful initial adoption of VOE even in the absence of such interfaces (when the other important success factors have been in place), it remains to be seen whether these practices can sustain the use of VOE if necessary data interfaces are not eventually implemented.

7.3. Factors Not Contributing to Success or Failure

Several other factors that varied across the beta test sites do not appear to have contributed to the success or failure of the sites to adopt VOE. These success "non-factors" include:

- Different pricing among the vendors
- Geographical proximity of the vendor to the practice site
- Previous experience of physicians with VistA software at V.A.
- Disruption of the practice during the implementation and configuration of VOE
- Hosting of VOE in a Client/server configuration versus an ASP configuration
- Hosting of VOE on a Cache/Windows platform versus a GT.M/Linux platform

Table 8. Correlation between Successful VOE Use and Content Customization

	PRACTICE						
	Clinic site 101	**Clinic site 102**	**Clinic site 103**	**Clinic site 104**	**Clinic site 105**	**Clinic site 106**	**Clinic site 109**
Implementation Status							
Practice was selected as a VOE Beta Test Site							
Practice has installed VOE							
Physicians using VOE to document some care							
Physicians using VOE to document most care							
Usage Status							
Number of physician users [total number of physicians in practice]	1 [3]	2 [9]	30 [30]	1 [1]	1 [1]	0 [1]	0 [2]
% of patient visits documented using VOE (among those physicians using the system)	75%	95%	100%	2%	100%	0%	0%
% of core VOE features used* (among those physicians using the system)	50%	50%	60%	40%	5%	0%	0%
Content Customization Performed							
Templates					None	None	None
Medication List				Partial	None	None	None
Billing Codes	Unknown			Partial	None	None	None
Clinical Reminders	Unknown			Unknown	None	None	None

* See Section 6.2.1

Table 9. Correlation between Successful VOE Use and End-User Training

	PRACTICE						
	Clinic site 101	**Clinic site 102**	**Clinic site 103**	**Clinic site 104**	**Clinic site 105**	**Clinic site 106**	**Clinic site 109**
Implementation Status							
Practice was selected as a VOE Beta Test Site							
Practice has installed VOE							
Physicians using VOE to document some care							
Physicians using VOE to document most care							
Usage Status							
Number of physician users [total number of physicians in practice]	1 [3]	2 [9]	30 [30]	1 [1]	1 [1]	0 [1]	0 [2]
% of patient visits documented using VOE (among those physicians using the system)	75%	95%	100%	2%	100%	0%	0%
% of core VOE features used* (among those physicians using the system)	50%	50%	60%	40%	5%	0%	0%
Primary source(s) of training							
VOE Vendor							
Training materials from WorldVista							
Previous use at VA facility							
Self							
Primary training modality(ies)							
On site training							
Remote interactive training (e.g., web-based)							
Pre-recorded training materials (e.g., CD ROM)							
User manuals or other written materials							
Other		Training at D.C. VA		Hands-on use			
Days of on-site training from vendor	4	8	10	0	0	0	0
How well the training prepared the practice				[No response]			[No response]
Perfectly							
Very well							
Somewhat							
Poorly							
Not at all (or no training received)							

* See Section 6.2.1

8. Cost Analysis

Most of the practices involved in the beta test indicated that the primary reason for their interest in VOE was its low cost. Indeed, the costs that the practices anticipated for the implementation and maintenance of VOE were generally very low. Table 10 shows the expected startup costs and expected ongoing costs at six practices that reported this information (the expected costs are normalized to the size of each practice).

Table 10: Cost Expectations for VOE by Practice Site

	Expected Startup Cost (per MD-FTE)	Expected Ongoing Cost (per MD-FTE per month)
Practice 1	7,500	750
Practice 2	5,000	200
Practice 3	3,333	67
Practice 4	1,083	167
Practice 5	1,400	0
Practice 6*	0	0

* The practice's EHR costs are subsidized by a government entity

With the exception of one practice, the general expectation was that the total direct cost to implement VOE (including hardware, software, and services) would be $5,000 or less and the total direct cost to maintain VOE would be $200 or less per month (on a per-physician basis). These expectations may be unrealistically low and do not necessarily reflect what the practices would be *willing* to pay for VOE (which is the actual determinant of demand for VOE at any specific price point) . However, the figures do provide some benchmark of what many practices in the country may expect to pay for a "low-cost" EHR solution.

Given these expectations, it's useful to evaluate the actual costs incurred by the beta-test practices and to predict the range of costs that similar practices might incur to implement and operate VOE subsequent to the beta-test period. Such an evaluation may indicate whether the actual costs of VOE are, in fact, in line with the low-cost expectations of small practices or whether certain drivers of cost must be reduced to bring VOE in line with these expectations.

This analysis is based on data from only the seven practice sites that implemented VOE, and it should be interpreted with that limitation in mind. Additionally, the cost experience of these early adopters may not reflect the true market costs that practices will face in the future, because several of the VOE vendors and 3rd-party software providers extended favorable terms to these early adopters. Nevertheless, it is a worthwhile exercise to consider the types and the magnitudes of the costs faced by the beta test sites in implementing and operating VOE over the past 6 – 12 months.

Table 11 and Table 12 describe the startup and the ongoing costs of VOE, respectively, as reported by the beta test sites. For each component of cost, the actual experience of the test sites is summarized and supplemental industry estimates are provided where the data was insufficient. Based on this information, a "LOW" and a "HIGH" estimate for each cost category is derived and normalized to a "per Physician" basis.

Table 11. Startup costs for VOE

Cost Component	Experience from Beta Test	Estimated Cost Per-Physician FTE*	
		LOW	HIGH
Hardware	Cost was highly variable, depending on the practice's existing hardware. The VOE client software (CPRS) can run on any Windows *workstation*, and several practices already had workstations capable of hosting the client, saving $1,500 per machine. The VOE server software (MUMPS) must run on a Windows or Linux *server*, so most practices needed to purchase a new computer for this purpose, at a cost of $2,000 - $3,000. One solo practitioner site bought no new hardware, whereas another site with 4 physician FTEs and numerous support staff spent over $10,000 on hardware.	0	7,000
Upgrades to computing environment (networking/peripherals/etc.)	Most practices had minimal needs in this area, and when additions or changes were required, the costs were minor (typically, less than $1,000 for the entire practice). In certain cases, printers or uninterrupted power supplies needed to be purchased or networking facilities upgraded (local area and/or wide area).	0	1,000
Cache licenses	Five of the seven sites are using Cache v5.0 or Cache Ensemble as their MUMPS platform, but have not yet been assessed any fees by Intersystems because of their status as beta test sites. The estimated cost for a Cache license is $500/concurrent user. Two of the sites are using GT.M on Linux (an open-source solution), so there is no Cache licensing cost to them.	0	500
VOE Installation (by vendor or local staff)	The cost for installing the software itself (exclusive of any local configuration or content customization) was $1,000 – $2,000 for those sites that were charged. Several of the sites were not charged for installation by their vendor.	0	2,000
Content customization (vendor fees)	Includes customization of note templates, medication lists, billing codes, and various user preferences. At the practices where customization was provided by the vendor, this task required dozens of person-hours. However, the dollar cost of this activity was sometimes bundled into a single flat fee for installing/configuring the VOE software. At other sites, the service was provided free of charge by the vendor or it was subsidized by a third party (in one case). One can conservatively estimate that content-customization services, when provided by a vendor at commercial rates, will cost at least $1,000 per physician-FTE.	1,000	3,000
Data-interface development	To date, only one data interface has been implemented across all of the beta test sites (a practice-management interface), and this was done as a no-cost service by a vendor. Hence, there is little data regarding the future costs of implementing data interfaces for VOE installations. However, several of the practice sites indicated that they expected to pay approximately $2,500 per implemented interface, which is probably a gross underestimate. Industry data suggests that interfaces from EMRs to labs and practice management systems can actually cost $5,000 - $10,000 each (most sites will require a lab and practice-management interface).	1,000	20,000
Content customization (clinician time)	The customization of note templates, medication lists, and other content requires clinician input, even when actually performed by the vendor. There is a cost in terms of lost productivity as clinicians take time away from their clinical duties to participate in this process. At the beta-test sites, approximately 5-10 hours per physician FTE was	500	1,000

	required for this task, resulting in an estimated opportunity cost of $500-$1,000 per physician FTE (based on an hourly billing rate of $100).		
Lost productivity during initial use (clinician time)	The three beta sites that are actually using VOE to document a substantial portion of their care reported on their loss of productivity during the initial stages of use. One site (a solo practitioner) experienced no loss of productivity. Another site (also a solo practitioner) dropped to 90% of her previous capacity upon implementing VOE, and has remained at that level for the past five months (largely due to the necessity for duplicate data entry because of her lack of a practice-management interface). The third site (a residency training program) dropped to 50% capacity upon implementing VOE and needed to hire an additional staff person, but subsequently returned to full capacity and normal staffing within eight weeks. The two sites that experienced losses in productivity both estimated a reduction in revenue of $11,000 per physician-FTE.	0	11,000
Total (Direct costs)		**2,000**	**33,500**
Total (Direct + Indirect costs)		**2,500**	**45,500**

*****The per-physician estimates vary depending both on the possible magnitude of each cost component and on the number of physicians FTEs that may share fixed costs in a small practice (i.e., between one and ten physicians). Lower costs apportioned among ten physicians result in the lowest per physician-FTE cost estimate, whereas higher costs borne by a single solo practitioner result in the highest per physician-FTE cost estimate.

The following points regarding the actual and estimated start-up costs for VOE are noteworthy:

- The largest costs incurred by the beta test sites were for hardware and VOE installation. However, this breakdown is unlikely to reflect the costs that typical VOE practice sites will incur in the future, because (1) no Cache licensing fees were assessed during the beta-test period, (2) content customization was provided free of charge to most of the beta test sites or not performed at all by the vendor, and (3) only one data interface was implemented, and this was done at no charge. In a commercially viable model of VOE vendor support, practices will incur real costs for Cache licenses, content customization, and interface development.
- The largest estimated costs for future VOE implementations are for content customization and interface development, which together comprise 75% or more of the estimated start-up costs (this proportion holds at both the LOW and the HIGH end of the cost estimates). As evidenced from the feedback of the beta test sites, customization of template and medication content and development of interfaces to lab and practice-management systems are all critical to the acceptability of VOE in clinical practice. Hence, these relatively costly components of VOE implementation will not be optional if the EHR is to be widely accepted.
- For the total startup costs to be consistent with the cost expectations of many practices that are interested in VOE (see Table 10), the costs of content customization and interface development will need to be at lower end of their estimated cost ranges, on a per physician-FTE basis. The V.V.S.O and the vendors should pursue measures to minimize these specific costs, possibly by (1) developing a larger library of built-in templates, particularly for specialties not prevalent in the V.A. system, (2) including a comprehensive and up-to-date medication list with each VOE release, (3) providing better end-user training and documentation to maximize the content customization that physicians and their staffs can perform themselves, (4) developing an interface engine that is bundled with VOE and that supports the configuration of specific lab and practice-management interfaces without low-level programming, and (5) developing a library of interface configurations that are compatible with common lab and practice-management systems and/or industry standards.

- Certain of the practices incurred significant *indirect* costs during the implementation of VOE, in the form of clinician staff time needed to assist with content customization and lost productivity associated with initial accustomization to the system. Although frequently unanticipated by practices, these costs can be a significant proportion of the overall startup costs for EHRs, and VOE is no exception.

Table 12. Ongoing costs for VOE

Cost Component	Experience from Beta Test	Estimated Cost Per Physician FTE Per Month *	
		LOW	HIGH
Cache license	Per estimates from the beta test sites, the annual license cost is $100/concurrent user (20% of the initial licensing cost).	0	80
VOE Maintenance Fees (to vendor for patching, tech support, etc.)	None of the sites have yet executed a maintenance contract with their vendor, but those that provided estimates of what they expect to pay indicated it would be $100 - $200 per month per physician-FTE.	100	200
Content maintenance (by vendor)	All of the vendors indicated that they would charge for this service on a time and materials basis. Therefore, the costs to the practice will be variable, depending on the need to modify templates as new users begin working with VOE and existing users change their preferences. Also, as new medications are introduced and as billing codes are updated. The costs of content maintenance will also vary depending on the practices' ability to create and modify templates themselves, rather than rely on their vendors. Assuming an hourly rate of $75, the cost of content maintenance could be as low as $1,500 per year for the entire practice (if only medication and billing code updates are needed), or a high as $375 per physician-FTE per month (if extensive template editing and medication updates by the vendor are needed on an ongoing basis)	13	375
Data interface maintenance	All of the vendors indicated that they would charge for this service on a time and materials basis. This ongoing cost will also be variable, depending on the number of data interfaces in place and the frequency with which updates to VOE or to the interfaced systems occur. Assuming a 10% annual maintenance cost, the ongoing cost of data interfaces would be $1,000 - $2,000 per year for the practice, with a per physician-FTE per month cost largely dependent on the practice size.	8	167
Wide area network connectivity	The site that is remotely hosted (ASP) requires a full T1 line to achieve adequate bandwidth, at a cost of $600 per month. Locally hosted sites need only a basic DSL connection, at a cost of $50-$60 for the practice.	5	150
Total		**126**	**972**

*****Again, the per-physician-FTE per-month estimates vary depending both on the possible magnitude of each cost component and on the number of physicians FTEs that may share fixed costs in a small practice (potentially, one to ten physicians).

The following points regarding the actual and estimated ongoing costs of VOE are noteworthy:

- The beta test sites have incurred almost no costs for the ongoing operation of VOE, particularly in the areas of Cache licensing, VOE maintenance, content maintenance, and data-interface maintenance. This situation is temporary, however, owing to the fact that (1) Intersystems has extended a cost-free license to most of the beta test sites for the first year, (2) the initial templates and medication lists have been in use just a few months, (3) most of the vendors have not yet developed their pricing models for VOE maintenance contracts, and (4) most beta test sites do not yet have functioning data interfaces to maintain. However, all of these conditions will change over the next six to twelve months, and the beta test sites will begin to incur ongoing costs in line with the estimates in Table 12.
- Little experience exists among the vendors and the beta-test sites in the application of patches to the VOE software. Few of the vendors have applied patches to their installed VOE systems, and the methodology for packaging and applying the many patches that are published by the V.A. is still under development. Hence, the pricing of vendors' maintenance contracts is subject to change as this part of the maintenance process matures.
- The largest potential components of ongoing cost are content maintenance and interface maintenance, particularly for small practices in which the fixed cost of maintaining data interfaces cannot be apportioned among multiple physicians. These services are somewhat open-ended and will be provided on a time-and-materials basis by most of the vendors. To bring the ongoing costs in line with the low-cost expectations of small practices, the level of effort needed from vendors will have to be minimized. Potential measures include sufficient training and documentation to allow practice staff to update content themselves, a configurable interface engine that minimizes the effort to adjust interfaces, and the adoption of widely supported data-exchange standards that minimize the need to adjust interfaces.

9. Vendor Support Model

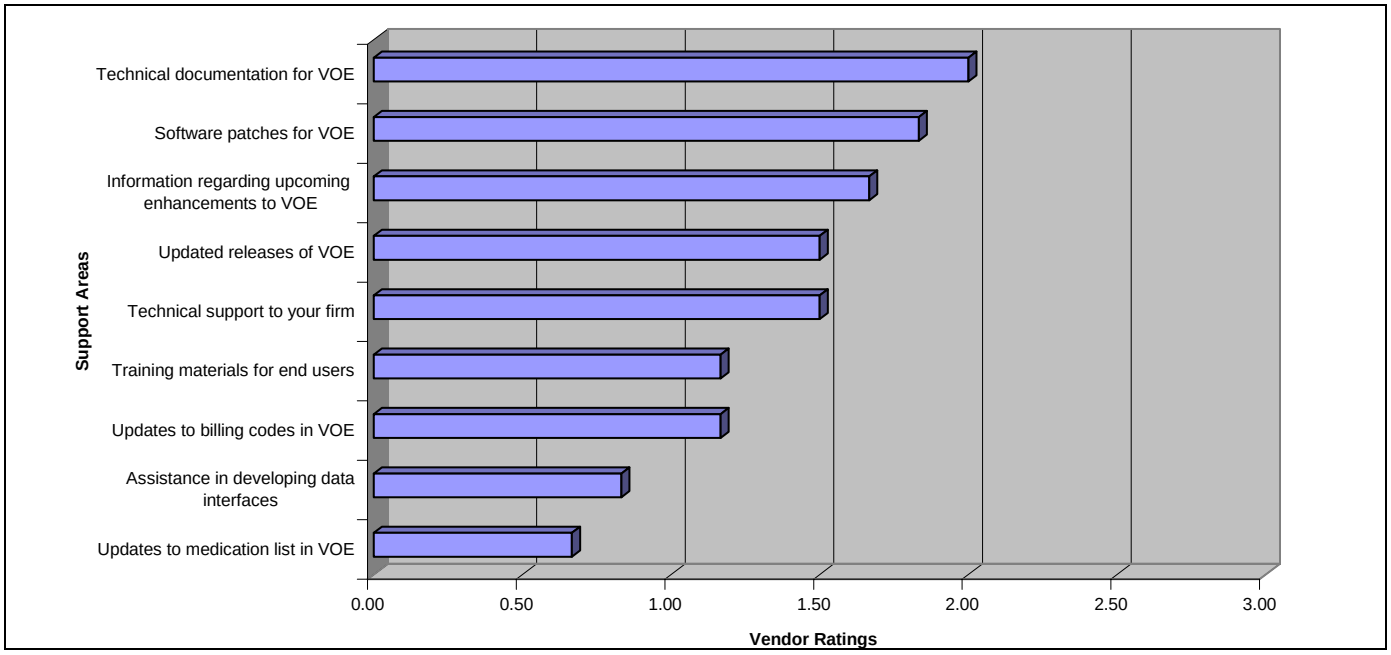
An important aspect of the beta-test evaluation was an assessment of the vendor-support model, as manifested in the Vista Vendor Support Organization (VVSO). To this end, the six vendors participating in the beta test were surveyed regarding the adequacy of support that they received from the VVSO and suggestions for improvements to the vendor-support process. The survey addressed nine specific areas of vendor support and asked the vendors to rate their satisfaction in each area on a scale of 0 - 3:

3: Very Satisfied
2: Mostly Satisfied
1: Somewhat Dissatisfied
0: Very Dissatisfied

The survey that the vendors completed appears in the addendum to this report.

Figure 1 shows the average rating of the six vendors in each of the support areas.

Figure 1. Vendor Satisfaction with VOE Support Services



In addition to numerical scoring, the vendors provided narrative comments and suggestions for each of the support areas. The most useful of these comments and suggestions are provided below.

Technical documentation for VOE

- "Installation documentation was adequate."
- "Documentation did not contain a good overview of the system and how the various modules and applications work together (VA's VistA does not have this either, but one should have been developed for VOE since this was being provided for use in a non-VA environment).
- "Documentation for configuring the system after installation needs to be expanded. The information on Pharmacy, Labs and DOQ-IT needs to be improved."
- "The configuration knowledge needed was obtained internally or from other VistA technical documentation. VVSO needs to complete the documentation"

Software patches for VOE

- "Need for patches was identified in March but the patches weren't released until the end of October."
- "The patch release by Cameron Schlehuber in October was a significant improvement over applying patches individually and should drastically reduce the amount of time required to upgrade VOE."

Information regarding upcoming enhancements to VOE

- "VVSO could adopt a more systematic process for disseminating information."

Updated releases of VOE

- "The only update (from Beta 1 to Beta 2) was just released. I'd like to see more small releases rather than a single big upgrade."
- "The VVSO needs to establish a process for Configuration Management and Version Control, and release updates in a timely manner."

Technical support to your firm

- "The Vendor Partner meetings and individual vendor meetings were very helpful in identifying problems and issues."
- "The few times I attempted to get support, I sent emails and made calls and never got a response."

Training materials for end users

- "The VistA-Office Electronic Health Record (VOE) Quick Reference User Guide was useful, however, advanced training for site super-users would be helpful."
- "Have not seen end user training material. Our company has developed our own."

Updates to billing codes in VOE

- "It took a long time to get the current CPT Codes. Some of the delay was due to AMA but the VVSO should have had a plan and schedule for updating the codes for VOE."

Assistance in developing data interfaces

- "Have not seen any. Practice Management and Lab interfaces (at a minimum) are a must for a successful implementation of VOE in a private practice."
- "The VVSO relied upon the vendors to provide solutions at their own expense"
- "Recommendation: Establish an interface development team."

Updates to medication list in VOE

- "Current drugs, dosages, brand names, etc were not in the orderable item file. The drug files should have been cleaned out and updated before the software was released even in Beta form."
- "Private providers and facilities need access to multiple formularies and more effortless drug updates."
- "Have not seen [updates] yet. This is an important element."

The vendors were also asked to suggest additional services and materials that the VVSO could provide to support the vendor's activities. They had the following suggestions:

1. Online curriculum and training materials would be helpful, for both new and advanced users
2. Standard lab and drug file should be developed for distribution

3. There needs to be a Vista for dummies approach with an "easy does it" setting on all the security features. At the present time, the product is shipped in a very basic form. Most physicians will not want to become system administrators The setup process needs to be canned and straightforward
4. Guidance on the DOQ-IT feature, with training materials.
5. We think the VVSO model could work if it had strong management and was adequately funded to respond to problems and critical requests

Analysis. The vendors are somewhat or very dissatisfied with the support they've received in a number of areas, and there are no areas of support with which they are mostly or very satisfied. This general dissatisfaction is likely due to a combination of the significant challenges the vendors face in successfully implementing VOE in private-practice environments and their heightened expectations for support from the VVSO. In addition, resource limitations may be preventing the VVSO from providing support at the level that the vendors expect and need, particularly in areas such as technical documentation, end-user training materials, and updates to medication and billing codes (i.e., areas in which it may make more sense for the VVSO to provide centralized services, rather than each vendor replicating similar resources).

The greatest dissatisfaction with support has been in the areas of updated medication content and interface development. Given adequate resources, the VVSO could theoretically address the medication-update challenges by creating a centralized mechanism to create a complete medication list as part of each VOE release and a process to distribute updates for the medication lists in installed VOE systems as the set of orderable drugs changes. This appears to be a worthwhile and feasible service that would address the physicians' and vendors' concerns. On the other hand, the variety of lab and practice management systems in use precludes an easy solution to the interface challenges faced by the vendors. A configurable interface engine provided with VOE could streamline interface development to a certain extent, but the absence of "plug-and-play" interfacing standards in healthcare will still require a lot of work to implement functioning interfaces to lab and practice-management systems.

Lastly, the process for publishing patches and new releases of the VOE software has been a notable area of concern, with significant implications for the vendors' ability to support VOE sites on an ongoing basis. The new mechanism for releasing consolidated bundles of patches ("super patches"), rather than hundreds of individual patches, holds promise for meeting the vendors' needs to upgrade their clients' systems and provide needed new functionalities (such as prescription finishing and scanning). However, to address the vendors' requirement for timely updates, the VVSO will need sufficient resources to test, modify, bundle, and distribute the patches received from the V.A. on a periodic and frequent basis.

In principle, the current VVSO-based model appears to be a feasible way to support independent vendors that install and maintain VOE systems in the private sector. However, feedback from the vendors suggests that the set of services provided by the VVSO must be improved and expanded if the model is to support successful VOE implementation on a large scale, something that will likely require more resources.