



CPRS Analysis Report

Deliverables 6.2, 6.4, 6.5, 7.2, 7.4, 7.5

Tasks 6, 7

Emerging Health Technology Investigations Support Project

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Transforming Data into Action
A Service Disabled Veteran Small Business

Executive Summary

Business Intelligence, Inc. (BI), as part of a project of the Veterans Health Administration (VHA) Emerging Health Technologies (EHT) office, observed clinicians interacting with the Veterans Health Information Systems and Technology Architecture (VistA) Computerized Patient Record System (CPRS) in order to:

- Identify high value, frequently performed CPRS functions directly related to patient care;
- Evaluate the tasks for inefficiencies and make recommendations for solutions to minimize or eliminate the inefficiencies;
- Establish measurable performance metrics for high-value, priority functions;
- Validate the recommendations by using a simulation model to gather performance metric data and clinician feedback;
- Solicit clinician feedback regarding the importance of the recommendations to their daily workflow; and
- Establish a baseline measurement for system response tolerance thresholds.

The BI Team gathered the observations and validations through two rounds of site visits to four Veterans Affairs Medical Centers (VAMCs) with 34 total participants (16 physicians and 18 nurses). The BI Team identified the following eight high-value, frequently performed clinician interactions with CPRS. Then, based on analysis of the task interaction, the BI Team developed recommended changes to CPRS. These are summarized below:

- **Print Patient List:** Provide the ability to print a patient list from CPRS, which would include the patient's name, location, and priority for use in inpatient clinician settings, and the patient's name, appointment time, and encounter status for use in outpatient clinician settings. The primary impact is in the hospital setting and the clinician is freed from having to leave CPRS for a clerical task.
- **Dashboard Functionality:** Provide the ability to access multiple patients' information from one screen. The primary impact is in the hospital setting and enables the clinicians to quickly triage their assigned patients.
- **Cover Sheet (Postings):** Highlight the importance of first-glance information. The impact is in both the hospital and clinic settings and enables the clinician to quickly confirm specific posting information.
- **Cover Sheet (Interactive Functionality):** Bring functionality from other parts of CPRS to the cover screen—e.g., starting new note, changing meds, or ordering labs. Primary impact is in the hospital setting and enables the clinician to conduct more of the patient encounter without leaving the cover screen.

- **Accessing Data Behind Templates and Consults:** Provide the capability to access additional patient data in CPRS while completing a locally developed template. The impact is in both the hospital and clinic settings, and enables the clinician to refrain from having to close and redo a template or consult, if additional patient information is needed.
- **Sorting and Comparing Medications:** Include the capability to sort and compare inpatient, out patient and non-VA medications in the Medication screen. Impact is in both the hospital and clinic settings, and enables the clinician to more quickly reconcile a patient's medication profile.
- **Sorting and Finding Orders:** Provide the ability to sort and quickly identify patient orders. The impact is in both the hospital and clinic settings and enables the clinician to more quickly identify a patient's order.
- **CPRS interaction with BCMA:** Link CPRS and BCMA to synchronize patient information between the two applications automatically. Primary impact is on inpatient nursing and has the potential to reduce the possibility of a patient medication error.

Overall Timesaving:

The BI Team calculated the average savings per task for the recommended changes using the difference between the means of the As-Is and To-Be sample execution timing results. The table below shows the timesavings gained by implementing the recommended changes to CPRS for each high-value frequently performed task. The project total time savings per physician per day is 28 minutes based on a per physician patient load of seven patients per day.

Task Listing	Average Savings per task (Seconds*)	Used during the day	Total savings (Seconds*)
Print Patient List	49	1	49
Dashboard Functionality	14	7	98
Cover Sheet (Postings)	15	7	105
Cover Sheet (Interactive Functionality)	19	7	133
Accessing Data behind Templates and Consults	17	7	119
Sorting and Comparing Medications	104	7	728
Sorting and Finding Orders	60	7	420
	Total Seconds		1,652
	Savings in Minutes		28*

* Calculations are rounded to the nearest second/minute.

Overall Task Rankings

The four highest ranked tasks among both nurses and physicians are Cover Sheet (Interactive Functionality), Dashboard Functionality, Sorting and Comparing Medications, and Accessibility of Data behind Templates and Consults.

Tolerance Threshold

As part of the overall task, the BI Team also conducted a study of CPRS response threshold tolerance. The results indicated that clinicians find screen-to-screen response times of 2 seconds and below acceptable; response times between 2 and 5 seconds were tolerated but not considered desirable.

Overall Recommendations

The BI Team is suggesting 34 recommendations (see Appendix F) regarding the eight high-value frequently performed tasks. The overarching recommendations are as follows:

- Enable sorting of tabular data by any column;
- Present data in a way that decreases the time a user needs to access information; and
- Consolidate functionality into single screens where possible to lessen the need for the clinician to use multiple screens to complete a single task.

Additionally, the BI Team outlined 24 proposed functional recommendations (see Table 28) that are not in the defined scope of the analysis, and 17 requested capabilities (see Table 29) that are considered future development.

Table i. Document Revision History

Table i below shows the revision history of this document.

Version	Date	Changed By	Revision Description
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1.1	08/15/2008	Ken Bodenheimer, Task Lead	Incorporating Government Comments
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Table ii. Approval History

Table ii below shows the approvals signatures for this version of the document.

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Eileen Cocks/Ken Bodenheimer Task 6, 7 Task Lead	Eileen Cocks/Kenneth Bodenheimer	08/26/2008

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1 Introduction

The Veterans Health Administration (VHA) Emerging Health Technologies (EHT) office, as part of its Investigation Support contract, tasked Business Intelligence, Inc. (BI) to measure the response time and workflow effectiveness of clinicians as they executed selected high-value, frequently performed Veterans Health Information Systems and Technology Architecture (VistA) Computerized Patient Record System (CPRS) functions. This portion of the contract, Tasks 6 and 7 had the following objectives:

- Identify high value, frequently performed CPRS functions directly related to patient care;
- Identify repetitious interactions, evaluate the interactions for inefficiencies and make recommendations for solutions to minimize or eliminate the inefficiencies;
- Establish measurable performance metrics for high-value, priority functions;
- Validate the recommendations by using a simulated model to gather performance metric data and clinician feedback;
- Solicit clinician feedback regarding the importance of the recommendations to their daily workflow (based on an one to eight ranking with one being the most important); and
- Establish a baseline measurement for system response tolerance thresholds.

To meet the objectives of this task, the BI Team engaged in a study of physician and nursing interactions with CPRS as they fulfilled their roles and responsibilities for the care of veterans. The BI Team identified eight high-value, frequently-performed tasks and evaluated them for improved efficiencies. Streamlining high-value frequently performed tasks will reduce clinician computer time which would allow a clinician more time to spend in patient interactions.

High value, frequently performed tasks are defined as:

CPRS activities that are directly related to patient care and are repetitive in nature for each patient. They possess critical data elements that are required in the clinical workflow process and hold the potential, when reengineered, to increase the efficiency of CPRS.

1.1 Project Objectives

For both Tasks 6 and 7, the objective was to measure the response time and workflow effectiveness of selected high value frequently performed CPRS functions in order to identify nonfunctional requirements that will have a direct impact on workflow efficiency.

The overall strategy was to engage the clinicians in their environment and gather their insights and recommendations on improving their efficiency with CPRS. Through direct interaction and observation, the team collected valuable information that was used to develop business requirements to improve CPRS functionality and increase efficiencies in the clinical setting.

The clinicians' suggestions focused on:

- Providing agility and intuitiveness within CPRS so that data is brought to the clinician;
- Reduce computer time by reordering functionality; and
- Increase patient safety by modifying the display of patient data.

The impact of this focus creates potential timesavings, streamlines the clinician interaction with CPRS, and increases the accuracy and quality of patient care. The following high value, frequently performed tasks are presented in this document:

- Print Patient List
- Dashboard Functionality
- Cover Sheet (Postings)
- Cover Sheet (Functionality)
- Accessibility of Data behind Templates and Consults
- Sorting and Comparing Medications
- Sorting and Finding Orders
- CPRS Interaction with BCMA

The BI Team validated the tasks and potential solutions and then asked clinicians to rank order these potential solutions so that future CPRS development could address the modifications in a manner that held the highest priority and significance to the clinicians. The results of the rank order recommendations are also included in this document.

In addition to these proposed solutions and rankings, the BI Team evaluated response-time thresholds for clinician interactions with CPRS. The goal in gathering this data was to establish the clinicians' "response time sensitivity," which will be used to identify the minimally acceptable and optimal screen-to-screen change requirements. The results of the response times also are presented in this document.

The BI Team examined the findings to produce a set of recommendations and requirements for both current and future CPRS functionality. The findings of the analysis are presented below.

1.2 About this Document and Document Scope

This document contains the following deliverables:

- Deliverable 6.2: Baseline response time data collected for tasks identified and weighted in Task 6.2;
- Deliverable 6.4: Response time simulation testing results report;
- Deliverable 6.5: Report that details recommended response time requirements;
- Deliverable 7.2: Baseline workflow efficiency data collected for high-value, frequently performed tasks;
- Deliverable 7.4: Workflow efficiency simulation testing results report; and
- Deliverable 7.5: Report detailing recommended workflow and keystroke efficiency improvements.

This consolidated report is organized into four major sections:

Section 1 Introduction – Provides basic context for the report: task purpose and objectives, analysis scope, and a brief overview of the methodology.

Section 2 Findings – Presents the recommendations, impacts, findings, and formal requirements statements, organized by the high-value, frequently performed tasks.

Section 3 Out of Scope Findings – At VHA’s request, BI collected and identified other candidate changes and future enhancements to CPRS that were outside the specific scope of this task. These are included in this section for VHA’s consideration.

Appendixes – The detailed analysis and data supporting the findings reported in Sections 2 and 3 are presented as Appendixes. This section also includes the report references and terms and abbreviations.

1.3 Analysis Methodology

The methodology used to conduct the site visit appears in the *Combined Industrial Engineering and Workflow Engineering Methodology Proposal for Tasks 6 and 7* dated 6 February 2008. The following is an overview of the process.

The approach focused on obtaining real-life CPRS observational data from 34 clinicians (16 physicians and 18 nurses) at four VA medical centers (VAMC) over two rounds of site visits. The VAMCs were: Bay Pines, Florida; Baltimore, Maryland; West Roxbury, Massachusetts, and Albany, New York.

The initial round of site visits first involved discussions with clinicians about their ideas for changes to CPRS that would facilitate improvements in their daily tasks. Second, the BI Team observed clinicians in their environments and daily routines and recorded their observations to determine if there were any tasks that could be made more efficient.

The BI Team analyzed the data and modeled the candidate changes in a simulation tool. The second round of site visits involved the presentation of and clinician interaction with the modeled proposed changes. This was followed by clinician feedback sessions to validate the changes and collect any additional insights. Concurrently, the BI Team asked clinicians to rank order the tasks related to their day-to-day activities.

Additionally, the BI Team developed scenarios that establish parameters for performing baseline process timings of the high-value, frequently performed tasks. The BI Team then executed a timings study to determine if any there were any efficiency gains or losses between the “As-Is” state, executed against the site’s CPRS training system, and “To-Be” model executed against the simulated screens on a standalone laptop.

Furthermore, the BI Team conducted a study of threshold tolerance times. The clinicians interacted with the simulator, viewing specific sets of CPRS screens with varying degrees of screen-to-screen transition times. The simulator began with a known “acceptable” response time (i.e., the current response times, which is the elapsed time between user entry and system response) and then varied the response time at set intervals. The clinicians recorded their opinion

as to whether the times were “acceptable,” “somewhat acceptable,” “somewhat unacceptable,” or “unacceptable.”

Tasks

Based on the observations and discussion of the first round of site visits, the BI Team developed the following overall recommendations to the list of high-value, frequently performed tasks:

- Modify CPRS so that a clinician can print a list of assigned patients.
- Modify CPRS to create a dashboard of assigned patients that contains high-level information.
- Modify the patient’s cover sheet in the Posting section to display the “do not resuscitate” (DNR) status of the patient, the Health Insurance Portability and Accountability Act (HIPAA) designee of the patient, and the patient’s non-VA primary healthcare provider (PCP).
- Modify the patient’s cover sheet so added functionality is available to manage and direct laboratory and medication orders.
- Modify templates and consults so that these screens can be minimized while the patient’s medical record remains active.
- Modify CPRS so that sorting and comparing outpatient-to-inpatient and inpatient-to-inpatient medications can be accomplished with improved accuracy and reduced effort.
- Modify the order screen so that the clinician can customize selected views and prominently display critical and time-sensitive medical orders.
- Modify CPRS so that when a patient’s arm band is scanned, Bar Code Medication Administration (BCMA) and CPRS synchronize to the same patient.

Once the on-site studies were complete, the BI Team analyzed the execution timings to determine if there were any time saving differentials between the two states. The BI Team also incorporated clinician feedback and refined the model. The finalized recommendations and appropriate requirements statements are presented in the sections below.

2 Findings

The following subsections present the findings for each individual task. Overarching findings include:

Total Timesaving Impact

Based on the results of the timing studies, the BI Team conjectured that clinicians could save at least 28 minutes per day if the changes were implemented. The BI Team calculated the average savings per task using the difference between the means of the As-Is and To-Be sample execution timing results utilizing a 95% confidence level. The daily time savings are based on the assumption that the clinician would print the patient list once, and then perform each task per patient and on a per physician patient load of seven patients per day.

Overall Clinical Impact

Implementing the recommendations has the potential of improving clinician interaction with CPRS, thus allowing the clinician more time for patient interaction and improved patient care. In some instances it also allows for the reduction of potential medication errors.

Tolerance Testing

The results of the threshold tolerance testing of CPRS response times indicated that clinician frustration with system response time started between 2 to 5 seconds. Clinician feedback indicated that consistent response times at this level or higher would seriously impact their daily workflows. Clinicians deemed system response times of 2 seconds or less as acceptable and indicated that such response times would not adversely impact daily workflows.

Task Ranking

The results of the task ranking indicate that out of the eight high value frequently performed task recommendations, the four most important solution recommendations to a clinician's workflow are Cover Sheet (Functionality), Dashboard Functionality, Sorting and Comparing Medications, and Accessing Data behind Templates. The breakdown of the ranking between doctors and nurses is presented in Appendix D.

2.1 Recommended Modifications to Print Patient List

The recommendations provided in this section focus on the "Print Patient List" high-value, frequently performed task. It addresses the printing of patient lists as performed by VHA clinicians observed during the site visits conducted for this analysis.

2.1.1 Assessment of As-Is State of Print Patient List

Clinician Feedback

During the initial observations and subsequent discussions, the BI Team found that clinicians are unable to print a patient list from CPRS. The clinicians requested that this function be brought into CPRS from VistA. Clinicians also provided suggested changes to the patient list that would increase its value by supplying further information on the list. The suggested changes are:

- Allow the clinician to print a patient list from the patient selection screen;
- Allow a clinician to choose the information displayed on a patient list or tailor it to a specialty (e.g. an outpatient clinician could see complete/incomplete encounter status and appointment times, while inpatient clinicians could view patient location and priority status);
- Allow clinicians to add or delete patients instantaneously; and
- Allow attending physicians to see their residents' lists.

Incorporating these suggested changes would move current functionality from VistA to CPRS, thus reducing keystrokes and the need to leave CPRS for a clerical task. Clinicians theorize that these changes will increase their efficiency while interacting with the system, and allow more time for patient care.

As-Is Scenario

To document the projected efficiencies related to the recommended changes, the BI Team devised a pair of parallel scenarios that best represent the task of a clinician printing a list of assigned patients. The first scenario (described in this section) mimics current CPRS functionality (As-Is), while the second scenario represents the recommended changes (To-Be).

Table 1 describes the basic instructions for printing a patient list from VistA as observed at three of the four sites. There exists some variation in clicks as the number of characters of the sign-on and provider name changes from clinician to clinician and site to site; however, this scenario is fairly representative of the process as a whole. The fourth site had different procedures related to different clinician roles, including some clinicians who were unable to print an inpatient roster. The data in those cases were excluded in the overall analysis (see Appendix B).

Table 1. As-Is Scenario Instructions for Printing a patient list

Step	Description	Clicks/keystrokes:
1.	Enter the VistA system	2
2.	Enter access and verify code	1
3.	From the main menu enter “^IR” (up carrot IR)	3
4.	Select inpatient Roster	1
5.	Select “P” (Provider)	1
6.	Select “A” (Attending)	1
7.	Enter a provider name	1
8.	Sort by “R” (Room)	1
9.	Select “Y” to double space	1
10.	Enter number of copies “1”	1
11.	Enter “Ward_4a”	7
12.	Close VistA	1
Total Clicks		21

As-Is Screen Shots

Since the functionality to print a patient list exists in VistA and not in CPRS, there is no As-Is screen shot of the patient list or process. The current state of the patient select screen is shown in Figure 1 to allow for comparison to the To-Be model in section 2.1.2 below.

In the current state CPRS, the Patient Selection screen (Figure 1) lists specific patient lists based on parameters such as providers, specialties, and wards, allows a clinician to select a patient and saves the selected settings. However, a clinician cannot print a patient list from this screen and must instead leave CPRS to print the list from VistA.

Figure 1. As-Is model of the CPRS Patient Selection screen.

Patient Selection

Patient List

☐ Default: DEMO LIST

☐ Providers ☐ Clinics

☐ Team/Person ☒ Wards

☐ Specialty: ☐ All

7A GEN MED

2-INTERMED

3 NORTH SURG

3E NORTH

4D

4D-STROKE

7A GEN MED

7A SURG

Patients (7A GEN MED)

Eight, Inpatient

Five, Inpatient

Four, Inpatient

Nine, Inpatient

One, Inpatient

Seven, Inpatient

Six, Inpatient

Ten, Inpatient

Three, Inpatient

Two, Inpatient

Bcma, Eight

Bcma, Eighteen-Patient

Bcma, Eighty-Patient

Bcma, Eighty-eight-Patient

Bcma, Eighty-five-Patient

Bcma, Eighty-four-Patient

OK

Cancel

Save Patient List Settings

Notifications

Info	Patient	Location	Urgency	Alert Date/Time	Message
I	SIX, INPAT (S0806)	7A GEN...	Moderate	11/29/2007@10:30	Admitted on 11/29 10:30 to 7A GEN MED 726-4

Process Info Process All Process Forward Remove

2.1.2 Assessment of To-Be Changes to Print Patient List

Description of Recommendations

In order to verify the clinician suggestions iterated in Section 2.1.1, the BI Team incorporated the following recommended modifications into the CPRS Patient Selection Screen and patient list:

- Modify the CPRS Patient Selection Screen to include a button to print the clinician's patient list (RCMD PPL #001).
- Modify the list to display basic information tailored to clinician preference (e.g., an outpatient clinician could see complete/incomplete status and appointment times while an inpatient clinician could view patient location and priority status) (RCMD PPL #002).

For a visual representation of these recommendations please see Figures 2 and 3 below.

To-Be Screen Shots

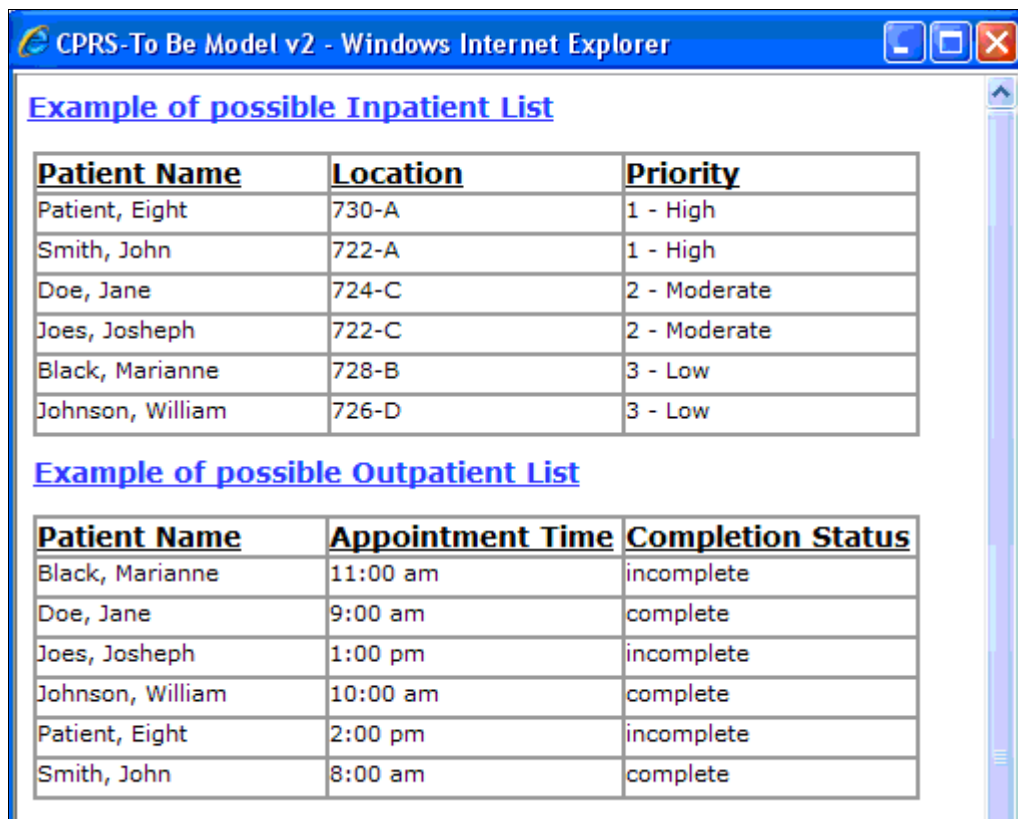
The To-Be model of the Patient Selection screen (Figure 2) maintains current CPRS functionality but allows a clinician to instantly print a patient list by pressing the Print Patient List button. Clinicians also have the option of entering a dashboard (discussed in Section 2 below) by pressing an added Dashboard button.

Figure 2. To-Be model of the CPRS Patient Selection screen

The screenshot shows the 'Patient Selection' window. On the left, under 'Patient List', there are radio buttons for 'Default: DEMO LIST' (selected), 'Providers', 'Clinics', 'Team/Personal', 'Wards', 'Specialties', and 'All'. The main area, titled 'Patients (DEMO LIST)', contains a list of patient names: Smith, John; Doe, Jane; Johnson, William; Black, Marianne; Joes, Josheph; and Patient, Eight. To the right of the list are 'OK' and 'Cancel' buttons. Below the list are three buttons: 'Dashboard', 'Print Patient List', and 'Save Patient List Settings'. At the bottom, there is a 'Notifications' section with a table header: Info, Patient, Location, Urgency, Alert Date/Time, Message, and Forwarded By/WI. Below the header is a large empty text area. At the very bottom are five buttons: 'Process Info', 'Process All', 'Process', 'Forward', and 'Remove'.

Figure 3 shows two possible options for a patient list. The first is for inpatient clinicians and shows the patient name, location, and priority status (for further information on priority status, please see the Dashboard in Section 3.1.2 below). The second example is for outpatient clinicians and shows the patient name, appointment time, and encounter completion status. Ideally and within reason, clinicians would be able to set preferences as to what information they wanted printed on this list. Also, if the list is printed from the Dashboard (discussed in Section 3.1.2 below), the order of the patients would reflect the order on the Dashboard.

Figure 3. To-Be model of an inpatient list and an outpatient list



Example of possible Inpatient List

<u>Patient Name</u>	<u>Location</u>	<u>Priority</u>
Patient, Eight	730-A	1 - High
Smith, John	722-A	1 - High
Doe, Jane	724-C	2 - Moderate
Joes, Josheph	722-C	2 - Moderate
Black, Marianne	728-B	3 - Low
Johnson, William	726-D	3 - Low

Example of possible Outpatient List

<u>Patient Name</u>	<u>Appointment Time</u>	<u>Completion Status</u>
Black, Marianne	11:00 am	incomplete
Doe, Jane	9:00 am	complete
Joes, Josheph	1:00 pm	incomplete
Johnson, William	10:00 am	complete
Patient, Eight	2:00 pm	incomplete
Smith, John	8:00 am	complete

To-Be Scenario

The BI Team captured the steps a clinician would use to print a patient list and created the To-Be scenario shown in Table 2. The BI Team then verified that the changes could potentially increase clinician efficiency by executing a timing study between the As-Is scenario and the To-Be scenario (see the Impacts Section below).

Table 2. To-Be Scenario Instructions for Printing a Patient List

Step	Description	Clicks
1.	From the Patient Select screen, press the Print Patient List button	1
2.	Close the patient list	1
Total Clicks		2

2.1.3 Impacts

Findings from the impact analysis are broken down in to three categories: clinical impact, time and keystroke efficiencies and task ranking. The following sections provide commentary on the specific findings.

Clinical Impact

The clinical impacts of the recommended changes are based on clinician comments and insights recorded during the two site visits.

The key clinical benefits of implementing the recommended changes to printing a patient list and the Patient Selection screen are:

- Eliminates the need to leave the CPRS environment;
- Potentially reduces the amount of time spent on administrative tasks (fewer keystrokes); and
- Promotes ease-of-use of the system (single button access).

Time and Keystroke Efficiencies

The BI Team conducted an execution timing comparison study utilizing task scenarios representing the As-Is and To-Be states. The analysis showed that the execution timesaving for the To-Be scenario was on average 49 seconds plus or minus 9 seconds.

Table 3 shows a summary of the results. Full calculations and statistical definitions are provided in Appendixes B and G.

Table 3. Time Data Results for Execution Timings for Printing a Patient List

Scenario	Sample Size	Mean Execution Time (Seconds)	Difference between the Means (Seconds)	Lower 95% Confidence Interval (Seconds)	Upper 95% Confidence Interval (Seconds)
As-Is	30	55			
To-Be	30	6			
			49	40	58

The BI Team also calculated keystroke differentials between the To-Be and As-Is scenarios and found there to be a 90 percent reduction between the current CPRS system and the recommended changes to accomplish the same task (Table 4).

Table 4. Keystroke Count for Printing a Patient List

Scenario	Keystrokes
As-Is	21
To-Be	2
Difference	19

Task Ranking

The BI Team asked clinicians to rank from one to eight (with one being the most important) the eight “To-Be” solution tasks in terms of importance to the individual clinician.

The Print Patient List task ranked in the lower half of order preference for both nurses and doctors.

- Of the 18 nurses, only one ranked it a 1, while seven ranked it an 8 and six ranked it a 7. The remaining four ranked it either a 4 or 5.
- Of the 16 doctors, none ranked it a one, four ranked it between a 3 and 4 and eleven ranked it between 5 and 8.

2.1.4 Requirements Statements

Based on the key findings, the BI Team has prepared a set of recommended requirements for VHA consideration.

- The system shall provide the ability to print a list of patients from the patient select screen (REQ PPL #001).
- The system shall provide the ability to print a list of the clinician's assigned patients (REQ PPL #002).
- The system shall provide the ability to print a patient list based on location (REQ PPL #003).
- The system shall provide the ability to print a date specific list of patients scheduled for a specific outpatient clinic (REQ PPL #004).
- The system shall print a patient list that contains the appointment times for each outpatient (REQ PPL #005).
- The system shall print a patient list that contains the completion status for each outpatient (REQ PPL #006).
- The system shall print a patient list that contains the location for each inpatient (REQ PPL #007).
- The system shall print a patient list that contains the priority level for each inpatient (REQ PPL #008).
- The system shall print the patient list in a logical grouping (REQ PPL #009).

2.1.5 Supporting Data

The supporting data, detailed analysis, and relevant references are found in Appendixes A-E.

2.2 Recommended Modifications to CPRS – addition of a Dashboard

The recommendations provided in this section focus on the “Dashboard Functionality” high-value, frequently performed task. It addresses the accessing of information from multiple patients as performed by VHA clinicians in the inpatient settings that were observed during the site visits conducted for this analysis.

2.2.1 Assessment of As-Is State of Dashboard Functionality

Clinician Feedback

During the initial observations and subsequent discussions, clinician feedback provided the suggestion to create a dashboard that would display high level, patient-specific clinical information for a group of patients. The suggested changes are:

- Display multiple patients' data to allow for quick triaging of patients and easy prioritization of the day's clinician responsibilities;
- Highlight critical or abnormal values; and
- Provide clinicians the ability to customize the display of patient data.

Incorporating these suggested changes would allow for a quicker assessment of multiple patients, reduce keystrokes and provide an overall view of a clinician's patients. Clinicians theorize that these changes will increase their efficiency while triaging the day's patients and allow more time for patient care.

As-Is Scenario

To document the projected efficiencies related to the recommended changes, the BI Team devised a pair of parallel scenarios that represent the task of a clinician viewing data for multiple patients at a time. The first scenario, which is described in this section, mimics current CPRS functionality (As-Is) while the other represents the recommended changes (To-Be).

The As-Is scenario shown in Table 5 shows one example of the steps a clinician would have to take to view information for one patient and then immediately check information for another patient. As the scenario shows, a clinician must continuously select the new patient to navigate through multiple charts.

Table 5. As-Is scenario for viewing information for more than one patient in a single interaction with CPRS

Step	Description	Clicks
1.	Starting from the Patient Select Screen, select the first patient	2
2.	Click on the "Labs" Tab	1
3.	View first lab value	-
4.	Select the second patient	4
5.	Select the cover page	1
6.	Open the first "Vitals" value	1
7.	Close the vitals information screen	1
	Total Clicks	10

As-Is Screen Shot

CPRS does not currently have a dashboard therefore there is no screen shot available. Though the BI Team acknowledges that there is a dashboard in the VistA care management package, clinician feedback from the site visits indicate that it was not used for a variety of reason. This includes reasons such as: the dashboard was not fully launched or advertised in certain sites; when an alert is resolved in Care Management it does not resolve in CPRS; a clinician must leave CPRS to use it, and there has been no formal training offered on the use of the dashboard.

2.2.2 Assessment of To-Be Changes to Dashboard Functionality

Description of Recommendations

In order to verify the clinician suggestions iterated in Section 2.2.1, the BI Team incorporated the following recommended modifications into the To-Be model:

- Modify CPRS to contain a single dashboard screen that displays multiple patients' data (RCMD DB #001).
- Highlight critical individual patient information (RCMD DB #002).
- Allow clinicians to specify the Dashboard data columns (RCMD DB #003).
- Allow clinicians to set data retrieval parameters (RCMD DB #004).
- Allow clinicians to see expanded data from Dashboard links (RCMD DB #005).
- Allow clinicians to sort information by specific column headers (RCMD DB #006).
- Link the dashboard to the patient selection screen (RCMD DB #007).

For a visual representation of these recommendations please see Figures 4-7 below.

To-Be Screen Shots

Figure 4 represents a possible customization screen, which would allow a clinician to choose the patient information they would like to have displayed on the dashboard by clicking or un-clicking a box next to column choices. The model also allows a clinician to choose which clinician's last note would be displayed and the date range for lab and vitals results display. Once this is set, it would become the default view for the clinician. Alternatively, changes could be made to allow clinicians to right click on the dashboard in order to add or delete columns.

Figure 4. To-Be model of the Dashboard Customization screen

The screenshot shows a web browser window titled "CPRS-To Be Model v2 - Windows Internet Explorer". Inside the browser is a form titled "Dashboard Custom Options:". The form contains two main sections: "Dashboard Custom Options:" and "Common Layouts:".

Dashboard Custom Options:

- ☒ Patient Location
- ☒ Current Medications
- ☒ Labs t- : days
- ☒ Test Results
- ☒ Vitals t- : days
- ☒ Notes Select Clinician:
- ☒ Priority
- ☐ Unverified Orders
- ☐ Appointment Time
- ☐ Admitting Team
- ☐ Encounter Status

Common Layouts:

- ☒ Inpatient Physician
- ☐ Inpatient Nurse
- ☐ Outpatient Clinician

At the bottom right of the form are "Cancel" and "OK" buttons.

Figure 5 is one possible example of an inpatient physician's dashboard. The dashboard contains columns for the patient name, admitting diagnosis, patient location, current medications, labs, test results, vitals, physician's last note and patient priority. When a link in a column is selected the data appears in the lower half of the screen.

Figure 5. To-Be model of a possible inpatient physician's Dashboard

Vista CPRS in use by: Provider.Three (CPRSdemo.va.gov)

File Edit View Action Tools Help [Customize](#)

No Patient Selected 000-00-0000

Patient Name	Admitting Diagnosis	Location	Meds	Labs	Results	Vitals	Notes	Priority
Black, Marianne	Headache	728-B	Current Meds			Apr 24, 2008 @ 9:00am	Apr 23, 2008 @ 9:00pm	3 - Low
Doe, Jane	Diabetes	724-C	Current Meds	abnormal		Apr 24, 2008 @ 7:00am	Apr 23, 2008 @ 7:00pm	2 - Moderate
Jones, Joseph	Chest Pain	722-C	Current Meds	abnormal	Avail	Apr 24, 2008 @ 6:15am	Apr 24, 2008 @ 6:30am	2 - Moderate
Johnson, William	Abdominal Pain	726-D	Current Meds	normal	Avail	Apr 24, 2008 @ 5:00am	Apr 24, 2008 @ 5:15am	3 - Low
Patient, Eight	Hyperlipidemia	730-A	Current Meds	critical	Avail	Apr 24, 2008 @ 9:30am	Apr 24, 2008 @ 9:45am	1 - High
Smith, John	Chest Pain	722-A	Current Meds	critical	Avail	Apr 24, 2008 @ 6:30am	Apr 24, 2008 @ 6:45am	1 - High

Current Medications for: [Enter Patient Name Here]

Medication	Stop Date	Status
HYDROCODONE 10MG TAB Sig: ONE TABLET BY MOUTH THREE TIMES A DAY AS NEEDED For Back pain flares	04/01/2008	Pending
CARBAMAZEPINE TAB; 200MG BY MOUTH THREE TIMES A DAY	04/15/2008	Active
CYCLOBENZAPRINE TAB; 10MG BY MOUTH THREE TIMES A DAY for muscle relaxation	01/01/2009	Active
DOCOSATE SODIUM CAP,ORAL 200MG BY MOUTH AT BEDTIME AS NEEDED constipation	02/29/2008	Pending
GABAPENTIN TAB; 600MG BY MOUTH THREE TIMES A DAY give 6 am, 2 pm and 10 pm	03/03/2008	Pending
LEVOTHYROXINE NA (SYNTHROID) TAB; 0.075MG BY MOUTH QAMAC hypothyroidism	06/15/2008	Active
OMEPRAZOLE CAP,EC; 20MG ORALLY QAMAC for stomach	06/15/2008	Active
PERPHENAZINE TAB; 4MG BY MOUTH EVERY MORNING	06/15/2008	Active
PERPHENAZINE TAB; 8MG BY MOUTH AT BEDTIME	06/15/2008	Active
QUETIAPINE TAB; 25MG BY MOUTH THREE TIMES A DAY AS NEEDED ANXIETY	06/15/2008	Active

Print Patient List Patient Select Screen

Figure 6 is one possible example of an inpatient nurse's dashboard. The dashboard contains columns for the patient name, admitting diagnosis, patient location, current medications, labs, STAT and unverified orders, vitals, attending physician's last note and patient priority. When a link in a column is selected the data appears in the lower half of the screen.

Figure 6. To-Be model of a possible inpatient nurse's Dashboard

Vista CPRS in use by: Provider.Three (CPRSdemo.va.gov)

File Edit View Action Tools Help [Customize](#)

No Patient Selected 000-00-0000

Patient Name	Admitting Diagnosis	Location	Meds	Labs	Orders	Vitals	Notes	Priority
Smith, John	Chest Pain	722-A	Current Meds	critical	STAT	Apr 24, 2008 @ 6:30am	Apr 24, 2008 @ 6:45am	1 - High
Patient, Eight	Hyperlipidemia	730-A	Current Meds	critical	Unverified	Apr 24, 2008 @ 9:30am	Apr 24, 2008 @ 9:45am	1 - High
Doe, Jane	Diabetes	724-C	Current Meds	abnormal	Unverified	Apr 24, 2008 @ 7:00am	Apr 23, 2008 @ 7:00pm	2 - Moderate
Jones, Joseph	Chest Pain	722-C	Current Meds	abnormal		Apr 24, 2008 @ 6:15am	Apr 24, 2008 @ 6:30am	2 - Moderate
Johnson, William	Abdominal Pain	726-D	Current Meds	normal		Apr 24, 2008 @ 5:00am	Apr 24, 2008 @ 5:15am	3 - Low
Black, Marianne	Headache	728-B	Current Meds			Apr 24, 2008 @ 9:00am	Apr 23, 2008 @ 9:00pm	3 - Low

Current Orders for: [Enter Patient Name Here]

Service	Action	Order	Start/Stop	Provider	Nurse	Clerk	Chart	Status	Location
Inpat.Meds	New STAT	METHYLDOPATE INJ 50MG/1ML IV AT ONSET *UNDESIGNED*		Provider, S				Unreleased	7a Gen Med
Labs	New STAT	GLUCOSE BLOOD SERUM WC LB #4800		Provider, S				Pending	7a Gen Med
Inpat.Meds	New NOW	ACETAMINOPHEN TAB 325MG PO 3XW First Dose NOW *UNDESIGNED*		Provider, S				Active	7a Gen Med

Print Patient List Patient Select Screen

Figure 7 is one possible example of an outpatient clinician's dashboard. The dashboard contains columns for the patient name, appointment time current medications, labs, encounter status and

physician's last note. When a link in a column is selected, the data appears in the lower half of the screen.

Figure 7. To-Be model of a possible outpatient clinician's Dashboard

Vista CPRS in use by: Provider,Three (CPRSdemo.va.gov)

File Edit View Action Tools Help Customize

No Patient Selected 000-00-0000 Flag Remote Data ? No Postings

Patient Name	Appt Time	Meds	Labs	Encounter Status	Notes
Smith, John	8:00 am	Current Meds	critical	complete	Apr 24, 2008 @ 6:45am
Doe, Jane	9:00 am	Current Meds	abnormal	complete	Apr 23, 2008 @ 7:00pm
Johnson, William	10:00 am	Current Meds	normal	complete	Apr 24, 2008 @ 5:15am
Black, Marianne	11:00 am	Current Meds		incomplete	Apr 23, 2008 @ 9:00pm
Joes, Joseph	1:00 pm	Current Meds	abnormal	incomplete	Apr 24, 2008 @ 6:30am
Patient, Eight	2:00 pm	Current Meds	critical	incomplete	Apr 24, 2008 @ 9:45am

Date: Apr 24, 2008 Time: 09:45 am Title: AUDIOLOGY - HEARING LOSS CONSULT Author: RADTECH,THRITYTWO

HX: Patient was seen for hearing aid fitting and orientation. The batteries supplied for this hearing aid were: za312. IMP: The veteran was seen for hearing aid fitting and orientation. A complete orientation was performed, and the patient can insert the aids(s), change the batteries, and adjust the volume. Response curves were obtained using a real-ear probe microphone in-situ Measurement System and indicated appropriate gain for the demonstrated hearing loss. Care of the aid(s), warranty information and dangers of battery ingestion were discussed with the veteran.

REC: Continued use of present amplification is recommended /es/ ONE PROVIDER

Signed: 04/01/2004 22:58 for THRITYTWO RADTECH

Print Patient List Patient Select Screen

To-Be Scenario

The BI Team captured the changes to the steps a clinician would use to access multiple patients' information and created the To-Be scenario shown in Table 6. As the scenario demonstrates, a clinician can access different information for different patients without leaving the dashboard. The BI Team then verified that the changes had the potential of increasing clinician efficiency by executing a timing study between the As-Is scenario and the To-Be scenario (see the Impacts Section 2.2.3 below).

Table 6. To-Be scenario for viewing information for more than one patient in a single interaction with CPRS

Step	Description	Clicks
1.	From the Patient Select Screen, press the "Dashboard" button	1
2.	Order the patients by "Patient Name"	1
3.	Select the "Labs" result link for Doe, Jane	1
4.	View first lab value	-
5.	Select the "Vitals" result link for Patient, Eight	1
6.	View the first vitals value	-
Total Clicks		4

2.2.3 Impacts

Findings from the impact analysis are broken down into three categories: clinical impact, time and keystroke efficiencies and task ranking. The following sections provide commentary on the specific findings.

Clinical Impact

The clinical impact of the recommended changes is based on clinician comments and insights recorded during the two rounds of site visits.

The key clinical benefits of implementing a dashboard are:

- Quicker triaging of patients (better visualization of critical data);
- Quicker analysis of patient data (fewer keystrokes and less searching); and
- Customization potentially increases utilization (tailored to clinician).

Time and Keystroke Efficiencies

The BI Team conducted an execution timing comparison study utilizing task scenarios representing the As-Is and To-Be states. The analysis showed that the execution timesaving for the To-Be scenario was on average 14 seconds plus or minus 4 seconds.

Table 7 results shows a summary of the results with full calculations and statistical definitions provided in Appendixes B and G.

Table 7. Time Data Results for Execution Timings for viewing information for more than one patient in a single interaction with CPRS

Scenario	Sample Size	Mean Execution Time (Seconds)	Difference between the Means (Seconds)	Lower 95% Confidence Interval (Seconds)	Upper 95% Confidence Interval (Seconds)
As-Is	34	37			
To-Be	34	23			
			14	10	18

The BI Team also calculated keystroke differentials between the To-Be and As-Is scenarios and found there to be a 60 percent reduction between the current CPRS system and recommended changes to accomplish the same task (Table 8).

Table 8. Keystroke Count for viewing information for more than one patient in a single interaction with CPRS

Scenario	Keystrokes
As-Is	10
To-Be	4
Difference	6

Task Ranking

The BI Team asked clinicians to rank from one to eight (with one being the most important) the eight “To-Be” solution tasks in terms of importance to the individual clinician.

The Dashboard Functionality task ranked in the upper half of order preference for both nurses and doctors.

- Of the 18 nurses, eight ranked it a 1 or 2 while five ranked it a 5 or above. The remaining four ranked it a 7.
- Of the 16 doctors, six ranked it a 1 or 2 while nine ranked it a 5 or above. The remaining individual ranked it a 7.

2.2.4 Requirements Statements

Based on the key findings, BI has prepared a set of recommended requirements for VHA consideration.

- The Dashboard shall display patients selected on the patient selection screen (REQ DB #001).
- The system shall maintain role based default configurations (REQ DB #002).
- The system shall display a dashboard of clinicians' assigned patients (REQ DB #003).
- The system shall display multiple patients on a single dashboard (REQ DB #004).
- The system shall provide the ability to sort data (REQ DB #005).
- The system shall display sorted patient data in a logical format (REQ DB #006).
- The system shall allow clinicians to set data retrieval parameters (REQ DB #007).
- The system shall provide a link to the patient selection screen (REQ DB #008).
- The system shall allow clinicians to customize the dashboard screen (REQ DB #009).
- The system shall allow clinicians to customize the dashboard list of patients by inpatient location (REQ DB #010).
- The system shall allow clinicians to customize the dashboard list of patients by outpatient location (REQ DB #011).
- The system shall display the patient's name (REQ DB #012).
- The system shall display the patient's admitting diagnosis (REQ DB #013).
- The system shall display the patient's room number (REQ DB #014).
- The system shall display the patient encounter status as complete or incomplete (REQ DB #015).
- The system shall display a link to a patient's list of current medications (REQ DB #016).
- The system shall provide the ability to view the patient's list of medications when the link is clicked (REQ DB #017).
- The system shall display a link to the patient's laboratory results (REQ DB #018).
- The system shall provide the ability to view the patient's laboratory results when the link is clicked (REQ DB #019).
- The system shall display a link to the patient's vital signs (REQ DB #020).
- The system shall display the vital signs link with the last date and time of the vital sign (REQ DB #021).
- The system shall provide the ability to view the patient's last vital signs (REQ DB #022).
- The system shall display a link notes (REQ DB #023).
- The system shall provide the ability for clinicians to set the default note to view (REQ DB #024).
- The system shall display the default note when clicked (REQ DB #025).
- The system shall display a priority level for all laboratory results (REQ DB #026).
- The system shall display a link to laboratory tests from the priority level

(REQ DB #027).

- The system shall display the laboratory result when the link is clicked (REQ DB #028).
- The system shall display a priority level of high if a laboratory alert is identified as critical (REQ DB #029).
- The system shall display a priority level of one if a laboratory alert is identified as critical (REQ DB #030).
- The system shall display a priority level of moderate if a laboratory alert is identified as abnormal (REQ DB #031).
- The system shall display a priority level of two if a laboratory alert is identified as abnormal (REQ DB #032).
- The system shall display a priority level of low if a laboratory alert is identified as normal (REQ DB #033).
- The system shall display a priority level of three if a laboratory alert is identified as normal (REQ DB #034).
- The system shall display an indicator when there are unverified orders (REQ DB #035).
- The system shall display a link to unverified orders (REQ DB #036).
- The system shall display all unverified orders when the link is clicked (REQ DB #037).
- The system shall display appointment times for outpatients (REQ DB #038).
- The system shall display the names of the admitting team (REQ DB #039).
- The system shall link the dashboard to the print patient list (REQ DB #40).

2.2.5 Supporting Data

The supporting data, detailed analysis, and relevant references are found in Appendixes A-E.

2.3 Recommended Modifications to the CPRS Cover Sheet Postings

The recommendations provided in this section focus on the “Cover Sheet (Postings)” high-value, frequently performed task. It is focused on raising the visibility of selected information and eliminating the need to view additional screens (e.g., the DNR status of the patient) as performed by VHA clinicians in the inpatient and outpatient settings observed during the site visits conducted for this analysis.

2.3.1 Assessment of As-Is State of Cover Sheet Postings

Clinician Feedback

During the initial observations and subsequent discussions, clinician feedback suggested the following:

- Cover Sheet Postings section display additional information in the title of the posting in the posting’s section of the cover sheet (including but not limited to: DNR status and basic HIPAA information).

Making this change would enable the clinician to quickly confirm specific posting information providing potential timesavings and efficiencies.

As-Is Scenario

To document the projected efficiencies related to the recommended changes, the BI Team devised a pair of parallel scenarios that represent the task of a clinician trying to find an order. The first scenario, described below, mimics current CPRS functionality (As-Is), while the other represents the recommended changes (To-Be).

The scenario described in Table 9 represents a best-case situation in trying to determine posting information. It assumes that the information needed is actually located in the posting itself. What BI observed and what this scenario does not reflect, is that if the information exists in a scanned image, a clinician must go into VistA imaging to retrieve the necessary information. The purpose of this scenario is to highlight efficiencies in the use of well-placed first-glance data.

Table 9. As-Is Scenario Instructions for Finding Specific Posting Information

Step	Description	Clicks:
1.	From the cover sheet, re-select the first patient	4
2.	Open the Advanced Directive posting	1
3.	Close information screen	1
	Total Clicks	6

As-Is Screen Shot

Figure 8 is a screen capture of the current state of the Postings section of the Cover Sheet screen. As is evidenced by the screen capture, currently a clinician must click on the posting title in order to ascertain a patient's posting information (e.g., DNR, HIPAA or PCP information). In the best case scenario the information will be contained in the pop-up window (Figure 9 below).

Figure 8. As-Is example of a default view of the Postings section of CPRS Cover Sheet screen.



Figure 9 displays a pop-up window containing specific information regarding a patient's posting information. In this example, the information screen states explicitly that the patient does not wish to be resuscitated.

Figure 9. As-Is example of a Postings Pop-up Information Window.

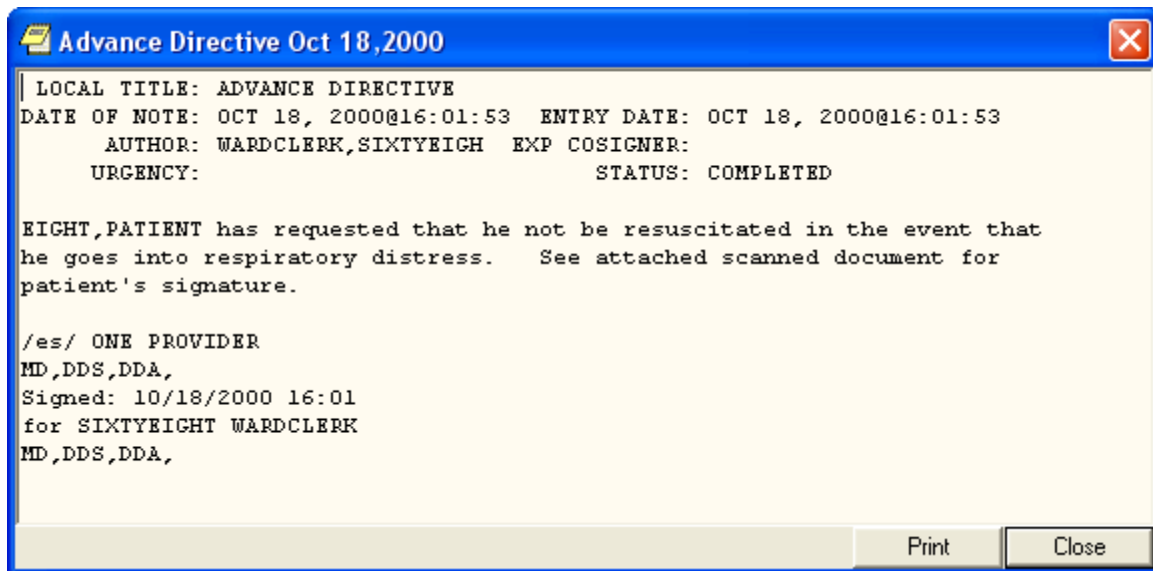
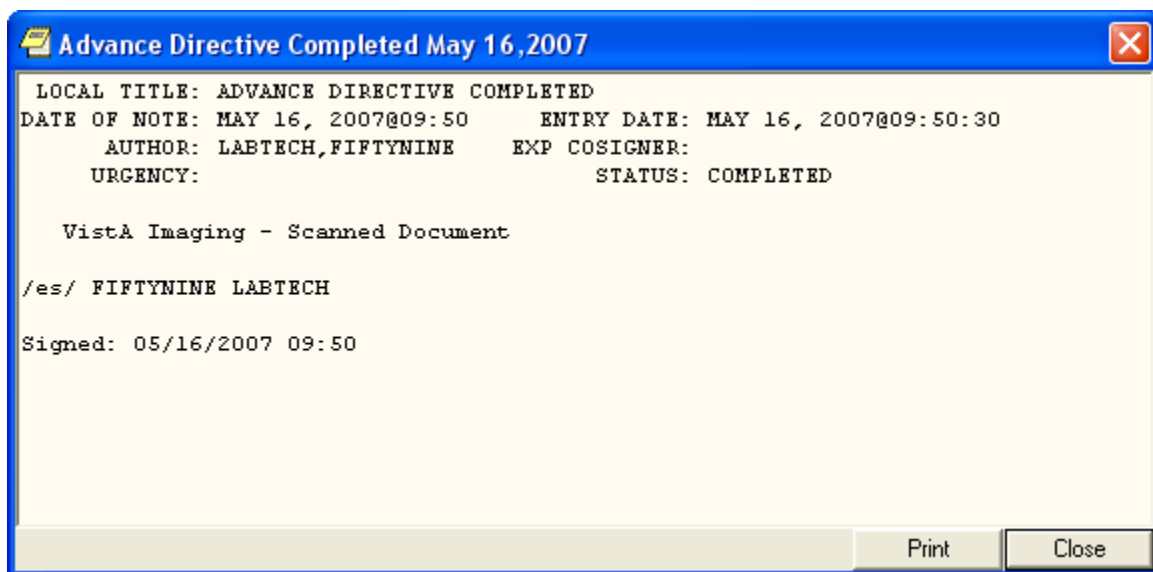


Figure 10 is an example of a posting's information pop-up window that does not contain the specific information regarding the patient's posting but rather directs the clinician to VistA imaging.

Figure 10. As-Is example of a Postings Pop-up Information Window.



2.3.2 Assessment of To-Be Changes to Cover Sheet Postings

Description of Recommendations

In order to verify the clinician suggestions iterated in Section 2.3.1, the BI Team incorporated the following recommended modifications into the To-Be model Cover Sheet Postings:

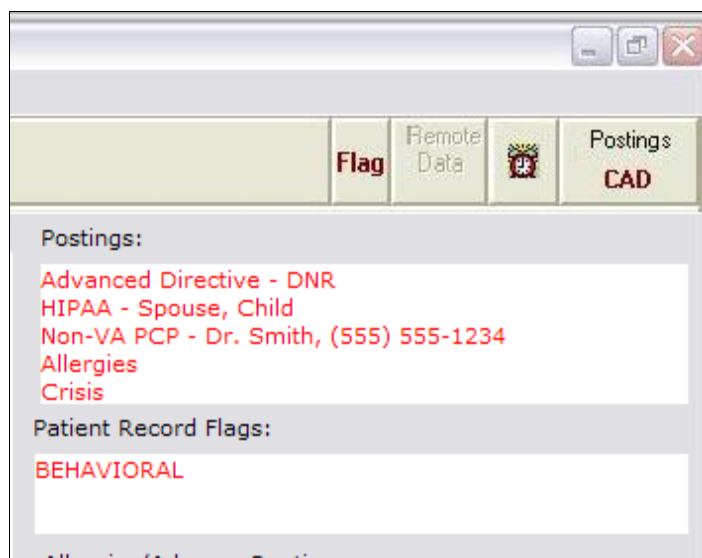
- Modify the Posting's section to include specific DNR status information in the Advanced Directives record header (RCMD CS #001).
- Modify the Posting's section to include the HIPAA designees' information in the HIPAA record header (RCMD CS #002).
- Modify the Posting's section to include the patient's non-VA Primary Healthcare Provider (PCP) name and phone number in the Non-VA PCP record header (RCMD CS #003).

For a visual representation of these recommendations please see Figure 11.

To-Be Screen Shot

As Figure 11 shows, the To-Be postings section gives more first glance information in the each posting's title, including the Advanced Directive status, HIPAA designees, and Non-VA Primary Care physician name and number. Details and scanned image information will still be designated in the posting information pop-up window.

Figure 11. To-Be model of the Postings section on the CPRS Cover Sheet screen.



To-Be Scenario

The BI Team captured the changes to the steps a clinician would use to find certain posting information and created the To-Be scenario shown in Table 10. The BI Team then verified that the changes had the potential of increasing clinician efficiency by executing a timing study between the As-Is scenario and the To-Be scenario (see the Impacts Section 2.3.3 below).

Table 10. To-Be Scenario Instructions for Finding Specific Posting Information

Step	Description	Clicks
1.	From the Dashboard, select the link for Patient, Eight	1
2.	View HIPAA approved persons	-
	Total Clicks	1

2.3.3 Impacts

Findings from the impact analysis are broken down into three categories: clinical impact, time and keystroke efficiencies and task ranking. The following sections provide commentary on the specific findings.

Clinical Impact

The clinical impact of the recommended changes is based on clinician comments and insights recorded during the two site visits.

The key clinical benefits of implementing the recommended changes to the Cover Sheet Postings are:

- Quicker access to information (increased timesaving);
- Less searching time; and
- Quicker confirmation of specific posting information.

Time and Keystroke Efficiencies:

The BI Team conducted an execution timing comparison study utilizing task scenarios representing the As-Is and To-Be states. The analysis showed that the execution timesaving for the To-Be scenario was on average 15 seconds plus or minus 7 seconds.

Table 11 shows a summary of the results. Full calculations and definitions are provided in Appendixes B and G.

Table 11. Time Data Results for Execution Timings for Finding Specific Posting Information

Scenario	Sample Size	Mean Execution Time (Seconds)	Difference between the Means (Seconds)	Lower 95% Confidence Interval (Seconds)	Upper 95% Confidence Interval (Seconds)
As-Is	34	21			
To-Be	34	6			
			15	8	21

The BI Team also calculated keystroke differentials between the To-Be and As-Is scenarios and found there to be an 83 percent reduction between the current CPRS system and recommended changes to accomplish the same task (Table 12).

Table 12. Keystroke Count for Finding Specific Posting Information

Scenario	Keystrokes
As-Is	6
To-Be	1
Difference	5

Task Ranking

The BI Team asked clinicians to rank from one to eight (with one being the most important) the eight “To-Be” solution tasks in terms of importance to the individual clinician.

The Cover Sheet (Postings) task ranked in the lower half of order preference for both nurses and doctors.

- Of the 18 nurses, ten ranked it a 4 or above, and eight ranked it between a 5 and 7.
- Of the 16 doctors, eleven ranked it a five, six, seven or eight, four ranked it a 3 or 4 and on one individual ranked it a 1.

2.3.4 Requirements Statements

Based on the key findings, the BI Team has prepared a set of recommended requirements for VHA consideration.

- The system shall display “DNR” within the record header of the Posting’s section, in the patient’s cover sheet, if a do not resuscitate order has been written (REQ CS #001).
- The system shall display the patient’s HIPAA designee within the record header of the Posting’s section, in the patient’s cover sheet (REQ CS #002).
- The system shall display the patient’s non-VA Primary Healthcare Provider (PCP) within the record header of the Posting’s section, in the patient’s cover sheet (REQ CS #003).

2.3.5 Supporting Data

The supporting data, detailed analysis, and relevant references are found in Appendixes A-E.

2.4 Recommended Modifications to CPRS Cover Screen

The recommendations provided in this section focus on the “Cover Sheet (Functionality)” high-value, frequently performed task. It addresses the functionality of the Cover Sheet as performed by VHA clinicians in the inpatient settings that were observed during the site visits conducted for this analysis.

2.4.1 Assessment of As-Is State of CPRS Cover Sheet Screen Functionality**Clinician Feedback**

During the initial observations and subsequent discussions, clinicians provided suggested changes to the Cover Sheet screen that would afford potential clinician timesavings and further improve patient care. The suggested changes are:

- Increase the functionality of the Cover Sheet screen in order to decrease the need to leave the Cover Sheet screen; and
- Modify the information on the Cover Sheet screen to make it more informative (e.g., add the lab values as opposed to collection time).

Incorporating these recommended changes would move some of the current functionality from the Tabs to the Cover Sheet and provide further first glance information to the screen thus enabling the clinician to conduct the patient encounter without leaving the cover screen and

reducing keystrokes. Clinicians theorize that these changes will increase their efficiency while interacting with the system and allow more time for patient care.

As-Is Scenario

To document the projected efficiencies related to the recommended changes, the BI Team devised a pair of parallel scenarios that represent the task of a clinician trying to find an order. The first scenario below mimics current CPRS functionality (As-Is), while the other represents the recommended changes (To-Be).

The scenario in Table 13 describes the steps a clinician would need to change a medication based on information found on the Cover Sheet screen. As is indicated by the scenario, a clinician cannot change the medication order from the Cover Sheet but must go to the medications screen (or orders screen) to do so.

Table 13. As-Is Scenario Instructions for changing a medication order from the Cover Sheet screen

Step	Description	Clicks:
•	From the cover sheet, click on the first medication	1
•	Note the dosage	-
•	Close the medication information screen	1
•	Click on the Meds tab	1
•	Highlight first medication	1
•	Right click	1
•	Select “change”	1
•	Select “cancel”	1
	Total Clicks	7

As-Is Screen Shot

The current CPRS Cover Screen, as shown in Figure 12, contains non-interactive information. A clinician can click on a listing to get more information but in order to act upon that information (e.g. create a new order or change a medication), a clinician must go into one of the other tabbed screens.

Figure 12. As-Is example of a default view of the CPRS Cover Sheet screen.

VistA CPRS in use by: Provider, Six (CPRSdemo.va.gov)

EIGHT PATIENT
666-00-0008 Apr 07, 1935 (73) Visit Not Selected Provider: PROVIDER, SIX Primary Care Team Unassigned

Active Problems
Hypertension
Hyperlipidemia
Acute Myocardial Infarction, Unspecified
Chronic Systolic Heart Failure
Diabetes Mellitus Type II Or Unspecified

Allergies / Adverse Reactions
Penicillin

Patient Record Flags
BEHAVIORAL

Postings
Allergies
Crisis Note May 21, 2000
Advance Directive Completed Oct 18, 2000
Advance Directive Oct 18, 2000

Active Medications
Non-VIA Aspirin 81mg Ec Tab Active

Clinical Reminders
Diabetes - Creatinine Apr 24, 08
Diabetes - Hb A1c Jun 01, 07
Diabetes - Retinal Exam DUE NOW
Diabetes - Urinalysis DUE NOW
Hepatitis C risk Factor Screening DUE NOW
Primary Care Depression Screening DUE NOW
Hypertension DUE NOW

Recent Lab Results
No Orders Found

Vitals
T 99 F Mar 16, 2005 10:00 (37.2 C) ORAL
P 82 Apr 24, 2007 08:00
R 18 Mar 16, 2005 10:00 SPONTANEOUS
BP 136/70 Apr 24, 2007 08:00
HT 71 in Mar 15, 2005 11:30 (180.3 cm) ACTUAL
WT 175 lb Apr 24, 2007 08:00 (79.4 kg)
PN 1 Mar 16, 2005 10:00

Appointments/Visits/Admissions
Aug 23, 07 09:00 General Medicine Action Requi
Aug 22, 07 09:00 General Medicine Action Requi
Aug 21, 07 09:00 General Medicine Action Requi
Aug 20, 07 09:00 General Medicine Action Requi

Cover Sheet | Problems | Meds | Orders | Notes | Consults | Surgery | D/C Summ | Labs | Reports

2.4.2 Assessment of To-Be Changes to the CPRS Cover Sheet Screen

Description of Recommendations

In order to verify the clinician suggestions iterated in Section 2.4.1, the BI Team incorporated the following recommended modifications into the To-Be model Cover Sheet screen:

- Provide clinicians with the same ability to view the details and administration history, change, discontinue, refill, renew or create a medication order with the same shortcut menu selections that are currently available when right clicking highlighted medications on the CPRS Medications screen (RCMD CSF #001).
- Provide the clinicians with the same ability to view the details, results, results history, change, change release event, copy to new order, discontinue, renew or sign a laboratory order with the same shortcut menu selections that are currently available when right clicking highlighted orders on the CPRS Orders screen (RCMD CSF #002).
- Allow a clinician to start, edit an unsigned note and sign a new note from the cover screen (RCMD CSF #003).
- Display actual lab results as opposed to collection dates (RCMD CSF #004).

For a visual representation of these recommendations please see Figures 12 and 13.

To-Be Screen Shots

The To-Be model of the CPRS Cover Screen (Figure 13) contains more functionality than currently exists. As in current CPRS functionality, a clinician can click on a data point to get more information; however, the To-Be model allows a clinician to act upon that information, such as order a new lab or change a medication, from the pop-up information window. The new

cover sheet also allows a clinician to view the last note or start and edit a new note as well as sign all new orders, all without leaving the cover sheet screen.

Figure 13. To-Be example of a default view of the CPRS Cover Sheet screen.

The screenshot displays the CPRS Cover Sheet interface for patient EIGHT,PATIENT (666-00-0008). The patient's primary care team is unassigned, and the provider is PROVIDER.TEN. The screen is divided into several sections:

- Physicians Progress Note:** Shows a note dated Apr 24, 2008, at 09:45 am, authored by RADTECH,THRITYTWO. The title is AUDIOLOGY - HEARING LOSS CONSULT. The note describes a hearing aid fitting and orientation session for a veteran.
- Active Medications:** Lists various medications such as Simvastatin Tab, Mupirocin 2% Oint, Top, Insulin Reg Human 'Novolin' Inj, and others, all marked as Active.
- Recent Lab Results:** Displays a table of laboratory results including Creatinine, Sodium, Potassium, Glucose, Cholesterol, and HDL, with values and units.
- Postings:** Includes sections for Advanced Directive (DNR), Allergies (Penicillin), and Patient Record Flags (Behavioral).
- Appointments/Visits/Admissions:** Shows an appointment on Aug 28, 08 at 09:00 for General Medicine.
- Clinical Reminders:** Lists reminders for Diabetes (Hb A1c, Retinal Exam, Urinalysis), Hepatitis C risk factor screening, Primary Care Depression Screening, and Hypertension.
- Active Problems:** Indicates no active problems.

The bottom of the screen features a navigation bar with tabs for Cover Sheet, Problems, Meds, Orders, Notes, Consults, Surgery, D/C Summ, Labs, Reports, and Dashboard. A Patient Letter button is also visible.

Figure 14 shows an example of a redesigned Medication Information screen. When a clinician right clicks on the information screen an option menu appears and allows the clinician to have the same functionality as right clicking on a medication on the main Medication screen. The same would be true if a clinician clicked on a lab or vital on the coversheet.

Figure 14. Be example of a Medication Information screen with option menu.

The screenshot shows the CPRS-To Be Model v2 interface in a Windows Internet Explorer browser. The main content area displays medication information for SIMVASTATIN TAB 40MG, including the instruction TAKE ONE TABLET BY MOUTH EVERY EVENING and Order #18070. The patient information is EIGHT,PATIENT, Male, DOB: APR 7,1935 (73), SSN: 666-00-0008, Ht/Wt: 180cm/78kg, Ward: 7A GEN, Dx: htn.

The medication details include:

- Quantity:** 90 Refills: 5
- Activity:** 04/11/2007 16:28 New Order (Renewal) Ordered By: entered by VEHU,ONEHUNDRED
- Order Text:** SIMVASTATIN TAB 40MG TAKE ONE TABLET BY MOUTH EVERY EVENING Quantity: 90 Refills: 5
- Nature of Order:** ELECTRONICALLY ENTERED
- Elec Signature:** VEHU,ONEHUNDRED on 04/11/2007 16:28
- 04/11/2007 18:16 Change entered by PHARMACIST,ONE (PHARMACIST)**
- Changed to:** SIMVASTATIN TAB 40MG TAKE ONE TABLET BY MOUTH EVERY EVENING Quantity: 90 Refills: 5
- Nature of Order:** SERVICE CORRECTION
- Signature:** SERVICE CORRECTION TO SIGNED ORDER

The Current Data section shows:

- Treating Specialty:** GENERAL MEDICINE
- Ordering Location:** GENERAL MEDICINE
- Start Date/Time:** 04/11/2007 (originally 03/30/2004)
- Stop Date/Time:** 04/11/2008
- Current Status:** ACTIVE

A right-click context menu is open, showing options: Administration History..., Change..., Discontinue..., Renew..., Refill..., and New Medication..

At the bottom, a note states: Orders that are active or have been accepted by the service for processing. e.g., Dietetic orders are active upon being ordered, Pharmacy orders are active when the order is verified, Lab orders are active when the sample has been collected, Radiology orders are active upon registration.

To-Be Scenario

The BI Team captured the changes to the steps a clinician would use to change a medication starting from the Cover Screen and created the To-Be scenario shown in Table 14. The BI Team then verified that the changes had the potential of increasing clinician efficiency by executing a timing study between the As-Is scenario and the To-Be scenario (see Impacts below).

Table 14. To-Be Scenario Instructions for changing a medication from the Cover Sheet screen

Step	Description	Clicks
1.	From the cover sheet, click on the first Medication	1
2.	Note the dosage	-
3.	Right click	1
4.	Select “change”	1
5.	Select cancel	1
Total Clicks		4

2.4.3 Impacts

Findings from the impact analysis are broken down in to three categories: clinical impact, time and keystroke efficiencies and task ranking. The following sections provide commentary on the specific findings.

Clinical Impact

The clinical impact of the recommended changes is based on clinician comments and insights recorded during the two rounds of site visits.

The key clinical benefits of decreasing the need to leave the Cover Sheet screen during a patient encounter results in:

- Reduction of system interaction time to complete a task (fewer keystrokes); and
- Increase ease of use (information is visible while a clinician is performing other functions).

Time and Keystroke Efficiencies

The BI Team conducted an execution timing comparison study utilizing task scenarios representing the As-Is and To-Be states. The analysis showed that the execution timesaving for the To-Be scenario was on average 19 seconds plus or minus 6 seconds.

Table 15 shows a summary of the results. Full calculations and statistical definitions are provided in Appendixes B and G.

Table 15. Time Data Results for Execution Timings for changing a medication order from the Cover Sheet screen

Scenario	Sample Size	Mean Execution Time (Seconds)	Difference between the Means (Seconds)	Lower 95% Confidence Interval (Seconds)	Upper 95% Confidence Interval (Seconds)
As-Is	34	34			
To-Be	34	15			
			19	13	25

The BI Team also calculated keystroke differentials between the To-Be and As-Is scenarios and found there to be a 43 percent reduction between the current CPRS system and recommended changes to accomplish the same task (Table 16).

Table 16. Keystroke Count for changing a medication order from the Cover Sheet screen

Scenario	Keystrokes
As-Is	7
To-Be	4
Difference	3

Task Ranking

The BI Team asked clinicians to rank from one to eight (with one being the most important) the eight “To-Be” solution tasks in terms of importance to the individual clinician.

The Cover Sheet (Functionality) task ranked highest overall by doctors and nurses.

- Of the 18 nurses, eleven ranked it a 1 or a 2, the remaining seven ranked it above a 6.
- Of the 16 doctors, half ranked it a 1 or a 2, the remaining ranked it 5 or above.

2.4.4 Requirements Statements

Based on the key findings, BI has prepared a set of recommended requirements for VHA consideration.

- The system shall provide clinicians with the same ability to view the details and administration history utilizing the current shortcut menu selections that are available when right clicking highlighted medications on the CPRS Medications screen (REQ CSF #001).
- The system shall provide clinicians with the same ability to discontinue a medication utilizing the current shortcut menu selections that are available when right clicking highlighted medications on the CPRS Medications screen (REQ CSF #002).
- The system shall provide clinicians with the same ability to refill a medication order utilizing the current shortcut menu selections that are available when right clicking highlighted medications on the CPRS Medications screen (REQ CSF #003).
- The system shall provide clinicians with the same ability a renew a medication order utilizing the current shortcut menu selections that are available when right clicking highlighted medications on the CPRS Medications screen (REQ CSF #004).

- The system shall provide clinicians with the same ability create a medication order utilizing the current shortcut menu selections that are available when right clicking highlighted medications on the CPRS Medications screen (REQ CSF #005).
- The system shall provide clinicians with the same ability to view the details of a laboratory order utilizing the current shortcut menu selections that are available when right clicking highlighted orders on the CPRS Orders screen (REQ CSF #006).
- The system shall provide clinicians with the same ability to view results history of a laboratory order utilizing the current shortcut menu selections that are available when right clicking highlighted orders on the CPRS Orders screen (REQ CSF #007).
- The system shall provide clinicians with the same ability to change a medication order utilizing the current shortcut menu selections that are available when right clicking highlighted orders on the CPRS Orders screen (REQ CSF #008).
- The system shall provide clinicians with the same ability to change a laboratory order utilizing the current shortcut menu selections that are available when right clicking highlighted orders on the CPRS Orders screen (REQ CSF #009).
- The system shall provide clinicians with the same ability to change a release event of a laboratory order utilizing the current shortcut menu selections that are available when right clicking highlighted orders on the CPRS Orders screen (REQ CSF #010).
- The system shall provide clinicians with the same ability to copy to new laboratory order utilizing the current shortcut menu selections that are available when right clicking highlighted orders on the CPRS Orders screen (REQ CSF #011).
- The system shall provide clinicians with the same ability to discontinue a laboratory order utilizing the current shortcut menu selections that are available when right clicking highlighted orders on the CPRS Orders screen (REQ CSF #012).
- The system shall provide clinicians with the same ability to renew a laboratory order utilizing the current shortcut menu selections that are available when right clicking highlighted orders on the CPRS Orders screen (REQ CSF #013).
- The system shall provide clinicians with the same ability to sign a laboratory order utilizing the current shortcut menu selections that are available when right clicking highlighted orders on the CPRS Orders screen (REQ CSF #014).
- The system shall allow clinicians to start a new note from the cover sheet screen (REQ CSF #015).
- The system shall allow clinicians to edit an unsigned note from the cover sheet screen (REQ CSF #016).
- The system shall allow clinicians to sign a note from the cover sheet screen (REQ CSF #017).
- The system shall display the actual laboratory results on the cover sheet screen (REQ CSF #018).
- The system shall not display the collection dates of the laboratory test on the cover sheet screen. (REQ CSF #019).

2.4.5 Supporting Data

The supporting data, detailed analysis, and relevant references are found in Appendixes A-E.

2.5 Recommended Modifications to CPRS Template and Consult Screens

The recommendations provided in this section focus on the “Accessibility of Data behind Templates and Consults” high-value, frequently performed task. It addresses the accessing of additional information while in a template or consult as performed by VHA clinicians in the inpatient and outpatient settings that were observed during the site visits conducted for this analysis.

2.5.1 Assessment of As-Is State of Templates and Consults

Clinician Feedback

During the initial observations and subsequent discussions, clinicians provided suggested changes to the Templates screen and the Consults screen that would provide potential clinician timesaving and further improve patient care. The suggested changes are:

- Provide the ability to access information outside of the template (either add functionality to minimize the templates or consults, or add the ability to temporarily remove focus from the template or consult); and
- Ensure that data is not lost if a template or consult is minimized or focus is temporarily removed.

Incorporating this feedback would ensure that necessary information is no more than a click or two away, and would increase efficiency by significantly decreasing the times a clinician must re-enter lost data. Clinicians theorize that these changes will increase their efficiency while interacting with the system and allow more time for patient care.

As-Is Scenario

To document the projected efficiencies related to the recommended changes, the BI Team devised a pair of parallel scenarios that represent the task of a clinician trying to find an order. The first scenario described below mimics current CPRS functionality (As-Is), while the other represents the recommended changes (To-Be).

Table 17. As-Is Scenario Instructions for gathering data while completing a locally developed template

Step	Description	Clicks:
1.	From the cover sheet, click on the Notes tab	1
2.	Select the ____ template*	3
3.	Choose the first title	2
4.	Click the first two boxes	2
5.	Type in the following sentence in the first text box “Lab Value”	-
6.	Cancel the template	1
7.	Click Labs Tabs	1
8.	View first Lab value	-
9.	Click Notes tab	1
10.	Re-select the template	1
11.	Choose the first title	2
12.	Click the first two boxes	2

Step	Description	Clicks:
13.	Type in the following sentences in the first text box "Lab value ok"	-
14.	Click ok	1
Total Clicks		17

*The template name varied from site to site.

The scenario described in Table 17 highlights the time lost by a clinician who, while completing a template, must exit the template to seek out additional data and then re-access the template and re-enter the data in order to complete it. The potential for time and click savings increases sharply with respect to the length and complexity of the template as well as by how much of the template the clinician has completed.

As-Is Screen Shot

Figure 15 is an example of a locally designed template. In current CPRS functionality, once a template is opened it locks CPRS and cannot be minimized. This forces a user to complete the template or lose data by exiting the template when attempting to find information in or interact with another part of CPRS. Once a user gathers the data, the user must then reopen and reenter the data into the template.

Figure 15. To-Be example of an active Template.

The screenshot displays the VISTA CPRS interface. At the top, the window title is "Vista CPRS in use by: Provider.Two (CPRSdemo.va.gov)". The main header shows patient information: "EIGHT PATIENT", "666-00-0008", "Apr 07, 1935 (73)", "GM Aug 23, 07 09:00", "Provider: PROVIDER.TWO", and "Primary Care Team Unassigned". A sidebar on the left lists "Last 100 Signed Notes" with a tree view showing "New Note in Progress" and "All signed notes". The main content area displays a "Template: INTERNAL MED CLINIC" window. This template has several sections: "REASON FOR VISIT/CHIEF COMPLAINT:" with checkboxes for "Acute problem(s)", "Chronic problem(s)", "Health maintenance", "Related to MVA/Accident", and "Work-related"; "SOURCE(S) OF HISTORY:" with checkboxes for "Patient", "Family", "Outside records", "VA records", and "Unobtainable"; "PAST HISTORY:"; "SOCIAL HISTORY: (HABITS/MARITAL STATUS/MISC)" and "(SOCIAL HISTORY - MILITARY/SEXUAL/ABUSE)"; and "ALLERGIES AS DISPLAYED IN VISTA:" with a text field for "PENICILLIN (Inquire about any changes since VISTA was last updated.)" and a "Patient/family state(s):" section with checkboxes for "No new allergies" and "New allergies". At the bottom of the template window are buttons for "All", "None", "Preview", "OK", and "Cancel". The background interface includes a menu bar (File, Edit, View, Action, Options, Tools, Help) and a bottom status bar with tabs for "Cover Sheet", "Problems", "Meds", "Orders", "Notes", "Consults", "Surgery", "D/C Summ", "Labs", and "Reports".

2.5.2 Assessment of To-Be Changes to Templates and Consults

Description of Recommendations

In order to verify the clinician suggestions iterated in Section 2.5.1, the BI Team incorporated the following recommended modifications into the To-Be model Templates functionality:

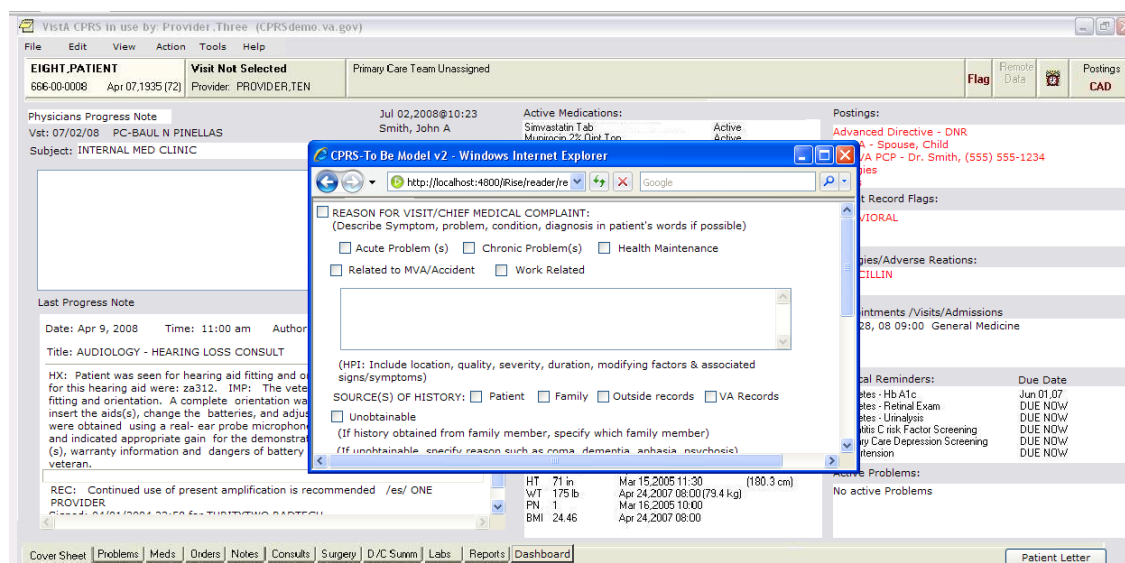
- Allow clinicians to switch to other Tabs within CPRS without closing out of the template or consult (RCMD TC #001).
- Allow clinicians to change window focus and, or minimize the template or consult without losing data already entered in the template or consult (RCMD TC #002).
- Allow clinicians the ability to expand the template (or consult) screen itself when the template (or consult) window is maximized to the full screen (RCMD TC #003)

For a visual representation of these recommendations please see Figure 16 below.

To-Be Screen Shots

In the To-Be model of a template, a clinician can minimize and move the template in order to see information behind the template (or consult) and in other parts of CPRS. The clinician can then maximize the template (or consult) to complete it (Figure 16).

Figure 16. To-Be example of a template that can be minimized.



To-Be Scenario

The BI Team captured the changes to the steps a clinician would use to access additional patient data in CPRS while completing a locally developed template and created the To-Be scenario shown in Table 18. The BI Team then verified that the changes had the potential of increasing clinician efficiency by executing a timing study between the As-Is scenario and the To-Be scenario (see the Impacts Section below).

Table 18. As-Is Scenario Instructions for gathering data while completing a locally developed template

Step	Description	Clicks
1.	From the cover sheet, click on the “Notes” tab	1
2.	Select the ____ template*	3
3.	Choose the first title	2
4.	Click the first two boxes	2
5.	Type in the following sentence in the first text box “Lab value”	-
6.	Minimize the template	1
7.	Click “Labs” Tabs	1
8.	View first Lab value	-
9.	Maximize the template	1
10.	Type in the following sentence after the first sentence “ok”	-
11.	Click ok	1
Total Clicks		12

*The template name changed from site to site

2.5.3 Impacts

Findings from the impact analysis are broken down in to three categories: clinical impact, time and keystroke efficiencies and task ranking. The following sections provide commentary on the specific findings.

Clinical Impact:

The clinical impact of the recommended changes is based on clinician comments and insights recorded during the two rounds of site visits.

The key clinical benefits of implementing the recommend changes to the locally developed template and consult functionality are:

- Decreases the potential for error (e.g. eliminates multiple sign-ons and manual workarounds);
- Increases efficiency (eliminates the need to reenter data); and
- Simplifies the process of entering data in the template and consults.

Time and Keystroke Efficiencies:

The BI Team conducted an execution timing comparison study utilizing task scenarios representing the As-Is and To-Be states. The analysis showed that the execution timesaving for the To-Be scenario was on average 17 seconds plus or minus 6 seconds.

Table 19 shows a summary of the results. Full calculations and definitions are provided in Appendixes B and G. It should be noted that the 17 seconds represents the "best case" scenario. Because templates are developed locally, they vary in length and complexity. The timesavings are based on closing out the template after the first two questions; observational comments indicated that in many cases template close out happens well into the completion of the template.

Table 19. Time Data Results for Execution Timings for gathering data while completing a locally developed template

Scenario	Sample Size	Mean Execution Time (Seconds)	Difference between the Means (Seconds)	Lower 95% Confidence Interval (Seconds)	Upper 95% Confidence Interval (Seconds)
As-Is	34	71			
To-Be	34	54			
			17	11	23

The BI Team also calculated keystroke differentials between the To-Be and As-Is scenarios and found there to be a 29 percent reduction between the current CPRS system and recommended changes to accomplish the same task (Table 20).

Table 20. Keystroke Count for gathering data while completing a locally developed template

Scenario	Keystrokes
As-Is	17
To-Be	12
Difference	5

Task Ranking

The BI Team asked clinicians to rank from one to eight (with one being the most important) the eight “To-Be” solution tasks in terms of importance to the individual clinician.

The Accessibility of Data behind Templates and Consults task ranked in the upper half of order preference for both nurses and doctors.

- Of the 18 nurses half ranked it a 1 or a 2, the remaining ranked it 7 or higher.
- Of the 16 doctors fourteen ranked it 4 or higher, while two ranked it 6 and 7.

2.5.4 Requirements Statements

Based on the key findings, BI has prepared a set of recommended requirements for VHA consideration.

- The system shall allow clinicians to switch to other Tabs within CPRS without closing the template screen (REQ TC #001).
- The system shall provide the ability for all CPRS template screens to be minimized or allow window focus to be shifted (REQ TC #002).
- The system shall provide the ability for all CPRS template screens to be maximized after having been minimized (REQ TC #003).
- The system shall remain active and provide the ability to navigate throughout the patient’s medical record when the template screen is minimized or window focus is shifted (REQ TC #004).
- The system shall provide the ability to expand template screen itself (data entry area) when the window is maximized to the full screen (REQ TC #005).
- The system shall retain any information that is entered by the clinician into the template before it is minimized or window focus is shifted (REQ TC #006).

- The system shall allow clinicians to switch to other Tabs within CPRS without closing the consult screen (REQ TC #007).
- The system shall provide the ability for all CPRS consult order screens to be minimized or allow window focus to be shifted (REQ TC #008).
- The system shall provide the ability for all CPRS consult order screens to be maximized after having been minimized (REQ TC #009).
- The system shall remain active and provide the ability to navigate throughout the patient's medical record when the consult order screen is minimized or window focus is shifted (REQ TC #010).
- The system shall provide the ability to expand the consult order screen itself (data entry area) when the window is maximized to the full screen. (REQ TC #011).
- The system shall retain any information that is entered by the clinician into the consult order before it is minimized or window focus is shifted (REQ TC #012).

2.5.5 Supporting Data

The supporting data, detailed analysis, and relevant references are found in Appendixes A-E.

2.6 Recommended Modifications to the CPRS Medications Screen

This recommendation focuses on the Sorting and Comparing Medications high-value, frequently performed task. It addresses the portion of the medication reconciliation task that involves sorting and comparing medications as performed by VHA clinicians in the inpatient setting that were observed during the site visits conducted for this analysis.

2.6.1 Assessment of As-Is State of Medications Screen

Clinician Feedback

During the initial observations and subsequent discussions, clinicians suggested changes to the Medication screen that would afford potential clinician timesaving and further improve patient care. The suggested changes are:

- Allow for easier comparison of inpatient and outpatient medications;
- Allow for easier comparison of current and past medications; and
- Allow clinicians to sort medications with a single click.

Incorporating this feedback would change a manual process to a more automatic process and eliminate the workarounds devised by clinicians to complete this task. Clinicians theorize that these changes will increase their efficiency while interacting with the system, reduce the potential for medication errors and allow more time for patient care.

As-Is Scenario

The scenario for this recommendation requires no clicks as it is based on a manual process. The process for reconciling medications varied from site to site and this represents one of the many workaround processes clinicians used to reconcile medications. The reason for the manual process is that there is no automatic process in CPRS for sorting medications or instantly comparing inpatient to outpatient medications. (See Table 21.)

Table 21. As-Is scenario for Sorting and Comparing Medications

Step	Description	Clicks:
1.	On the paper printouts of medications, highlight all inpatient and outpatient medications which match in name, form and dosage	N/A
	Total Clicks	N/A

As-Is Screen Shot

Figure 17 is of an example of the current CPRS medications screen. Clinicians cannot sort the medications with a single click. It is also visually difficult to compare inpatient to outpatient medications.

Figure 17. As-Is example of the CPRS Medications screen.

VistA CPRS in use by: Provider, Ten (CPRSdemo.va.gov)

File Edit View Action Tools Help

EIGHT, PATIENT 666-00-0008 Apr 07, 1935 (73) **Visit Not Selected** Provider: PROVIDER, TEN Primary Care Team Unassigned **Flag** **Remote Data** **Postings CAD**

Action	Outpatient Medications	Expires	Status	Last Filled	Refills R...
	*SIMVASTATIN 40MG TAB Qty: 90 for 30 days Sig: TAKE ONE TABLET BY BY MOUTH EVERY EVENING	04/11/08	Expired	Apr 11, 07	5
	*METOPROLOL TARTRATE 50MG TAB Qty: 180 for 90 days Sig: TAKE ONE TABLET BY MOUTH TWICE A DAY	04/11/08	Expired	Apr 11, 07	3
	*METFORMIN HCL 500MG TAB SA Qty: 180 for 90 days Sig: TAKE ONE TABLET BY BY MOUTH TWICE A DAY	04/11/08	Expired	Apr 11, 07	3

Action	Non-VA Medications	Start Date	Status
	Non-VA: ASPIRIN 81MG EC TAB 81MG MOUTH EVERY MORNING Non-VA medication recommended by VA provider.		Active

Action	Inpatient Medications	Stop Date	Status	Location
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Cover Sheet Problems Meds Orders Notes Consults Surgery D/C Summ Labs Reports

2.6.2 Assessment of To-Be Changes to Medications Screen

Description of Recommendations

In order to verify the clinician suggestions iterated in Section 2.6.1, the BI Team incorporated the following recommended modifications into the To-Be model Medications screen:

- Modify the system to allow clinicians to sort orders by each column header (RCMD MS #001).
- Allow clinicians to navigate easily between Medication List, Medication Reconciliation and Medication History views with a single click (RCMD MS #002).
- Modify the system so medication orders can be custom color-coded by the clinician using a system wide standard color palette (for example, STAT orders displayed in Red and New orders in Green) (RCMD MS #003).

- Modify the screen to allow clinicians to compare medications side-by-side (RCMD MS #004).
- Allow clinicians to compare inpatient to outpatient medications (RCMD MS #005).
- Allow clinicians to compare current inpatient medications to medication history of the current hospitalization (RCMD MS #006).

For a visual representation of these recommendations please see Figure 18 below.

To-Be screen shots

Figure 18 is an example of a To-Be medication reconciliation screen, which compares inpatient medications on the left to outpatient medications on the right. The medication comparisons are distinguished as “Match” (where medication name, dosage and form match between the inpatient side and outpatient side), “LM” (Limited Match – where the medication name matches but the form and/or dosage do not match) and a blank square, which indicates that the medication does not have a match.

Figure 18. To-Be example of a medication reconciliation screen comparing inpatient and outpatient medications.

Match	Action	Inpatient Medications	Stop Date	Status	Location	Match	Action	Outpatient Medications	V/A/Non	Expires	Status	Last Filled	Refills
Match	New	DOCUSATE SODIUM CAP, ORAL 200MG BY MOUTH AT BEDTIME AS NEEDED constipation	02/29/2008	Pending	South 2	Match	New	DOCUSATE NA 100MG CAP; TAKE TWO CAPSULES BY MOUTH DAILY AT BEDTIME (STOOL SOFTENER) FOR CONSTIPATION		6/1/2008	Pending	4/2/2008	0
Match		HYDROCODONE 10MG TAB Sig: ONE TABLET BY MOUTH THREE TIMES A DAY AS NEEDED For Back pain flares	04/01/2008	Pending	BI	Match		HYDROCODONE 10MG TAB Sig: ONE TABLET BY MOUTH THREE TIMES A DAY AS NEEDED For Back pain flares		07/01/08	Active	01/15/08	6
Match		LEVOTHYROXINE NA (SYNTHROID) TAB; 0.075MG BY MOUTH QAMAC hypothyroidism	06/15/2008	Active		Match		LEVOTHYROXINE NA (SYNTHROID) 0.075MG TAB; TAKE ONE TABLET BY MOUTH EVERY MORNING BEFORE BREAKFAST FOR HYPOTHYROIDISM (DOSE INCREASE)		05/19/09	Active	05/12/08	4
Match		QUETIAPINE TAB; 25MG BY MOUTH THREE TIMES A DAY AS NEEDED ANXIETY	06/15/2008	Active		Match		QUETIAPINE 25MG TAB; TAKE ONE TABLET BY MOUTH THREE TIMES A DAY AS NEEDED FOR MOOD AND ANXIETY		5/19/09	Active	05/12/08	4
LM		CYCLOBENZAPRINE TAB; 10MG BY MOUTH THREE TIMES A DAY for muscle relaxation	01/01/2009	Active	North 1	LM		CYCLOBENZAPRINE HCL 20MG TAB; TAKE ONE TABLET BY MOUTH THREE TIMES A DAY AS NEEDED FOR MUSCLE RELAXATION		04/15/08	Active	11/21/07	3
LM		OMEPRAZOLE CAP, EC; 20MG ORALLY QAMAC for stomach	06/15/2008	Active		LM		OMEPRAZOLE 30MG EC CAP; TAKE ONE CAPSULE BY MOUTH EVERY MORNING BEFORE BREAKFAST FOR STOMACH		05/19/09	Active	05/12/08	4
	ASAP	CARBAMAZEPINE TAB; 200MG BY MOUTH THREE TIMES A DAY	04/15/2008	Active				ASPIRIN	Non-VA		Active		
		GABAPENTIN TAB; 600MG BY MOUTH THREE TIMES A DAY give 6 am, 2 pm and 10 pm	03/03/2008	Pending	East 5			BUSPIRONE HCL 15MG TAB; TAKE ONE-HALF TABLET BY MOUTH TWICE A DAY FOR 7 DAYS, THEN TAKE ONE TABLET TWICE A DAY FOR MOOD AND ANXIETY		04/10/08	Active	12/21/07	1
		PERPHENAZINE TAB; 4MG BY MOUTH EVERY MORNING	06/15/2008	Active				QUETIAPINE 200MG TAB; TAKE ONE TABLET BY MOUTH DAILY AT BEDTIME FOR MOOD		05/19/09	Active	05/12/08	4
		PERPHENAZINE TAB; 8MG BY MOUTH AT BEDTIME	06/15/2008	Active									

Figure 19 is an example of a To-Be medication reconciliation screen, which compares current inpatient medications on the left to inpatient medications ordered for the patient in the last 24 hours on the right. The clinician could change the time parameter of the right side of the screen to reflect medication orders older than 24 hours. This screen is designed to give the clinician a snap shot of a patient's medication history that can facilitate the complete and proper ordering and administration of a patient's medications if a patient is moved between wards.

Figure 19. To-Be example of a medication reconciliation screen comparing current and past medications.

Vista CPRS in use by: Provider,Three (CPRSdemo.va.gov)

File Edit View Action Tools Help

EIGHT,PATIENT Visit Not Selected Primary Care Team Unassigned

666-00-0008 Apr 07,1935 (72) Provider: PROVIDER,TEN

Flag Remote Data Postings CAD

Active Medications

From: Jul 14,2008@23:59 ... Through: NOW/ ...

Match	Action	Inpatient Medications	Stop Date	Status	Location
Match	New	DOCUSATE SODIUM CAP,ORAL 200MG BY MOUTH AT BEDTIME AS NEEDED constipation	08/15/2008	Pending	South 2
Match		GABAPENTIN TAB; 600MG BY MOUTH THREE TIMES A DAY give 6 am, 2 pm and 10 pm	09/03/2008	Pending	East 5
Match	New	HYDROCODONE 10MG TAB Sig: ONE TABLET BY MOUTH THREE TIMES A DAY AS NEEDED For Back pain flares	09/01/2008	Pending	BI
Match		LEVOTHYROXINE NA (SYNTHROID) TAB; 0.075MG BY MOUTH QAMAC hypothyroidism	08/15/2008	Active	
LM		CYCLOBENZAPRINE TAB; 10MG BY MOUTH THREE TIMES A DAY for muscle relaxation	01/01/2009	Active	North 1
LM		OMEPRAZOLE CAP,EC; 20MG ORALLY QAMAC for stomach	08/15/2008	Active	
	ASAP	CARBAMAZEPINE TAB; 200MG BY MOUTH THREE TIMES A DAY	08/15/2008	Active	
		PERPHENAZINE TAB; 4MG BY MOUTH	08/15/2008	Active	

Match	Action	Inpatient Medications	Stop Date	Status	Location
Match		DOCUSATE SODIUM CAP,ORAL 200MG BY MOUTH AT BEDTIME AS NEEDED constipation	06/15/2008	Discontinued	South 2
Match		GABAPENTIN TAB; 600MG BY MOUTH THREE TIMES A DAY give 6 am, 2 pm and 10 pm	06/15/2008	Discontinued	East 5
Match		HYDROCODONE 10MG TAB Sig: ONE TABLET BY MOUTH THREE TIMES A DAY AS NEEDED For Back pain flares	06/15/2008	Discontinued	BI
Match		LEVOTHYROXINE NA (SYNTHROID) TAB; 0.075MG BY MOUTH QAMAC hypothyroidism	06/15/2008	Discontinued	
LM		CYCLOBENZAPRINE TAB; 5MG BY MOUTH TWO TIMES A DAY for muscle relaxation	06/15/2008	Discontinued	North 1
LM		OMEPRAZOLE CAP,EC; 40MG ORALLY QAMAC for stomach	06/15/2008	Discontinued	
		AMPICILLIN INJ; 1GM/1VIAL IVPB Q6H	06/15/2008	Discontinued	
		QUETIAPINE TAB; 25MG BY MOUTH THREE TIMES A DAY AS NEEDED	06/15/2008	Discontinued	

Action	Non-VA Medications	Start Date	Status
	Non-VA ASPIRIN 81MG EC TAB 81MG MOUT-H EVERY MORNING Non-VA medication recommended by VA provider.		Active

Cover Sheet Problems Meds Orders Notes Consults Surgery D/C Summ Labs Reports Dashboard Meds List Meds Reconciliation

Because there are situations where the clinician only needs a list of medications (e.g., outpatient clinics), the BI Team included the current CPRS screen in the model but modified the screen to allow the clinician to sort the medications by column header (Figure 20). The BI Team also designed the screen to be accessible to and from the other two medication screens.

Figure 20. To-Be example of a medication list.

Vista CPRS in use by: Provider,Three (CPRSdemo.va.gov)

File Edit View Action Tools Help

EIGHT,PATIENT Visit Not Selected Primary Care Team Unassigned

666-00-0008 Apr 07,1935 (72) Provider: PROVIDER,TEN

Flag Remote Data Postings CAD

Outpatient Medications

	Expires	Status	Last Filled	Refills Remaining
BUSPIRONE HCL 15MG TAB; TAKE ONE-HALF TABLET BY MOUTH TWICE A DAY FOR 7 DAYS, THEN TAKE ONE TABLET TWICE A DAY FOR MOOD AND ANXIETY	04/10/08	Active	12/21/07	1
CYCLOBENZAPRINE HCL 20MG TAB; TAKE ONE TABLET BY MOUTH THREE TIMES A DAY AS NEEDED FOR MUSCLE RELAXATION	04/15/08	Active	11/21/07	3
DOCUSATE NA 100MG CAP; TAKE TWO CAPSULES BY MOUTH DAILY AT BEDTIME (STOOL SOFTENER) FOR CONSTIPATION	6/1/2008	Pending	4/2/2008	0
HYDROCODONE 10MG TAB Sig: ONE TABLET BY MOUTH THREE TIMES A DAY AS NEEDED For Back pain flares	07/01/08	Active	01/15/08	6
LEVOTHYROXINE NA (SYNTHROID) 0.075MG TAB; TAKE ONE TABLET BY MOUTH EVERY MORNING BEFORE BREAKFAST FOR HYPOTHYROIDISM (DOSE INCREASE)	05/19/09	Active	05/12/08	4
OMEPRAZOLE 30MG EC CAP; TAKE ONE CAPSULE BY MOUTH EVERY MORNING BEFORE BREAKFAST FOR STOMACH	05/19/09	Active	05/12/08	4
QUETIAPINE 200MG TAB; TAKE ONE TABLET BY MOUTH DAILY AT BEDTIME FOR	05/19/09	Active	05/12/08	4

Action	Non-VA Medications	Start Date	Status
	Non-VA ASPIRIN 81MG EC TAB 81MG MOUTH EVERY MORNING Non-VA medication recommended by VA provider.		Active

Action	Inpatient Medications	Stop Date	Status	Location
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Cover Sheet Problems Meds Orders Notes Consults Surgery D/C Summ Labs Reports Dashboard Meds History Meds Reconciliation

To-Be scenario

The BI Team captured the changes to the steps a clinician would use to sort and compare inpatient to outpatient medications and created the To-Be scenario shown in Table 22. The BI Team then verified that the changes had the potential of increasing clinician efficiency by executing a timing study between the As-Is scenario and the To-Be scenario (see *Impacts*).

Table 22. To-Be scenario for Sorting and Comparing Medications

Step	Description	Clicks
1.	From the cover sheet, select the “Meds” Tab	1
2.	Sort the Medications by the “Match” category	1
3.	Answer the question: How many matching medications are there?	-
	Total Clicks	2

2.6.3 Impacts**Clinical Impacts**

The clinical impact of the recommended changes is based on clinician comments and insights recorded during the two rounds of site visits.

The key clinical benefits of implementing the recommended changes to the Medications screen are:

- Reduce the potential for medication errors of omission when trying to match medications;
- Reduce the potential for medication errors having to do with the wrong dosage, route and time of administration;
- Increase the efficiency of the clinician’s workflow processes (eliminate manual workarounds); and
- Reduce medication reconciliation time (automate process).

Time and Keystroke Efficiencies

The BI Team conducted an execution timing comparison study utilizing task scenarios representing the As-Is and To-Be states. The analysis showed that the execution timesaving for the To-Be scenario was on average 104 seconds plus or minus 17 seconds.

Table 23 shows a summary of the results. Full calculations and statistical definitions are provided in Appendixes B and G. It should be noted that the 104 seconds represents the manual process captured in the As-Is scenario. Because medication reconciliation workarounds vary from clinician to clinician as do the number of medications from patient to patient, the timesaving could vary greatly depending on the situation.

No keystroke comparisons are identified because the BI Team compared a manual and automated process.

Table 23. Time Data Results for Execution Timings for Sorting and Comparing Medications

Scenario	Sample Size	Mean Execution Time (Seconds)	Difference between the Means (Seconds)	Lower 95% Confidence Interval (Seconds)	Upper 95% Confidence Interval (Seconds)
As-Is	34	119			
To-Be	34	15			
			104	87	121

Task Ranking

The BI Team asked clinicians to rank from one to eight (with one being the most important) the eight “To-Be” solution tasks in terms of importance to the individual clinician.

The Sorting and Comparing Medications task ranked in the upper half of order preference for both nurses and doctors.

- Of the 18 nurses, twelve ranked it between a 1 and 6, with five ranking it a 6 and one a 7.
- Of the 16 doctors, nine ranked it either a 1 or a 2, with the remaining seven ranking it between 6 and 3.

2.6.4 Requirements Statements

Based on the key findings, BI has prepared a set of recommended requirements for VHA consideration.

- The system shall allow clinicians to sort orders by each column header (REQ MS #001).
- The system shall allow clinicians to navigate using one click between the Medication List, Medication Reconciliation and Medication History view (REQ MS #002).
- The system shall display inpatient, outpatient, and non-VA medications on one screen (REQ MS #003).
- The CPRS system shall distinguish between outpatient medications and inpatient medications (REQ MS #004).
- The CPRS system shall display all outpatient and inpatient medications side-by-side on the same screen (REQ MS #005).
- The system shall provide the ability to compare inpatient to outpatient medications on the same screen (REQ MS #006).
- The system shall provide the ability to compare current inpatient medications to medication history of the current hospitalization (REQ MS #007).
- The system shall display each medication in full context with the specific name, dosage, and route of administration (REQ MS #008).
- The system shall display an identifier that designates a match between inpatient and outpatient medications if the medication exactly matches the name, dosage and route of administration (REQ MS #009).
- The system shall display an identifier that when name only is matched between inpatient and outpatient medications (REQ MS #010).

- The system shall allow clinicians to custom color-code medication orders utilizing a system wide standard color palette (for example, STAT orders displayed in Red and New orders in Green) (REQ MS #011).
- The system shall display the key medication order indicators (STAT, ASAP, New, Now and Flagged) as a separate and distinct column (REQ MS #012).

2.6.5 Supporting Data

The supporting data, detailed analysis, and relevant references are found in Appendixes A-E.

2.7 Recommended Modifications to CPRS Orders Screen

The recommendations provided in this section focus on the “Finding and Sorting Orders” high-value, frequently performed task. It addresses the sorting and finding of orders as performed by VHA clinicians in the inpatient settings that were observed during the site visits conducted for this analysis.

2.7.1 Assessment of As-Is State of Orders Screen

Clinician Feedback

During the initial observations and subsequent discussions, clinicians suggested changes to the Orders screen that would provide potential clinician timesaving and allow clinicians more time with the patient. The suggested changes are:

- Modify the screen to include a column that lists order type (e.g. STAT, ASAP, new, now and flagged);
- Modify the screen to include the capability to use column headers to sort information.
- Allow clinicians to automatically graph a specific value by selecting a specific medication or lab and right clicking;
- Allow users to access the graphing application from the orders screen with a single click; and
- Modify the screen to show clarifications between the various statuses, (specifically between pending and active) by showing a small pop-up box containing the definition of the status when the cursor hovers over the word.

Incorporating these suggestions would move current functionality from the menus to the screen thus reducing keystrokes and increasing system intuitiveness. Clinicians theorize that these changes will increase their efficiency while interacting with the system and allow more time for patient care.

As-Is Scenario

To document the projected efficiencies related to the recommended changes, the BI Team devised a pair of parallel scenarios that represent the task of a clinician trying to find an order. The first scenario described below mimics current CPRS functionality (As-Is), while the other represents the recommended changes (To-Be).

The scenario in Table 24 describes the steps a clinician might take to find specific order information.

Table 24. As-Is Scenario Instructions for Finding and Sorting Orders

Step	Description	Clicks:
1.	From the cover sheet, select “Orders” Tab	1
2.	Answer the question: Does an order exist for a “Cardiology Consult”?	-
3.	Answer the question: How many STAT orders are there?	-
4.	Click view	1
5.	Click Custom Order View	1
6.	Click Laboratory	1
7.	Click Ok	1
8.	Answer the question: Does an order exist for a lab titled “Glucose Blood Serum”?	-
Total Clicks		5

As-Is Screen Shot

Figure 21 is a screen capture of the current state of the Orders screen. In order to change the data displayed in the main window, a clinician must choose new parameters by using the tool bar at the top of the screen. The capability to sort the data by columns or access the graphing application on the main screen does not exist.

Figure 21. As-Is example of a default view of the CPRS Orders screen.

Vista CPRS in use by: Provider_One (CPRSdemo.va.gov)

File Edit View Action Options Tools Help

EIGHT.PATIENT 666-00-0008 Apr 07,1935 (73) **Visit Not Selected** Provider: PROVIDER.ONE Primary Care Team Unassigned **Flag** Remote Data **Postings CAD**

View Orders **Active Orders (includes Pending & Recent Activity) - ALL SERVICES**

Service	Order	Start / Stop	Provider	Nurse	Clerk	Chart	Status	Location
Out. Meds	*SIMVASTATIN TAB 40MG TAKE ONE TABLET BY MOUTH EVERY EVENING Quantity: 90 Refills: 5	Start: 04/11/07 Stop: 04/11/08	Vehu,D				active	General Medicine
	*METFORMIN TAB.SA. 500MG TAKE ONE TABLET BY MOUTH TWICE A DAY Quantity: 180 Refills: 3	Start: 04/11/07 Stop: 04/11/08	Vehu,D				active	General Medicine
Non-VA Meds	Non-VA ASPIRIN TAB EC 81MG TAKE ONE TABLET BY MOUTH EVERY MORNING Non-VA medication recommended by VA provider.		Vehu,D				active	General Medicine
Lab	GLUCOSE BLOOD SERUM SP LB #2804	Start: 07/07/05 10:31	Vehu,T				active	0
	HEMOGLOBIN A1C SERUM SP LB #2681	Start: 03/17/05 01:59	Vehu,T				active	General Medicine
	INR BLOOD PLASMA SP LB #2681	Start: 03/17/05 01:59	Vehu,T				active	General Medicine
	PROTIME BLOOD PLASMA SP LB #2681	Start: 03/17/05 01:59	Vehu,T				active	General Medicine
	PROTIME BLOOD PLASMA SP LB #2156	Start: 04/28/03 10:38	Vehu,T				active	Icu/Ccu
Consults	01HEMATOLOGY CONSULT Cons Consultant's Choice	Start: 04/01/04 22:57	Radtech,T				pending	General Medicine
	CARDIOLOGY Cons Consultant's Choice	Start: 05/21/00 09:54	Vehu,S				pending	Cardiology

Cover Sheet | Problems | Meds | Orders | Notes | Consults | Surgery | D/C Summ | Labs | Reports

2.7.2 Assessment of To-Be Changes to Orders screen

Description of Recommendations

In order to verify the clinician suggestions iterated in Section 2.7.1, the BI Team incorporated the following recommended modifications into the To-Be model Orders screen:

- Modify the system to allow clinicians to sort orders by each column header (RCMD OS #001).
- Modify the system to allow clinicians to create multiple custom views to save on the Orders screen for future use (RCMD OS #002).
- Allow clinicians to navigate easily between multiple preferred views with a single click (RCMD OS #003).
- Modify the system so orders can be custom color-coded by the clinician using a system wide standard color palette (for example, STAT orders displayed in Red and New orders in Green) (RCMD OS #004).
- Modify the system so that the order key indicators: STAT, ASAP, New, Now and Flagged are visually distinct and separate from the order (RCMD OS #005).
- Allow clinicians to sort by order key indicator (RCMD OS #006).
- Modify the system so that clinicians are allowed to access CPRS Graphing with a single click (RCMD OS #007).
- Modify the system so that the definition of the Status (e.g. “pending” or “active”) when the cursor hovers over the word in the column (RCMD OS #008).

For a visual representation of these recommendations please see Figures 22-26 below.

To-Be Screen Shot

In the To-Be model, the default view (Figure 22) is set by the clinician preferences (current CPRS functionality) and is the first available view selection option. Beneath this option are two additional saved view options that a clinician can toggle between quickly and easily. A clinician is also able to sort the orders by category by clicking any of the column headers. The column Type shows the key indicators STAT, New and Flagged. (CPRS currently shows these delineators as the last field in an order under the Order column.) Additionally, the current CPRS graphing application is also accessible from the Write Orders box. ¹

¹ Modeler’s Note: It is intended that the color-coding scheme for New, STAT and Flagged orders be maintained throughout the various screens. It is a limitation in the simulation tool that the data displayed can be sorted **or** colored but cannot be both.

Figure 22. To-Be model of a default view of the CPRS Orders screen.

Vista CPRS in use by: Provider, Three (CPRSdemo.va.gov)

File Edit View Action Tools Help

EIGHT, PATIENT Visit Not Selected Primary Care Team Unassigned

666-00-0008 Apr 07, 1935 [72] Provider: PROVIDER, TEN

Flag Remote Data Postings CAD

View Orders Active Orders [includes Pending and Recent Activity] - All Services

Active Orders - All Services

Saved View 1 - STAT Orders

Saved View 2 - Medications and Labs

Write Delayed Orders

Write Orders

Diet Order

Vital Signs

Inpatient Medications

Outpatient Medications

Infusion

Non-VA Meds

Metoprolol/atriate 50MG

Aspirin 81 MG Non-VA

Laboratory

Inpt Labs Routine Menu...

Imaging

Consult

Diabetic Nutrition Consult

Clinician Add Order Menu...

NPO/Dressing Change

Graphing

Service	Type	Order	Start/Stop	Provider	Nurse	Clerk	Chart	Status	Location
Out. Meds	D/C	SIMVASTATIN 40MB TAB Qty: 90 for 30 days Sig: TAKE ONE TABLET BY MOUTH EVERY EVENING		Provider, S				Active	General Medicine
	New	METOPROLOL TARTRATE 50 MG TAB Qty: 180 for 90 days Sig: TAKE ONE TABLET BY MOUTH TWICE A DAY	Start: 4/1/2008 Stop: 04/15/2008	Provider, S				Active	General Medicine
		METFORMIN HCL 500MB TAB, SA Qty: 180 for 90 days Sig: TAKE ONE TABLET BY MOUTH TWICE A DAY	Stop: 01/01/2009	Provider, S				Active	General Medicine
	Change	Testing 2 - Oral	Stop: 05/01/2008	Provider, S				Pending	General Medicine
Non-VA Meds		Non-VA ASPIRIN TAB, EC 81MG TAKE ONE TABLET BY MOUTH EVERY MORNING Non-VA medication recommended by VA provider.		Provider, S				unreleased	Cardiology
Lab	New	CREATININE BLOOD SERUM WC LB #3283		Provider, S				Active	General Medicine
		SODIUM BLOOD SERUM WC LB #3583		Provider, S				Active	General Medicine
		POTASSIUM BLOOD SERUM WC LB #3883		Provider, S				Active	General Medicine
		CHLORIDE BLOOD SERUM WC LB #4185		Provider, S				Active	General Medicine
		CO2 BLOOD SERUM WC LB #4497		Provider, S				Active	General Medicine
		GLUCOSE BLOOD SERUM WC LB #4800		Provider, S				Active	General Medicine
	Flagged	CHOLESTEROL BLOOD SERUM WC LB #5103		Provider, S				Active	General Medicine
		HDL BLOOD SERUM WC LB #5406		Provider, S				Active	General Medicine
		TRIGLYCERIDE SERUM WC LB #5709		Provider, S				Active	General Medicine

Cover Sheet Problems Meds Orders Notes Consults Surgery D/C Summ Labs Reports Dashboard

Figure 23 shows an example of a definition appearing when the clinician rolls over a word in the Status columns.

Figure 23. To-Be model of the pop-up definition in the CPRS Orders screen.

Flag Remote Data Postings CAD

Stop	Provider	Nurse	Clerk	Chart	Status	Location
	Provider, S				Active	Definition of Term would go here.
4/1/2008 04/15/2008	Provider, S				Active	
01/01/2009	Provider, S				Active	General Medicine
	Provider, S				Active	General Medicine

Figure 24 shows one example of a possible saved view. A clinician accesses the view by selecting a saved view in the View Orders box on the CPRS Orders screen. In this example, the view is of all STAT orders. The object of the saved view is to allow a clinician to determine the specific criteria they wish to save and make it available with a single click.²

² Modeler's Note: It is the intent of the modeler that the sorting capability of orders be maintained throughout the various screens. It is a limitation in simulation tool that the data displayed can be sorted **or** colored but cannot be both.

Figure 24. To-Be example of a possible saved view.

VISTA CPRS in use by: Provider, Three (CPRSdemo.va.gov)

File Edit View Action Tools Help

EIGHT, PATIENT Visit Not Selected Primary Care Team Unassigned

666-00-0008 Apr 07, 1935 (72) Provider: PROVIDER, TEN

Flag Remote Data Postings CAD

View Orders

- Active Orders - All Services
- Saved View 1 - STAT Orders**
- Saved View 2 - Medications and Labs
- Write Delayed Orders
- Write Orders
- Diet Order
- Vital Signs
- Inpatient Medications
- Outpatient Medications
- Infusion
- Non VA Meds
- Metoprolol Tartrate 50MG
- Aspirin 81 MG Non VA
- Laboratory
- Inpt Labs Routine Menu...
- Imaging
- Consult
- Diabetic Nutrition Consult
- Clinician Add Order Menu...
- NPO/Dressing Change
- Graphing

Service	Action	Order	Start/Stop	Provider	Nurse	Clerk	Chart	Status	Location
Inpat. Meds	New STAT	METHYLDOPATE 1N3 50MG/1ML IV AT ONSET *UNSIGNED*		Provider, S				Unreleased	7a Gen Med
Labs	New STAT	GLUCOSE BLOOD SERUM WC LB #4800		Provider, S				Pending	7a Gen Med
Inpat. Meds	New NOW	ACETAMINOPHEN TAB 325MG PO 3XW First Dose NOW *UNSIGNED*		Provider, S				Active	7a Gen Med

Cover Sheet Problems Meds Orders Notes Consults Surgery D/C Summ Labs Reports Dashboard

In the example shown in Figure 25, only medications and labs are shown in the main window. The model also shows an example of a possible color scheme where STAT orders are red, New orders are green, Unsigned orders are blue, and Flagged orders are back-colored in red. The orders can be sorted by column.

Figure 25. To-Be example of a second possible saved view.

VISTA CPRS in use by: Provider, Three (CPRSdemo.va.gov)

File Edit View Action Tools Help

EIGHT, PATIENT Visit Not Selected Primary Care Team Unassigned

666-00-0008 Apr 07, 1935 (72) Provider: PROVIDER, TEN

Flag Remote Data Postings CAD

View Orders

- Active Orders - All Services
- Saved View 1 - STAT Orders
- Saved View 2 - Medications and Labs**
- Write Delayed Orders
- Write Orders
- Diet Order
- Vital Signs
- Inpatient Medications
- Outpatient Medications
- Infusion
- Non VA Meds
- Metoprolol Tartrate 50MG
- Aspirin 81 MG Non VA
- Laboratory
- Inpt Labs Routine Menu...
- Imaging
- Consult
- Diabetic Nutrition Consult
- Clinician Add Order Menu...
- NPO/Dressing Change
- Graphing

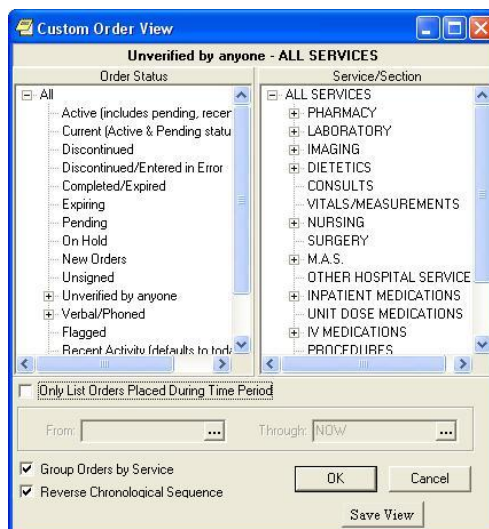
Service	Type	Order	Start/Stop	Provider	Nurse	Clerk	Chart	Status	Location
Out. Meds	New UNSIGNED	AMOXAPINE TAB 50MG TAKE ONE TABLET BY MOUTH 3XW Quantity: 5 Refills: 0	Start: 4/23/2008 Stop: 9/1/2008	Provider, S				Unreleased	General Medicine
		METFORMIN TAB, SA 500MG TAKE ONE TABLET BY MOUTH TWICE A DAY Quantity: 180 Refills: 3	Start: 4/23/2007 Stop: 4/23/2009	Smith, J				Active	General Medicine
		SIMVASTATIN TAB 40MG TAKE ONE TABLET BY MOUTH EVERY EVENING Quantity: 90 Refills: 5		Smith, J				Active	General Medicine
Inpat. Meds	New NOW	ACETAMINOPHEN TAB 325MG PO 3XW First Dose NOW		Provider, S				Active	7a Gen Med
	New STAT	METHYLDOPATE 1N3 50MG/1ML IV AT ONSET STAT		Provider, S				Pending	7a Gen Med
Labs	Flagged	CHLORIDE BLOOD SERUM WC LB #4185							
		CHOLESTEROL BLOOD SERUM WC LB #5103							
		CO2 BLOOD SERUM WC LB #4497							
	New STAT	GLUCOSE BLOOD SERUM WC LB #4800		Provider, S				Pending	7a Gen Med
		POTASSIUM BLOOD SERUM WC LB #3883							
		SODIUM BLOOD SERUM WC LB #3583							

Cover Sheet Problems Meds Orders Notes Consults Surgery D/C Summ Labs Reports Dashboard

Figure 26 shows one possible method of saving criteria for a saved view. The Custom Order View dialog box (current CPRS) allows a clinician to choose the criteria to determine which

orders to display. The To-Be model includes the ability to save it as one of the saved view options on the CPRS Orders screen.

Figure 26. To-Be Model of Custom Order View screen with Save View button.



To-Be Scenario

The BI Team captured the changes to the steps a clinician would use to find an order and created the To-Be scenario shown in Table 25. The BI Team then verified that the changes had the potential of increasing clinician efficiency by executing a timing study between the As-Is scenario and the To-Be scenario (see the Impacts Section below).

Table 25. To-Be Scenario Instructions for Finding and Sorting Orders

Step	Description	Clicks
1.	From the cover sheet, select Orders screen	1
2.	Sort by "Location"	1
3.	Answer the question: Does an order exist for a "Cardiology Consult"?	-
4.	Change view to Saved View 1 - Stat Orders	1
5.	Answer the question: How many STAT orders are there?	-
6.	Change view to Saved View 2 - Medications and Labs	1
7.	Answer the question: Does an order exist for a lab titled "Glucose Blood Serum"?	-
	Total Clicks	4

2.7.3 Impacts

Findings from the impact analysis are broken down in to three categories: clinical impact, time and keystroke efficiencies and task ranking. The following sections provide commentary on the specific findings.

Clinical Impact:

The clinical impact of the recommended changes is based on clinician comments and insights recorded during the two rounds of site visits.

The key clinical benefits of implementing the recommended changes to the order screen are:

- Decreases the possibility of missing or not seeing new or STAT orders;
- Improves visualization and reduces search time and keystrokes to locate data; and
- Increases intuitiveness that facilitates easier staff training.

Time and Keystroke Efficiencies:

The BI Team conducted an execution timing comparison study utilizing task scenarios representing the As-Is and To-Be states. The analysis showed that the execution timesaving for the To-Be scenario was on average 60 seconds plus or minus 14 seconds.

Table 26 results shows a summary of the results with full calculations and statistical definitions provided in Appendixes B and G.

Table 26. Time Data Results for Execution Timings for Finding and Sorting Orders

Scenario	Sample Size	Mean Execution Time (Seconds)	Difference between the Means (Seconds)	Lower 95% Confidence Interval (Seconds)	Upper 95% Confidence Interval (Seconds)
As-Is	34	95			
To-Be	34	34			
			60	46	74

The BI Team also calculated keystroke differentials between the To-Be and As-Is scenarios and found there to be a 20 percent reduction between the current CPRS system and recommended changes to accomplish the same task (Table 27).

Table 27. Keystroke Count for Finding and Sorting Orders

Scenario	Keystrokes
As-Is	5
To-Be	4
Difference	1

Task Ranking

The BI Team asked clinicians to rank from one to eight (with one being the most important) the eight “To-Be” solution tasks in terms of importance to the individual clinician.

The Finding and Sorting Orders task was low in the rank order preference for both nurses and doctors.

- Of the 18 nurses none of them ranked Sorting and Finding Orders as a 1 or a 2. Five nurses ranked it a 3, the remainder ranked it between 4 and 7.
- Of the 16 doctors only one ranked it as a 2, four ranked as a 3 or 4, three ranked as a 6 and eight ranked it as a 7.

2.7.4 Requirements Statements

Based on the key findings, BI has prepared a set of recommended requirements for VHA consideration.

- The system shall provide the ability to sort medical orders on the Order screen by the column header (REQ OS #001).
- The system shall allow clinicians to create custom views that will be accessible from the View Orders box (REQ OS #002).
- The system shall enable clinicians to save a new custom order sort view from the custom view order screen (REQ SO #003).
- The system shall provide the ability to display saved custom views in the view orders box of the Orders screen for future use (REQ OS #004).
- The system shall allow clinicians to navigate easily between multiple custom views with a single click (REQ OS #005).
- The system shall allow clinicians to custom color-code medication orders utilizing a system wide standard color palette (for example, STAT orders displayed in Red and New orders in Green) (REQ OS #006).
- The system shall display order key indicators: STAT, ASAP, New, Now and Flagged so they are visually distinct and separate from the order (REQ OS #007).
- The system shall allow clinicians to sort by order key indicator (REQ OS #008).
- The system allows clinicians to access CPRS Graphing with a single click (REQ OS #009).
- The system shall display the definition of the Status (e.g. “pending” or “active”) when the cursor hovers over the word in the column (REQ OS #010).

2.7.5 Supporting Data

The supporting data, detailed analysis, and relevant references are found in Appendixes A-E.

2.8 Recommended Modifications to CPRS interaction with BCMA

The recommendations provided in this section focus on the “CPRS interaction with BCMA” high-value, frequently performed task. It addresses the needed link between two separate applications, BCMA and CPRS.

2.8.1 Assessment of As-Is State of CPRS interaction with BCMA

Clinician Feedback

During the initial observations and subsequent discussions, clinician feedback indicated a need for BCMA and CPRS to be linked. The clinicians suggested that:

- BCMA and an open session of CPRS should synchronize to the same patient medical record if a patient bracelet is scanned in BMCA.

Incorporating this change has the potential to reduce the possibility of a patient medication error.

As-Is Scenario

Because the simulation tool could not accurately simulate a clinician encounter with BCMA, the BI Team did not create a scenario for timing purposes.

As-Is Screen Shot

Figure 27 is of the current BCMA screen while scanning in a wristband. Currently, a nurse must manually select the new patient in CPRS.

Figure 27. As-Is Model of the Bar Code Medication Administration Screen with Wristband Scan.

The screenshot displays the 'Bar Code Medication Administration - v3.0.10.6 - Patient Context is Joined' window. The patient information section shows: SMITH, JOE (MALE), SSN = 101-10-7912, DOB = 12/25/1922 (83), Height = 177cm, Weight = 66.82kg, Location = NHCU-2-BH 236-01-BH. Allergies are listed as 'No allergies on file' and 'ADR: codeine'. The medication list includes SODIUM CHLORIDE 0.45% INJ, ACETAMINOPHEN TAB, INSULIN REGULAR (HUMAN) INJ, and ACETAMINOPHEN TAB. A 'Patient Lookup' dialog box is open, prompting the user to 'Scan Patient Wristband'. The dialog box has a text input field and 'OK' and 'Cancel' buttons. The BCMA Clinical Reminders section shows a count of 2 for PRN Effectiveness.

VDL Tab	Status	Type	Medication	Schedule	Dosage, Route	Next Action	Special Instructions	Order Stop Date
IV	Active		SODIUM CHLORIDE 0.45% INJ		30 ml/hr, IV			11/17@0211
			Bag ID: 75453V42	Action By: KCF 09/27@0946	Action: INFUSING			
UD	Active	C	ACETAMINOPHEN TAB					12/18@2400
UD	Active	C	INSULIN REGULAR (HUMAN) INJ				ve 0 units 81...	12/27@2400
UD	Active	P	ACETAMINOPHEN TAB					02/05@2400
UD	Active	C	ACETAZOLAMIDE TAB				Testing Order Flag.	02/05@2400

2.8.2 Assessment of To-Be Changes to CPRS Interaction with BCMA

The BI Team recommends the following:

- Modify the system to provide a link between an open session of CPRS and BCMA to automatically synchronize to the same patient medical record if a patient bracelet is scanned in BCMA (RCMD BCMA #001).

Due to the restrictions of the simulation tool and the nature of the recommendation, the BCMA screen and additional functionality were not modeled and therefore no screen shot exists.

2.8.3 Impacts

The clinical impact of the recommended changes is based on clinician comments and insights recorded during the two rounds of site visits.

The key clinical benefits of implementing the recommended changes to the order screen are:

- Reduces potential for medication errors;
- Reduces key strokes in CPRS (clinician does not need to select new patient); and
- Reduces the time required to administer medications (fewer keystrokes).

Clicks

Though the BI Team could not accurately simulate test scenarios, average clicks could be determined based on task analysis. If CPRS were to automatically update, a clinician would save the 4 clicks needed to select a new patient.

Task Ranking

The BI Team asked clinicians to rank from one to eight (with one being the most important) the eight “To-Be” solution tasks in terms of importance to the individual clinician.

The CPRS interaction with BCMA task was low in the rank order preference for both nurses and doctors.

The results of the ranking indicated that fifteen doctors ranked it an 8 and one ranked it a 7. Eleven of the nurses ranked it as an 8 and one ranked it a 7. One explanation for the low ranking is the majority of the participating clinicians do not use it in their daily workflow. The nurses who use BCMA on a daily basis ranked it much higher, including one nurse who ranked it a 1, and another nurse who ranked it a 3. Four other nurses ranked it either a 4 or a 5.

2.8.4 Requirements Statements

Based on the key findings, BI has prepared a set of recommended requirements for VHA consideration.

- CPRS and the BCMA application shall automatically synchronize to the same patient when a wristband is scanned (REQ BCMA #001).
- When synchronization occurs, the CPRS system shall display the cover sheet of the patient whose wristband was scanned by BCMA (REQ BCMA #002).

2.8.5 Supporting Data

The supporting data, detailed analysis, and relevant references are found in Appendixes A-E.

3 Out of Scope Findings & Recommendations

The BI Team was directed to stay within the current functional framework of CPRS and make recommendations that did not involve new development. The intent was to capitalize on current CPRS functionality. The functional recommendations that were derived from the clinician feedback that did not meet this requirement were captured and identified as either secondary recommendations or for future development.

The secondary recommendations met the requirement to stay within the functionality of CPRS, but were not identified in the primary grouping of high value frequently performed tasks. Those tasks that were identified as future development did not meet the requirement and required new development work within CPRS. As with all the high value tasks, the secondary and future development recommendations were documented, and are presented here.

3.1 Secondary Findings

The following secondary recommendations in Table 28 are based upon interactions with the clinicians at each site visited and are presented here for further consideration.

Table 28. Secondary Recommendations

Task	Issue	Proposed Functional Recommendations
Cover Sheet Customization	CPRS cover sheet is “one size fits all” and does not allow for the differences between various clinician roles.	1. Allow for individual customization of screen by providing clinicians the ability to add, delete or move the type of information displayed and alter the data retrieval parameters.
Templates: (Auto-Populate) (Presentation) (Check boxes) (Calculations) (Tracking) (Readability)	Templates do not pre-populate data, (e.g. contact number, life events) or maintain static information. (Note: This is also true for consult templates.)	2. Provide the ability to pre-populate data. 3. Provide ability to easily import static information.
	Templates are not linked to CPRS. Data entered in the template does not flow back to (change) CPRS data.	4. Provide link between CPRS and templates so that data is bi-directional.
	Complicated, complex and long templates are difficult to complete efficiently due to formatting issues.	5. Templates must be able to be dynamically resized. 6. Data entry fields should reflect the true field limits.
	Templates allow for a clinician to select all check boxes on a template but there is not a check-all box for specific sections.	7. Add a “check all” or “uncheck all” box to any section of templates that have multiple check boxes.
	Templates do not automatically calculate where needed (e.g. for Braden Scale, KATZ Scale, Depression Scale or Fall Risk).	8. Provide auto-calculation of totals and scores.

Task	Issue	Proposed Functional Recommendations
	Templates are developed but not tracked for volume of use, which has lead to over abundance of templates.	9. Provide a method to track development and usage.
	It is time consuming to locate information within the note created by template.	10. Provide the ability to tailor the order of information on a template.
CPRS Auto Refresh	CPRS does not notify the clinician that new values are available. CPRS also does not automatically refresh data.	11. Provide a pop-up alert to indicate that new values are available while automatically refreshing the information. 12. Indicate the date and time of the auto-refresh event. 13. Move the manual patient refresh function from the drop down menu to a single click button on the toolbar.
Patient Problem List	The Patient Problem List is not maintained to reflect active problems.	14. Provide problem expiration dates. 15. Provide sort capability to display by active and historical data
Remote Data View (Response Time) (Sort and Search)	System response time to retrieve remote data is too long.	16. Conduct an examination of the cause of the data delays and remedy the problem, architecture, hardware, etc.
	Presentation of remote data is non-interactive (e.g. a clinician cannot sort the data).	17. Provide the ability to sort and search results.
Reminders & Alerts	Too many reminders with no way to prioritize or categorize them.	18. Provide the ability to categorize and prioritize reminders and alerts.
	No ability to save the alert and address it later, or use it as a personal reminder to create a task list.	19. Provide the ability to save and recall alerts. 20. Provide the ability to create a task list from reminders.
	Only the primary provider receives the alert—medical specialties and supervising attendees do not. ED is not removed from the recipient list when a patient changes care status.	21. Provide the ability to create and edit reminder/alert distribution lists.
	Cannot resolve and answer reminder on the same screen that displays the reminder.	22. Provide the ability to resolve reminders from the display screen.
Consults	When ordering consults that requires a lab or medication, there is no automatic link to the orders functionality.	23. Provide a required link between consult orders and lab/pharmacy orders.
	No feedback on order/consult completion to the requesting clinician.	24. Provide a completion email back to the requesting clinician.

3.2 Future CPRS Recommendations

The BI Team captured clinician suggested changes that fall out of scope of the analysis. These changes are not within current CPRS functionality. These proposed functionalities, shown in Table 29, were identified as desired advanced capabilities that would enhance clinician productivity.

Table 29. Capabilities Identified by Clinicians for Future Consideration

Proposed Functionality	Requested Capability
Search Engine Functionality	1. Provide "Google-like" search to retrieve patient data.
Image Retrieval	2. Allow for images to be displayed in CPRS so that a clinician does not need to go into Vista imaging to retrieve images or results.
Closed Loop Communication for image alerts	3. Provide a feedback methodology for alert read-response, so that the radiologist initiating the alert has confirmation that the image alert has been read and acknowledged.
Identify Priority Patient Data	4. Provide the ability to highlight, bold, move, or underline text to assist with identification of high priority patient data.
Notes	5. Enable note prioritization, better sort capabilities, and a search function to find specific notes. 6. Assign highlight codes, identify cut and pasted text, age notes by date, and tag notes for later action. 7. Enable a highlighting function for parts of notes clinicians deem important. 8. Create multiple views of note sorting that can be toggled between with one click.
Clinical Tasks	9. Enable creation of clinician task lists, allowing clinicians to track their tasks.
Insufficient Computer Resources	10. Enable multiuser logon functions, as, when computers are in demand, the clinicians would like the ability to share one computer with another clinician, without losing their data or their "place" within CPRS.
Decision Support for Clinical Decision Making	11. Provide more robust decision support tools that use intelligence to control execution of business rules/decision tree logic (e.g., diagnosis, controls available drugs that match to patient allergies and potential drug interactions, links to relevant test results, and associations to system templates and applications).
Data Integration and Display	12. Enable integration of data so that laboratory results, medications, and vital signs cross-populate in the different functionalities (e.g. into BCMA).
Physiological Display of Data	13. Computerize flow sheets and contain them within CPRS.
Interdisciplinary Notes	14. Implement more user-friendly interdisciplinary notes and care planning.
Orders Management in BCMA	15. Enable order verification in BCMA for nurses.
Patient Lists	16. Create resident lists and allow attending physicians to see their residents' lists. 17. Allow clinicians to add or delete patients instantaneously from the CPRS print patient list.

The BI Team makes the above secondary and future recommendations based on the observations and discussions from the site visits. Modeling the recommendations and repeating this study could further validate these recommendations.

Appendixes

Appendix A. Site Demographics and Participant Profile

This appendix provides basic information on the participating facilities and the participant profile. The BI Team traveled to each of these sites twice.

Site: Bay Pines VAMC

Location: Bay Pines, Florida

Visit Dates: January 15-17, 2008 and May 21, 2008

Facility Overview: The Bay Pines VA Healthcare System provides comprehensive medical care including acute/in-patient medical, surgical, and psychiatric care; extended/long-term medical and psychiatric care, rehabilitative inpatient care; and comprehensive outpatient care with multiple specialty services available. In addition, the Medical Center supervises a community nursing home care program, which that is one of the largest in the VA system. The facility also operates a large outpatient clinic in Fort Myers and Community Based Outpatient Clinics (CBOCs) in Dunedin, St. Petersburg, Ellenton, Sarasota, Port Charlotte, Naples, and Sebring, Florida.

Site: West Roxbury Campus VAMC

Location: Boston, MA

Visit Dates: February 5-7, 2008 and May 29, 2008

Facility Overview: The VA Boston Healthcare System, the largest consolidated facility in VISN 1, encompasses three main campuses and six outpatient clinics within a 40- mile radius of the greater Boston area. The consolidated facility consists of the Jamaica Plain Campus, located in the heart of Boston's Longwood Medical Community; the West Roxbury Campus, located on the Dedham line; and the Brockton Campus, located 20 miles south of Boston in the City of Brockton. In addition to the three main medical centers, six Community Based Outpatient Clinics (CBOCs) located in Worcester, Framingham, Lowell, Quincy, Causeway Street (Boston), and Dorchester make up the VA Boston Healthcare System (VA BHS). The VA Boston Healthcare System is the proud recipient of five Centers of Excellence Awards for the following programs: Cardiac Surgery, PTSD, Women's Health, Seriously Mentally Ill, and Substance Abuse.

Site: Baltimore VAMC

Location: Baltimore, Maryland

Visit Dates: February 5-7, 2008 and June 5, 2008

Facility Overview: Baltimore Veterans Affairs Medical Center (VAMC) offers veterans state-of-the-art medical technology, clinical services and research programs. The Medical Center, part of the VA Capitol Health Care Network (VISN 5), is home to the world's first filmless radiology department, which allows health care providers to have nearly instant access to patient radiology images from anywhere in the facility and throughout the health care system. The Baltimore VAMC is the acute medical and surgical care facility for the VA Maryland Health Care System (VAMHCS) and offers a full range of inpatient, outpatient, and primary care services. Located next to the University of Maryland Medical Center, with a walkway connecting the two facilities, the Medical Center maintains an active affiliation with the University of Maryland School of Medicine in the sharing of staff, resources, and technology. Having one of the largest funded research and development programs in the VA system, including studies in diabetes,

immunology, oncology, virology, cellular biology, and infectious diseases, enhances the Medical Center's ability to provide state-of-the-art medical techniques and treatments to Maryland's veterans. A Geriatric Research, Education, and Clinical Center, one of only 21 in the VA system nationwide, conducts research on the prevention of stroke and cardiovascular disease through exercise and nutrition therapy in older veterans. In response to a growing demand for specialized care for veterans with Multiple Sclerosis (MS), the Baltimore VAMC coordinates one of only two MS Centers of Excellence throughout the VA. The Center is responsible for facilitating clinical care, research and education for patients with MS in the Eastern part of the country. The Baltimore VAMC is also the home base for one of VA's ten 10 Mental Illness Research, Education, and Clinical Centers. This program is dedicated to improving the provision of health care to veterans suffering from severe mental illness, with a special emphasis on the treatment of individuals with schizophrenia.

Site: Albany VAMC

Location: Albany, New York

Visit Dates: March 4-6, 2008 and June 11, 2008

Facility Overview: The Stratton VA Medical Center, part of the VA Healthcare Network Upstate New York, is located in the heart of Albany, New York. Opened in 1951, the Medical Center serves veterans in 22 counties of upstate New York, western Massachusetts, and Vermont. In 1990 this facility was named in honor of Samuel S. Stratton, U.S. Congressman for 30 years of the 23rd District, a staunch supporter of veterans and a frequent visitor to the hospital.

Participants

The following Table A-1 depicts each site visited and the participants, and their medical service within each hospital:

Table A-1. Site and Participant List

Facility	Name	MD/RN	Service	In/Out patient
Albany	Participant #1	MD	Geriatric Primary Care Clinic	Outpatient
Albany	Participant #2	MD	General Surgery	Inpatient
Albany	Participant #3	MD	Primary Care	Outpatient
Albany	Participant #4	MD	Specialty Clinics/ ICU	Inpatient
Albany	Participant #5	MD	Emergency	Outpatient
Albany	Participant #6	RN	Behavioral	Inpatient
Albany	Participant #7	RN	Medical/Surgery	Inpatient
Albany	Participant #8	RN	Primary Care	Outpatient
Albany	Participant #9	RN	Medicine/Emergency	Outpatient
Baltimore	Participant #10	MD	Managed Care	Outpatient
Baltimore	Participant #11	MD	Surgery	Inpatient
Baltimore	Participant #12	MD	Psychiatry	Outpatient
Baltimore	Participant #13	RN	Primary Care	Outpatient
Baltimore	Participant #14	RN	MICU	Inpatient
Baltimore	Participant #15	RN	5B Surgical	Inpatient
Baltimore	Participant #16	RN/CAC	CIS	Inpatient
Bay Pines	Participant #17	MD	Medicine	Inpatient
Bay Pines	Participant #18	MD	Surgery	Inpatient
Bay Pines	Participant #19	MD	Primary Care	Outpatient
Bay Pines	Participant #20	RN	Psychiatry	Inpatient
Bay Pines	Participant #21	RN	Geriatrics	Outpatient
Bay Pines	Participant #22	RN	Medical/Surgery/ Neurology	Inpatient
Bay Pines	Participant #23	RN	Primary Care	Outpatient
West Roxbury	Participant #24	MD	Medical Service	Inpatient
West Roxbury	Participant #25	MD	Primary Care	Outpatient
West Roxbury	Participant #26	MD	Primary Care	Outpatient
West Roxbury	Participant #27	MD	Medical Service	Inpatient
West Roxbury	Participant #28	MD	Primary Care	Outpatient
West Roxbury	Participant #29	NP	Medical Service	Outpatient
West Roxbury	Participant #30	RN	Primary Care	Outpatient
West Roxbury	Participant #31	RN	Primary Care	Outpatient
West Roxbury	Participant #32	RN	NVR	Inpatient
West Roxbury	Participant #33	RN	3 North	Inpatient
West Roxbury	Participant #34	RN	NSG	Inpatient

Appendix B. Performance Data and Calculations

Confidence Interval for the difference of two means

Table B-1 shows the calculations used to determine the confidence interval for the difference of the two means for the Print Patient List Scenario (As-Is and To-Be scenarios). The sample size (n) for both groups was thirty. It should be noted that four clinician's VistA sign-on menu was not set up to allow the functions necessary to perform the scripted scenario, so their timings were not used in the calculations. The sample mean (M) was 55 seconds for the As-Is scenario and 6 seconds for the To-Be scenario. The sample standard deviation for the As-Is scenario was 25 and 2 for the To-Be scenario. The difference between the means was 49 seconds. The confidence interval was calculated to be 9 seconds. To establish the lower confidence interval, 9 seconds was subtracted from the difference between the means. To establish the upper confidence interval, 9 seconds was added to the difference between the means.

Table B-1 Confidence Calculations for Print Patient List Task

Print Patient List										
Scenario	Sample n	Sample Mean (M) (Seconds)	Sample s	(Masis - MtoBe) (Seconds)	SQs/n	SQRT (sasis + stobe)	Z _{0.95}	1.96* SQRT (sasis + stobe)	LCI (Seconds)	UCI (Seconds)
As-Is	30	55	25		21					
To-Be	30	6	2		0					
				49		5	1.96	9	40	58

Table B-2 shows the calculations used to determine the confidence interval for the difference of the two means for the Dashboard Scenario (As-Is and To-Be scenarios). The sample size (n) for both groups was thirty-four. The sample mean (M) was 37 seconds for the As-Is scenario and 23 seconds for the To-Be scenario. The sample standard deviation for the As-Is scenario was 9 and 6 for the To-Be scenario. The difference between the means was 14 seconds. The confidence interval was calculated to be 4 seconds. To establish the lower confidence interval, 4 seconds was subtracted from the difference between the means. To establish the upper confidence interval, 4 seconds was added to the difference between the means.

Table B-2. Confidence Calculations for Dashboard Functionality

Dashboard Functionality										
Scenario	Sample n	Sample Mean (M) (Seconds)	Sample s	(Masis - MtoBe) (Seconds)	SQs/n	SQRT (sasis + stobe)	Z _{0.95}	1.96* SQRT (sasis + stobe)	LCI (Seconds)	UCI (Seconds)
As-Is	34	37	9		3					
To-Be	34	23	6		1					
				14		2	1.96	4	10	18

Table B-3 shows the calculations used to determine the confidence interval for the difference of the two means for the Cover Sheet (Postings) Scenario (As-Is and To-Be scenarios). The sample size (n) for both groups was 34. The sample mean (M) was 21 seconds for the As-Is scenario and 6 seconds for the To-Be scenario. The sample standard deviation for the As-Is scenario was 20 and 2 for the To-Be scenario. The difference between the means was 15 seconds. The confidence interval was calculated to be 7 seconds. To establish the lower confidence interval, 7 seconds was subtracted from the difference between the means. To establish the upper confidence interval, 7 seconds was added to the difference between the means.

Table B-3. Confidence Calculations for Cover Sheet (Postings)

Cover Sheet (Postings)										
Scenario	Sample n	Sample Mean (M) (Seconds)	Sample s	(Masis - MtoBe) (Seconds)	SQs/n	SQRT (sasis + stobe)	Z _{0.95}	1.96* SQRT (sasis + stobe)	LCI (Seconds)	UCI (Seconds)
As-Is	34	21	20		12					
To-Be	34	6	2		0					
				15		3	1.96	7	8	22

Table B-4 shows the calculations used to determine the confidence interval for the difference of the two means for the Cover Sheet (Interactive Functionality) Scenario (As-Is and To-Be scenarios). The sample size (n) for both groups was 34. The sample mean (M) was 34 seconds for the As-Is scenario and 15 seconds for the To-Be scenario. The sample standard deviation for the As-Is scenario was 16 and 3 for the To-Be scenario. The difference between the means was 19 seconds. The confidence interval was calculated to be 6 seconds. To establish the lower confidence interval, 6 seconds was subtracted from the difference between the means. To establish the upper confidence interval, 6 seconds was added to the difference between the means.

Table B-4. Confidence Calculations for Cover Sheet (Interactive Functionality)

Cover Sheet (Interactive Functionality)										
Scenario	Sample n	Sample Mean (M) (Seconds)	Sample s	(M _{asis} - M _{tobe}) (Seconds)	SQs/n	SQRT (s _{asis} + s _{tobe})	Z _{0.95}	1.96* SQRT (s _{asis} + s _{tobe})	LCI (Seconds)	UCI (Seconds)
As-Is	34	34	16		8					
To-Be	34	15	3		0					
				19		3	1.96	6	13	25

Table B-5 shows the calculations used to determine the confidence interval for the difference of the two means for the Accessibility of Data behind Templates and Consults Scenario (As-Is and To-Be scenarios). The sample size (n) for both groups was 34. The sample mean (M) was 71 seconds for the As-Is scenario and 54 seconds for the To-Be scenario. The sample standard deviation for the As-Is scenario was 15 and 12 for the To-Be scenario. The difference between the means was 17 seconds. It should be noted that the 17 seconds represents the “best case” scenario. Because templates are developed locally, they vary in length and complexity. The timesavings are based on closing out the template after the first two questions; observational comments indicated that in many cases template close out happens well into completing the template, thus timesavings could be greater. The confidence interval was calculated to be 6 seconds. To establish the lower confidence interval, 6 seconds was subtracted from the difference between the means. To establish the upper confidence interval, 6 seconds was added to the difference between the means.

Table B-5. Confidence Calculations for Accessibility of Data behind Templates and Consults

Accessibility of Data behind Templates and Consults										
Scenario	Sample n	Sample Mean (M) (Seconds)	Sample s	(Masis -Mtobe) (Seconds)	SQs/n	SQRT (sasis+stobe) _l	Z _{0.95}	1.96* SQRT (sasis + stobe)	LCI (Seconds)	UCI (Seconds)
As-Is	34	71	15		6					
To-Be	34	54	12		4					
				17		3	1.96	6	11	23

Table B-6 shows the calculations used to determine the confidence interval for the difference of the two means for the Sorting and Comparing Medications Scenario (As-Is and To-Be scenarios). The sample size (n) for both groups was 34. The sample mean (M) was 119 seconds for the As-Is scenario and 15 seconds for the To-Be scenario. The sample standard deviation for the As-Is scenario was 49 and 6 for the To-Be scenario. The difference between the means was 104 seconds. The confidence interval was calculated to be 17 seconds. To establish the lower confidence interval, 17 seconds was subtracted from the difference between the means. To establish the upper confidence interval, 17 seconds was added to the difference between the means.

Table B-6. Confidence Calculations for Sorting and Comparing Medications

Sorting and Comparing Medications										
Scenario	Sample n	Sample Mean (M) (Seconds)	Sample s	(Masis -Mtobe) (Seconds)	SQs/n	SQRT (sasis+stobe) _l	Z _{0.95}	1.96* SQRT (sasis + stobe)	LCI (Seconds)	UCI (Seconds)
As-Is	34	119	49		70					
To-Be	34	15	6		1					
				104		8	1.96	17	87	121

Table B-7 shows the calculations used to determine the confidence interval for the difference of the two means for the Sorting and Finding Orders Scenario (As-Is and To-Be scenarios). The sample size (n) for both groups was 34. The sample mean (M) was 94

seconds for the As-Is scenario and 34 seconds for the To-Be scenario. The sample standard deviation for the As-Is scenario was 42 and 9 for the To-Be scenario. The difference between the means was 60 seconds. The confidence interval was calculated to be 14 seconds. To establish the lower confidence interval, 14 seconds was subtracted from the difference between the means. To establish the upper confidence interval, 14 seconds was added to the difference between the means.

Table B-7. Confidence Calculations for Sorting and Finding Orders

Sorting and Finding Orders										
Scenario	Sample n	Sample Mean (M) (Seconds)	Sample s	(Masis .Mtobe) (Seconds)	SQs/n	SQRT (sasis+stobe ₁)	Z _{0.95}	1.96* SQRT (sasis + stobe)	LCI (Seconds)	UCI (Seconds)
As-Is	34	94	42		51					
To-Be	34	34	9		2					
				60		7	1.96	14	46	74

Raw Scenario Execution Timing Data

Table B-8 below provides the execution timing data for the Print Patient List Scenarios. It should be noted that four clinicians' Vista sign-on menu did not allow the functions necessary to execute the scripted scenario, so not all timings were collected. The collected data are rounded to the nearest second.

Table B-8. Execution Timing Data for the Print Patient List Scenarios

Facility	Name	MD/RN	Service	AS-IS Time (Seconds)	TO-BE Time (Seconds)	Delta (Seconds)
Albany	Participant #1	MD	Geriatric Primary Care Clinic	38	12	26
Albany	Participant #2	MD	General Surgery	52	6	46
Albany	Participant #3	MD	Primary Care	*	5	*
Albany	Participant #4	MD	Specialty Clinics/ ICU	*	8	*
Albany	Participant #5	MD	Emergency	*	7	*
Albany	Participant #6	RN	Behavioral	13	5	8

Facility	Name	MD/RN	Service	AS-IS Time (Seconds)	TO-BE Time (Seconds)	Delta (Seconds)
Albany	Participant #7	RN	Medical/Surgery	20	5	15
Albany	Participant #8	RN	Primary Care	25	8	17
Albany	Participant #9	RN	Medicine/Emergency	*	6	*
Baltimore	Participant #10	MD	Managed Care	44	4	40
Baltimore	Participant #11	MD	Surgery	48	6	42
Baltimore	Participant #12	MD	Psychiatry	56	6	50
Baltimore	Participant #13	RN	Primary Care	67	6	61
Baltimore	Participant #14	RN	MICU	84	5	79
Baltimore	Participant #15	RN	5B Surgical	87	5	82
Baltimore	Participant #16	RN/CAC	CIS	77	5	72
Bay Pines	Participant #17	MD	Medicine	32	4	28
Bay Pines	Participant #18	MD	Surgery	57	5	52
Bay Pines	Participant #19	MD	Primary Care	58	5	53
Bay Pines	Participant #20	RN	Psychiatry	30	5	25
Bay Pines	Participant #21	RN	Geriatrics	34	7	27
Bay Pines	Participant #22	RN	Medical/Surgery/ Neurology	35	4	31
Bay Pines	Participant #23	RN	Primary Care	35	7	28
West Roxbury	Participant #24	MD	Medical Service	36	4	32
West Roxbury	Participant #25	MD	Primary Care	52	5	47
West Roxbury	Participant #26	MD	Primary Care	65	5	60
West Roxbury	Participant #27	MD	Medical Service	91	6	85
West Roxbury	Participant #28	MD	Primary Care	102	5	97
West Roxbury	Participant #29	NP	Medical Service	55	6	49
West Roxbury	Participant #30	RN	Primary Care	41	6	35
West Roxbury	Participant #31	RN	Primary Care	46	5	41
West Roxbury	Participant #32	RN	NVR	89	5	84
West Roxbury	Participant #33	RN	3 North	95	7	88
West Roxbury	Participant #34	RN	NSG	100	10	90

Table B-9 below provides the execution timing data for the Dashboard Functionality Scenarios. All timings are rounded to the nearest second.

Table B-9. Execution Timing Data for the Dashboard Functionality Scenarios

Facility	Name	MD/RN	Service	AS-IS Time (Seconds)	TO-BE Time (Seconds)	Delta (Seconds)
Albany	Participant #1	MD	Geriatric Primary Care Clinic	57	35	22
Albany	Participant #2	MD	General Surgery	46	24	22
Albany	Participant #3	MD	Primary Care	34	25	9
Albany	Participant #4	MD	Specialty Clinics/ ICU	45	23	22
Albany	Participant #5	MD	Emergency	47	25	22
Albany	Participant #6	RN	Behavioral	38	26	12
Albany	Participant #7	RN	Medical/Surgery	39	23	16
Albany	Participant #8	RN	Primary Care	37	30	7
Albany	Participant #9	RN	Medicine/Emergency	64	26	38
Baltimore	Participant #10	MD	Managed Care	26	24	2
Baltimore	Participant #11	MD	Surgery	28	27	1
Baltimore	Participant #12	MD	Psychiatry	33	20	13
Baltimore	Participant #13	RN	Primary Care	28	15	13
Baltimore	Participant #14	RN	MICU	31	21	10
Baltimore	Participant #15	RN	5B Surgical	33	22	11
Baltimore	Participant #16	RN/CAC	CIS	37	19	18
Bay Pines	Participant #17	MD	Medicine	32	15	17
Bay Pines	Participant #18	MD	Surgery	34	21	13
Bay Pines	Participant #19	MD	Primary Care	55	36	19
Bay Pines	Participant #20	RN	Psychiatry	32	18	14
Bay Pines	Participant #21	RN	Geriatrics	32	22	10
Bay Pines	Participant #22	RN	Medical/Surgery/ Neurology	21	17	4
Bay Pines	Participant #23	RN	Primary Care	46	21	25
West Roxbury	Participant #24	MD	Medical Service	32	17	15
West Roxbury	Participant #25	MD	Primary Care	30	22	8
West Roxbury	Participant #26	MD	Primary Care	29	11	18
West Roxbury	Participant #27	MD	Medical Service	34	18	16
West Roxbury	Participant #28	MD	Primary Care	40	20	20
West Roxbury	Participant #29	NP	Medical Service	31	25	6
West Roxbury	Participant #30	RN	Primary Care	34	30	4

Facility	Name	MD/RN	Service	AS-IS Time (Seconds)	TO-BE Time (Seconds)	Delta (Seconds)
West Roxbury	Participant #31	RN	Primary Care	28	21	7
West Roxbury	Participant #32	RN	NVR	42	20	22
West Roxbury	Participant #33	RN	3 North	34	37	-3
West Roxbury	Participant #34	RN	NSG	45	26	19

Table B-10 below provides the execution timing data for the Cover Sheet Postings Scenarios. All timings are rounded to the nearest second.

Table B-10. Execution Timing Data for the Cover Sheet (Postings) Scenarios

Facility	Name	MD/RN	Service	AS-IS Time (Seconds)	TO-BE Time (Seconds)	Delta (Seconds)
Albany	Participant #1	MD	Geriatric Primary Care Clinic	20	5	15
Albany	Participant #2	MD	General Surgery	31	6	25
Albany	Participant #3	MD	Primary Care	16	3	13
Albany	Participant #4	MD	Specialty Clinics/ ICU	18	13	5
Albany	Participant #5	MD	Emergency	25	6	19
Albany	Participant #6	RN	Behavioral	18	6	12
Albany	Participant #7	RN	Medical/Surgery	29	7	22
Albany	Participant #8	RN	Primary Care	22	6	16
Albany	Participant #9	RN	Medicine/Emergency	23	5	18
Baltimore	Participant #10	MD	Managed Care	13	5	8
Baltimore	Participant #11	MD	Surgery	11	5	6
Baltimore	Participant #12	MD	Psychiatry	11	6	5
Baltimore	Participant #13	RN	Primary Care	13	13	0
Baltimore	Participant #14	RN	MICU	10	9	1
Baltimore	Participant #15	RN	5B Surgical	11	5	6
Baltimore	Participant #16	RN/CAC	CIS	11	5	6
Bay Pines	Participant #17	MD	Medicine	17	4	13
Bay Pines	Participant #18	MD	Surgery	18	6	12
Bay Pines	Participant #19	MD	Primary Care	21	9	12
Bay Pines	Participant #20	RN	Psychiatry	9	7	2
Bay Pines	Participant #21	RN	Geriatrics	17	6	11
Bay Pines	Participant #22	RN	Medical/Surgery/ Neurology	14	7	7

Facility	Name	MD/RN	Service	AS-IS Time (Seconds)	TO-BE Time (Seconds)	Delta (Seconds)
Bay Pines	Participant #23	RN	Primary Care	17	5	12
West Roxbury	Participant #24	MD	Medical Service	31	4	27
West Roxbury	Participant #25	MD	Primary Care	16	9	7
West Roxbury	Participant #26	MD	Primary Care	11	6	5
West Roxbury	Participant #27	MD	Medical Service	25	6	19
West Roxbury	Participant #28	MD	Primary Care	128	9	119
West Roxbury	Participant #29	NP	Medical Service	14	6	8
West Roxbury	Participant #30	RN	Primary Care	12	6	6
West Roxbury	Participant #31	RN	Primary Care	15	5	10
West Roxbury	Participant #32	RN	NVR	19	4	15
West Roxbury	Participant #33	RN	3 North	34	6	28
West Roxbury	Participant #34	RN	NSG	23	7	16

Table B-11 below provides the execution timing data for the Cover Sheet (Interactive Functionality) Scenarios. All timings are rounded to the nearest second.

Table B-11. Execution Timing Data for the Cover Sheet (Interactive Functionality) Scenarios

Facility	Name	MD/RN	Service	AS-IS Time (Seconds)	TO-BE Time (Seconds)	Delta (Seconds)
Albany	Participant #1	MD	Geriatric Primary Care Clinic	18	13	5
Albany	Participant #2	MD	General Surgery	20	12	8
Albany	Participant #3	MD	Primary Care	28	13	15
Albany	Participant #4	MD	Specialty Clinics/ ICU	43	14	29
Albany	Participant #5	MD	Emergency	29	13	16
Albany	Participant #6	RN	Behavioral	30	11	19
Albany	Participant #7	RN	Medical/Surgery	34	18	16
Albany	Participant #8	RN	Primary Care	30	13	17
Albany	Participant #9	RN	Medicine/Emergency	32	11	21
Baltimore	Participant #10	MD	Managed Care	22	12	10
Baltimore	Participant #11	MD	Surgery	33	16	17
Baltimore	Participant #12	MD	Psychiatry	30	16	14

Facility	Name	MD/RN	Service	AS-IS Time (Seconds)	TO-BE Time (Seconds)	Delta (Seconds)
Baltimore	Participant #13	RN	Primary Care	18	23	-5
Baltimore	Participant #14	RN	MICU	35	11	24
Baltimore	Participant #15	RN	5B Surgical	41	21	20
Baltimore	Participant #16	RN/CAC	CIS	25	13	12
Bay Pines	Participant #17	MD	Medicine	78	12	66
Bay Pines	Participant #18	MD	Surgery	29	17	12
Bay Pines	Participant #19	MD	Primary Care	60	19	41
Bay Pines	Participant #20	RN	Psychiatry	39	14	25
Bay Pines	Participant #21	RN	Geriatrics	26	16	10
Bay Pines	Participant #22	RN	Medical/Surgery/ Neurology	38	12	26
Bay Pines	Participant #23	RN	Primary Care	35	18	17
West Roxbury	Participant #24	MD	Medical Service	31	13	18
West Roxbury	Participant #25	MD	Primary Care	28	18	10
West Roxbury	Participant #26	MD	Primary Care	16	19	-3
West Roxbury	Participant #27	MD	Medical Service	29	16	13
West Roxbury	Participant #28	MD	Primary Care	98	20	78
West Roxbury	Participant #29	NP	Medical Service	28	15	13
West Roxbury	Participant #30	RN	Primary Care	28	13	15
West Roxbury	Participant #31	RN	Primary Care	26	13	13
West Roxbury	Participant #32	RN	NVR	34	17	17
West Roxbury	Participant #33	RN	3 North	28	22	6
West Roxbury	Participant #34	RN	NSG	40	17	23

Table B-12 below provides the execution timing data for the Accessibility of Data behind Templates and Consults Scenarios. All timings are rounded to the nearest second.

Table B-12. Execution Timing Data for the Accessibility of Data behind Templates and Consults Scenarios

Facility	Name	MD/RN	Service	AS-IS Time (Seconds)	TO-BE Time (Seconds)	Delta (Seconds)
Albany	Participant #1	MD	Geriatric Primary Care Clinic	56	71	-15
Albany	Participant #2	MD	General Surgery	54	41	13
Albany	Participant #3	MD	Primary Care	58	41	17
Albany	Participant #4	MD	Specialty Clinics/ ICU	64	53	11
Albany	Participant #5	MD	Emergency	63	47	16
Albany	Participant #6	RN	Behavioral	57	42	15
Albany	Participant #7	RN	Medical/Surgery	61	52	9
Albany	Participant #8	RN	Primary Care	60	56	4
Albany	Participant #9	RN	Medicine/Emergency	70	49	21
Baltimore	Participant #10	MD	Managed Care	58	49	9
Baltimore	Participant #11	MD	Surgery	60	34	26
Baltimore	Participant #12	MD	Psychiatry	74	66	8
Baltimore	Participant #13	RN	Primary Care	86	52	34
Baltimore	Participant #14	RN	MICU	70	47	23
Baltimore	Participant #15	RN	5B Surgical	95	66	29
Baltimore	Participant #16	RN/CAC	CIS	80	54	26
Bay Pines	Participant #17	MD	Medicine	83	52	31
Bay Pines	Participant #18	MD	Surgery	72	63	9
Bay Pines	Participant #19	MD	Primary Care	114	72	42
Bay Pines	Participant #20	RN	Psychiatry	95	62	33
Bay Pines	Participant #21	RN	Geriatrics	68	54	14
Bay Pines	Participant #22	RN	Medical/Surgery/ Neurology	66	42	24
Bay Pines	Participant #23	RN	Primary Care	98	52	46
West Roxbury	Participant #24	MD	Medical Service	57	46	11
West Roxbury	Participant #25	MD	Primary Care	68	57	11
West Roxbury	Participant #26	MD	Primary Care	61	47	14
West Roxbury	Participant #27	MD	Medical Service	79	50	29
West Roxbury	Participant #28	MD	Primary Care	58	47	11
West Roxbury	Participant #29	NP	Medical Service	56	52	4
West Roxbury	Participant #30	RN	Primary Care	60	43	17

Facility	Name	MD/RN	Service	AS-IS Time (Seconds)	TO-BE Time (Seconds)	Delta (Seconds)
West Roxbury	Participant #31	RN	Primary Care	70	48	22
West Roxbury	Participant #32	RN	NVR	80	58	22
West Roxbury	Participant #33	RN	3 North	74	62	12
West Roxbury	Participant #34	RN	NSG	91	101	-10

Table B-13 below provides the execution timing data for the Sorting and Comparing Medications scenarios. All timings are rounded to the nearest second.

Table B-13. Execution Timing Data for the Sorting and Comparing Medications Scenarios

Facility	Name	MD/RN	Service	AS-IS Time (Seconds)	TO-BE Time (Seconds)	Delta (Seconds)
Albany	Participant #1	MD	Geriatric Primary Care Clinic	168	15	153
Albany	Participant #2	MD	General Surgery	125	16	109
Albany	Participant #3	MD	Primary Care	82	19	63
Albany	Participant #4	MD	Specialty Clinics/ ICU	88	10	78
Albany	Participant #5	MD	Emergency	59	27	32
Albany	Participant #6	RN	Behavioral	145	9	136
Albany	Participant #7	RN	Medical/Surgery	192	15	177
Albany	Participant #8	RN	Primary Care	62	26	36
Albany	Participant #9	RN	Medicine/Emergency	185	11	174
Baltimore	Participant #10	MD	Managed Care	155	38	117
Baltimore	Participant #11	MD	Surgery	152	10	142
Baltimore	Participant #12	MD	Psychiatry	68	12	56
Baltimore	Participant #13	RN	Primary Care	129	15	114
Baltimore	Participant #14	RN	MICU	75	13	62
Baltimore	Participant #15	RN	5B Surgical	198	22	176
Baltimore	Participant #16	RN/CAC	CIS	56	10	46
Bay Pines	Participant #17	MD	Medicine	116	14	102
Bay Pines	Participant #18	MD	Surgery	198	5	193
Bay Pines	Participant #19	MD	Primary Care	127	16	111
Bay Pines	Participant #20	RN	Psychiatry	74	15	59

Facility	Name	MD/RN	Service	AS-IS Time (Seconds)	TO-BE Time (Seconds)	Delta (Seconds)
Bay Pines	Participant #21	RN	Geriatrics	75	16	59
Bay Pines	Participant #22	RN	Medical/Surgery/ Neurology	74	8	66
Bay Pines	Participant #23	RN	Primary Care	65	10	55
West Roxbury	Participant #24	MD	Medical Service	150	18	132
West Roxbury	Participant #25	MD	Primary Care	95	12	83
West Roxbury	Participant #26	MD	Primary Care	41	14	27
West Roxbury	Participant #27	MD	Medical Service	125	19	106
West Roxbury	Participant #28	MD	Primary Care	180	11	169
West Roxbury	Participant #29	NP	Medical Service	126	19	107
West Roxbury	Participant #30	RN	Primary Care	118	11	107
West Roxbury	Participant #31	RN	Primary Care	53	14	39
West Roxbury	Participant #32	RN	NVR	191	12	179
West Roxbury	Participant #33	RN	3 North	130	15	115
West Roxbury	Participant #34	RN	NSG	174	18	156

Table B-14 below provides the execution timing data for the Sorting and Finding Orders scenarios. All timings are rounded to the nearest second.

Table B-14. Execution Timing Data for the Finding and Sorting Orders Scenarios

Facility	Name	MD/RN	Service	AS-IS Time (Seconds)	TO-BE Time (Seconds)	Delta (Seconds)
Albany	Participant #1	MD	Geriatric Primary Care Clinic	91	53	38
Albany	Participant #2	MD	General Surgery	38	28	10
Albany	Participant #3	MD	Primary Care	50	32	18
Albany	Participant #4	MD	Specialty Clinics/ ICU	189	26	163
Albany	Participant #5	MD	Emergency	117	33	84
Albany	Participant #6	RN	Behavioral	80	39	41
Albany	Participant #7	RN	Medical/Surgery	39	32	7
Albany	Participant #8	RN	Primary Care	38	28	10
Albany	Participant #9	RN	Medicine/Emergency	41	28	13
Baltimore	Participant #10	MD	Managed Care	59	34	25

Facility	Name	MD/RN	Service	AS-IS Time (Seconds)	TO-BE Time (Seconds)	Delta (Seconds)
Baltimore	Participant #11	MD	Surgery	55	29	26
Baltimore	Participant #12	MD	Psychiatry	97	31	66
Baltimore	Participant #13	RN	Primary Care	97	38	59
Baltimore	Participant #14	RN	MICU	118	21	97
Baltimore	Participant #15	RN	5B Surgical	75	45	30
Baltimore	Participant #16	RN/CAC	CIS	104	39	65
Bay Pines	Participant #17	MD	Medicine	129	27	102
Bay Pines	Participant #18	MD	Surgery	94	50	44
Bay Pines	Participant #19	MD	Primary Care	146	54	92
Bay Pines	Participant #20	RN	Psychiatry	115	35	80
Bay Pines	Participant #21	RN	Geriatrics	151	35	116
Bay Pines	Participant #22	RN	Medical/Surgery/ Neurology	111	25	86
Bay Pines	Participant #23	RN	Primary Care	215	37	178
West Roxbury	Participant #24	MD	Medical Service	110	25	85
West Roxbury	Participant #25	MD	Primary Care	64	27	37
West Roxbury	Participant #26	MD	Primary Care	56	28	28
West Roxbury	Participant #27	MD	Medical Service	115	31	84
West Roxbury	Participant #28	MD	Primary Care	139	29	110
West Roxbury	Participant #29	NP	Medical Service	103	38	65
West Roxbury	Participant #30	RN	Primary Care	83	25	58
West Roxbury	Participant #31	RN	Primary Care	64	29	35
West Roxbury	Participant #32	RN	NVR	69	47	22
West Roxbury	Participant #33	RN	3 North	76	43	33
West Roxbury	Participant #34	RN	NSG	95	49	46

Appendix C. Rank Order Analysis

Table C-1 shows consolidated results for both physicians and nurses' task order ranking of the simulated high- value frequently performed tasks. Ranking was done on a scale of 1 to 8, with 1 being the most important to their daily work functions. There were a total of 34 respondents to the survey. Data are presented by individual count totals and corresponding percentages in parentheses. Survey results indicated that the top four tasks in rank order were Cover Sheet (Interactive Functionality), Dashboard Functionality, Sorting and Comparing Medications, and Accessibility of Data behind Templates and Consults. CPRS Interaction with BCMA ranked lowest, but it should be noted that this application is only used by nurses in the in-patient setting and thus is not relevant to physicians or nurses who work in an outpatient setting.

Table C-1. Consolidated Task Order Ranking Results

Consolidated Task Order Ranking Results								
Scale	Print Patient List	Dashboard Functionality	Cover Sheet (Postings)	Cover Sheet (Interactive Functionality)	Accessibility of Data behind Templates and Consults	Sorting and Comparing Medications	Sorting and Finding Orders	CPRS Interaction with BCMA
1	1 (3%)	7 (21%)	2 (6%)	10 (29%)	6 (18%)	7 (21%)	0 (0%)	1 (3%)
2	1 (3%)	7 (21%)	2 (6%)	9 (26%)	9 (26%)	5 (15%)	1 (3%)	0 (0%)
3	3 (9%)	4 (12%)	5 (15%)	3 (9%)	7 (21%)	4 (12%)	7 (21%)	1 (3%)
4	4 (12%)	7 (21%)	6 (18%)	3 (9%)	5 (15%)	3 (9%)	4 (12%)	2 (6%)
5	6 (18%)	4 (12%)	4 (12%)	7 (21%)	2 (6%)	6 (18%)	3 (9%)	2 (6%)
6	2 (6%)	0 (0%)	10 (29%)	2 (6%)	3 (9%)	8 (24%)	9 (26%)	0 (0%)
7	10 (29%)	5 (15%)	4 (12%)	0 (0%)	2 (6%)	1 (3%)	10 (29%)	2 (6%)
8	7 (21%)	0 (0%)	1 (3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	26 (76%)

Table C-2 shows the Albany facility's consolidated results for both physicians and nurses' task order ranking of the simulated high-value frequently performed tasks. Ranking was done on a scale of 1 to 8, with 1 being the most important to their daily work functions. There were a total of nine respondents to the survey. Data are presented by individual count totals and corresponding percentages in parentheses. Survey results indicated that the top three tasks in rank order were Cover Sheet (Interactive Functionality), Accessibility of Data behind Templates and Consults, and Dashboard Functionality. Cover Sheet (Posting) and Sorting and Comparing Medications both received two number 1 ratings and two number 2 ratings. Cover Sheet (postings) did receive four

number 3 ratings, which indicates a slight preference over the Sorting and Comparing Medications task. CPRS Interaction with BCMA ranked lowest, but it should be noted that this application is only used only by nurses in the in-patient setting and thus is not relevant to physicians or nurses in an outpatient setting. (Note: due to rounding, not all column percentages add up to 100.)

Table C-2. Albany Task Order Ranking Results

Combined Albany Task Order Ranking Results								
Scale	Print Patient List	Dashboard Functionality	Cover Sheet (Postings)	Cover Sheet (Interactive Functionality)	Accessibility of Data behind Templates and Consults	Sorting and Comparing Medications	Sorting and Finding Orders	CPRS Interaction with BCMA
1	0 (0%)	1 (11%)	1 (11%)	4 (44%)	2 (22%)	1 (11%)	0 (0%)	0 (0%)
2	0 (0%)	2 (22%)	1 (11%)	2 (22%)	3 (33%)	1 (11%)	0 (0%)	0 (0%)
3	1 (11%)	1 (11%)	4 (44%)	0 (0%)	1 (11%)	0 (0%)	2 (22%)	0 (0%)
4	0 (0%)	3 (33%)	1 (11%)	1 (11%)	1 (11%)	1 (11%)	1 (11%)	1 (11%)
5	1 (11%)	2 (22%)	0 (0%)	2 (22%)	0 (0%)	4 (44%)	0 (0%)	0 (0%)
6	0 (0%)	0 (0%)	1 (11%)	0 (0%)	1 (11%)	2 (22%)	5 (56%)	0 (0%)
7	5 (56%)	0 (0%)	1 (11%)	0 (0%)	1 (11%)	0 (0%)	1 (11%)	1 (11%)
8	2 (22%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (78%)

Table C-3 shows the Baltimore facility's consolidated results for both physicians and nurses' task order ranking of the simulated high-value frequently performed tasks. Ranking was done on a scale of 1 to 8, with 1 being the most important to their daily work functions. There were a total of seven respondents to the survey. Data are presented by individual count totals and corresponding percentages in parentheses. Survey results indicated that Cover Sheet (Interactive Functionality) and Dashboard Functionality was the two top ranked tasks. Accessibility of Data behind Templates and Consults did not receive any number 1 ratings; however it did receive five (72%) number 2 ratings suggesting it was high on the clinician's preference list. (Note: due to rounding, not all columns percentages add up to 100.)

Table C-3. Baltimore Task Order Ranking Results

Combined Baltimore Task Order Ranking Results								
Scale	Print Patient List	Dashboard Functionality	Cover Sheet (Postings)	Cover Sheet (Interactive Functionality)	Accessibility of Data behind Templates and Consults	Sorting and Comparing Medications	Sorting and Finding Orders	CPRS Interaction with BCMA
1	0 (0%)	2 (29%)	0 (0%)	3 (43%)	0 (0%)	1 (14%)	0 (0%)	1 (14%)
2	0 (0%)	1 (14%)	0 (0%)	1 (14%)	5 (72%)	0 (0%)	0 (0%)	0 (0%)
3	1 (14%)	1 (14%)	0 (0%)	0 (0%)	1 (14%)	3 (43%)	1 (14%)	1 (14%)
4	1 (14%)	0 (0%)	3 (43%)	1 (14%)	0 (0%)	1 (14%)	1 (14%)	0 (0%)
5	1 (14%)	2 (29%)	0 (0%)	2 (29%)	0 (0%)	1 (14%)	0 (0%)	1 (14%)
6	0 (0%)	0 (0%)	3 (43%)	0 (0%)	1 (14%)	1 (14%)	2 (29%)	0 (0%)
7	1 (14%)	1 (14%)	1 (14%)	0 (0%)	0 (0%)	0 (0%)	3 (43%)	0 (0%)
8	3 (43%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4 (58%)

Table C-4 shows the Bay Pines facility's consolidated results for both physicians and nurses' task order ranking of the simulated high-value frequently performed tasks. Ranking was done on a scale of 1 to 8, with 1 being the most important to their daily work functions. There were a total of seven respondents to the survey. Data are presented by individual count totals and corresponding percentages in parentheses. Survey results indicated that Cover Sheet (Interactive Functionality) was ranked highest in preference when combining the number 1 (29%) and 2 (43%) rankings. Dashboard Functionality was ranked second and Accessibility of Data behind Templates and Consults was ranked third when applying the same criteria. Sorting and Comparing Medications ranked fourth. (Note: due to rounding not all columns percentages add up to 100.)

Table C-4. Bay Pines Task Order Ranking Results

Combined Bay Pines Task Order Ranking Results								
Scale	Print Patient List	Dashboard Functionality	Cover Sheet (Postings)	Cover Sheet (Interactive Functionality)	Accessibility of Data behind Templates and Consults	Sorting and Comparing Medications	Sorting and Finding Orders	CPRS Interaction with BCMA
1	0 (0%)	2 (29%)	0 (0%)	2 (29%)	2 (29%)	1 (14%)	0 (0%)	0 (0%)
2	1 (14%)	2 (29%)	0 (0%)	3 (43%)	1 (14%)	0 (0%)	0 (0%)	0 (0%)
3	0 (0%)	0 (0%)	1 (14%)	0 (0%)	3 (43%)	2 (29%)	1 (14%)	0 (0%)
4	2 (29%)	2 (29%)	1 (14%)	0 (0%)	0 (0%)	1 (14%)	1 (14%)	0 (0%)
5	2 (29%)	0 (0%)	3 (43%)	1 (14%)	1 (14%)	0 (0%)	0 (0%)	0 (0%)
6	0 (0%)	0 (0%)	1 (14%)	1 (14%)	0 (0%)	3 (43%)	2 (29%)	0 (0%)
7	2 (29%)	1 (14%)	1 (14%)	0 (0%)	0 (0%)	0 (0%)	3 (43%)	0 (0%)
8	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (100%)

Table C-5 shows the West Roxbury facility's consolidated results for both physicians and nurses' task order ranking of the simulated high- value frequently performed tasks. Ranking was done on a scale of 1 to 8, with 1 being the most important to their daily work functions. There were a total of 11 respondents to the survey. Data are presented by individual count totals and corresponding percentages in parentheses. Survey results indicated that Sorting and Comparing Medications ranked highest in preference. Dashboard Functionality ranked second and Accessibility of Data behind Templates and Consults was ranked third. (Note: due to rounding not all columns percentages add up to 100.)

Table C-5. West Roxbury Task Order Ranking Results

Combined West Roxbury Task Order Ranking Results								
Scale	Print Patient List	Dashboard Functionality	Cover Sheet (Postings)	Cover Sheet (Interactive Functionality)	Accessibility of Data behind Templates and Consults	Sorting and Comparing Medications	Sorting and Finding Orders	CPRS Interaction with BCMA
1	1 (9%)	2 (18%)	1 (9%)	1 (9%)	2 (18%)	4 (36%)	0 (0%)	0 (0%)
2	0 (0%)	2 (18%)	1 (9%)	3 (27%)	0 (0%)	4 (36%)	1 (9%)	0 (0%)
3	1 (9%)	2 (18%)	0 (0%)	3 (27%)	2 (18%)	0 (0%)	3 (27%)	0 (0%)
4	1 (9%)	2 (18%)	1 (9%)	1 (9%)	4 (36%)	0 (0%)	1 (9%)	1 (9%)
5	2 (18%)	0 (0%)	1 (9%)	2 (18%)	1 (9%)	1 (9%)	3 (27%)	1 (9%)
6	2 (18%)	0 (0%)	5 (45%)	1 (9%)	1 (9%)	2 (18%)	0 (0%)	0 (0%)
7	2 (18%)	3 (27%)	1 (9%)	0 (0%)	1 (9%)	0 (0%)	3 (27%)	1 (9%)
8	2 (18%)	0 (0%)	1 (9%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	8 (73%)

Table C-6 shows the consolidated results for physicians' task order ranking of the simulated high- value frequently performed tasks. Ranking was done on a scale of 1 to 8, with 1 being the most important to their daily work functions. There were a total of sixteen 16 respondents to the survey. Data are presented by individual count totals and corresponding percentages in parentheses. Survey results indicated that Sorting and Comparing Medications and Cover Sheet (Interactive Functionality) ranked highest in preference. Dashboard Functionality ranked second and Accessibility of Data behind Templates and Consults was ranked third. (Note: due to rounding not all columns percentages add up to 100.)

Table C-6. Combined Physicians Task Order Ranking Results

Combined Physicians Task Order Ranking Results								
Scale	Print Patient List	Dashboard Functionality	Cover Sheet (Postings)	Cover Sheet (Interactive Functionality)	Accessibility of Data behind Templates and Consults	Sorting and Comparing Medications	Sorting and Finding Orders	CPRS Interaction with BCMA
1	0 (0%)	3 (19%)	1 (6%)	5 (31%)	2 (13%)	5 (31%)	0 (0%)	0 (0%)
2	1 (6%)	3 (19%)	0 (0%)	3 (19%)	4 (25%)	4 (25%)	1 (6%)	0 (0%)
3	3 (19%)	2 (13%)	2 (13%)	2 (13%)	4 (25%)	1 (6%)	2 (13%)	0 (0%)
4	1 (6%)	4 (25%)	2 (13%)	1 (6%)	4 (25%)	2 (13%)	2 (13%)	0 (0%)
5	5 (31%)	3 (19%)	2 (13%)	5 (31%)	0 (0%)	1 (6%)	0 (0%)	0 (0%)
6	2 (13%)	0 (0%)	7 (44%)	0 (0%)	1 (6%)	3 (19%)	3 (19%)	0 (0%)
7	4 (25%)	1 (6%)	1 (6%)	0 (0%)	1 (6%)	0 (0%)	8 (50%)	1 (6%)
8	0 (0%)	0 (0%)	1 (6%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	15 (94%)

Table C-7 shows the consolidated results for nurses' task order ranking of the simulated high- value frequently performed tasks. Ranking was done on a scale of 1 to 8, with 1 being the most important to their daily work functions. There were a total of 18 respondents to the survey. Data are presented by individual count totals and corresponding percentages in parentheses. Survey results indicated that Cover Sheet (Interactive Functionality) ranked highest in preference. Dashboard Functionality and Accessibility of Data behind Templates and Consults ranked second and Sorting and Comparing Medications ranked third. (Note: due to rounding not all columns percentages add up to 100.)

Table C-7. Combined Nurse Task Order Ranking Results

Combined Nurse Task Order Ranking Results								
Scale	Print Patient List	Dashboard Functionality	Cover Sheet (Postings)	Cover Sheet (Interactive Functionality)	Accessibility of Data behind Templates and Consults	Sorting and Comparing Medications	Sorting and Finding Orders	CPRS Interaction with BCMA
1	1 (6%)	4 (22%)	1 (6%)	5 (28%)	4 (22%)	2 (11%)	0 (0%)	1 (6%)
2	0 (0%)	4 (22%)	2 (11%)	6 (33%)	5 (28%)	1 (6%)	0 (0%)	0 (0%)
3	0 (0%)	2 (11%)	3 (17%)	1 (6%)	3 (17%)	3 (17%)	5 (28%)	1 (6%)
4	3 (17%)	3 (17%)	4 (22%)	2 (11%)	1 (6%)	1 (6%)	2 (11%)	2 (11%)
5	1 (6%)	1 (6%)	2 (11%)	2 (11%)	2 (11%)	5 (28%)	3 (17%)	2 (11%)
6	0 (0%)	0 (0%)	3 (17%)	2 (11%)	2 (11%)	5 (28%)	6 (33%)	0 (0%)
7	6 (33%)	4 (22%)	3 (17%)	0 (0%)	1 (6%)	1 (6%)	2 (11%)	1 (6%)
8	7 (38%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	11 (61%)

Table C-8 is the raw Task Rank Order data.

Table C-8. Raw Task Rank Order Data

Facility	Name	MD/RN	Service	Print Patient List	Dashboard Functionality	Cover Sheet (Postings)	Cover Sheet (Interactive Functionality)	Accessibility of Data behind Templates and Consults	Sorting and Comparing Medications	Sorting and Finding Orders	CPRS Interaction with BCMA
Albany	Participant #1	MD	Geriatric Primary Care Clinic	5	4	3	1	2	6	7	8
Albany	Participant #2	MD	General Surgery	3	2	4	1	7	5	6	8
Albany	Participant #3	MD	Primary Care	7	5	1	2	3	6	4	8
Albany	Participant #4	MD	Specialty Clinics/ ICU	7	4	6	5	2	1	3	8

Facility	Name	MD/RN	Service	Print Patient List	Dashboard Functionality	Cover Sheet (Postings)	Cover Sheet (Interactive Functionality)	Accessibility of Data behind Templates and Consults	Sorting and Comparing Medications	Sorting and Finding Orders	CPRS Interaction with BCMA
Albany	Participant #5	MD	Emergency	7	5	3	1	4	2	6	8
Albany	Participant #6	RN	Behavioral	8	1	3	4	2	5	6	7
Albany	Participant #7	RN	Medical/ Surgery	8	2	7	1	6	5	3	4
Albany	Participant #8	RN	Primary Care	7	3	2	5	1	4	6	8
Albany	Participant #9	RN	Medicine/ Emergency	7	4	3	2	1	5	6	8
Baltimore	Participant #10	MD	Managed Care	5	1	4	2	6	3	7	8
Baltimore	Participant #11	MD	Surgery	4	3	6	5	2	1	7	8
Baltimore	Participant #12	MD	Psychiatry	3	5	6	1	2	4	7	8
Baltimore	Participant #13	RN	Primary Care	7	5	4	1	2	3	6	8
Baltimore	Participant #14	RN	MICU	8	2	4	1	3	7	6	5
Baltimore	Participant #15	RN	5B Surgical	8	7	6	4	2	5	3	1
Baltimore	Participant #16	RN/CAC	CIS	8	1	7	5	2	6	4	3
Bay Pines	Participant #17	MD	Medicine	2	4	6	5	3	1	7	8
Bay Pines	Participant #18	MD	Surgery	7	2	5	1	3	6	4	8
Bay Pines	Participant #19	MD	Primary Care	5	1	7	2	3	4	6	8
Bay Pines	Participant #20	RN	Psychiatry	5	7	4	2	1	3	6	8
Bay Pines	Participant #21	RN	Geriatrics	4	2	3	1	5	6	7	8
Bay Pines	Participant #22	RN	Medical/ Surgery/ Neurology	7	4	5	2	1	6	3	8

Facility	Name	MD/RN	Service	Print Patient List	Dashboard Functionality	Cover Sheet (Postings)	Cover Sheet (Interactive Functionality)	Accessibility of Data behind Templates and Consults	Sorting and Comparing Medications	Sorting and Finding Orders	CPRS Interaction with BCMA
Bay Pines	Participant #23	RN	Primary Care	4	1	5	6	2	3	7	8
West Roxbury	Participant #24	MD	Medical Service	6	1	5	3	4	2	7	8
West Roxbury	Participant #25	MD	Primary Care	6	3	8	5	4	1	2	7
West Roxbury	Participant #26	MD	Primary Care	5	7	6	4	1	2	3	8
West Roxbury	Participant #27	MD	Medical Service	3	2	6	5	4	1	7	8
West Roxbury	Participant #28	MD	Primary Care	5	4	6	3	1	2	7	8
West Roxbury	Participant #29	NP	Medical Service	1	4	7	2	5	6	3	8
West Roxbury	Participant #30	RN	Primary Care	4	7	1	6	3	2	5	8
West Roxbury	Participant #31	RN	Primary Care	7	1	6	2	4	5	3	8
West Roxbury	Participant #32	RN	NVR	7	2	4	3	6	1	5	8
West Roxbury	Participant #33	RN	3 North	8	3	2	1	7	6	5	4
West Roxbury	Participant #34	RN	NSG	8	7	6	2	3	1	4	5

Appendix D. Threshold / Tolerance

Table D-1 shows the consolidated results of the system tolerance testing that was conducted during the second set of site visits. The test was conducted by randomly incorporating eight different screen change system response times into a CPRS model. The selected response times ranged from 0:25 to 15:00 seconds. System response settings were duplicated so each of the 34 participants would provide a set of 16 data points, totaling a sample size of 68. Clinicians were asked to subjectively rank each system response screen change on a four-point scale:

1. Acceptable Response Time
2. Some What Acceptable Response Time
3. Some What Unacceptable Response Time
4. Unacceptable Response Time

The data are presented by individual count totals and corresponding percentages are shown in parentheses. Test results indicated that the range of Acceptable system response time was highest in the 0.25 to 2:00 seconds interval settings. As system response increased beyond 2:00 seconds, participants' system acceptability ratings declined. The table shows that system unacceptability ratings increased as the screen change interval settings progressed from 5:00 seconds to 15:00 seconds.

Table D-1. System Tolerance Testing Results

System Tolerance Testing Results				
Time (Seconds)	Acceptable Response Time	Some What Acceptable Response Time	Some What Unacceptable Response Time	Unacceptable Response Time
0.25	58 (86%)	3 (4%)	4 (6%)	3 (4%)
0.50	55 (82%)	7 (10%)	5 (7%)	1 (1%)
1:00	54 (80%)	12 (18%)	1 (1%)	1 (1%)
2:00	28 (41%)	23 (34%)	11 (16%)	6 (9%)
5:00	15 (22%)	27 (40%)	16 (23%)	10 (15%)
7:00	2 (3%)	13 (19%)	21 (31%)	32 (47%)
10:00	2 (3%)	6 (9%)	14 (21%)	46 (67%)
15:00	3 (4%)	0 (0%)	7 (10%)	58 (86%)

Table D-2 below provides the raw data captured during the tolerance testing study.

Table D-2. Raw data captured during the tolerance testing study

Facility	Name	MD/ RN	Service	Seconds															
				1:00	7:00	2:00	10:00	15:00	10:00	1:00	0:25	0:50	7:00	15:00	0:25	5:00	0:50	5:00	2:00
Albany	Participant #1	MD	Geriatric Primary Care Clinic	1	3	2	4	4	4	2	1	1	3	4	1	3	1	3	2
Albany	Participant #2	MD	General Surgery	1	4	1	4	4	4	1	1	1	4	4	4	4	1	2	2
Albany	Participant #3	MD	Primary Care	1	4	1	4	4	3	1	1	1	4	4	1	3	1	3	2
Albany	Participant #4	MD	Specialty Clinics/ ICU	1	4	3	4	4	4	1	1	1	3	4	1	3	1	2	2
Albany	Participant #5	MD	Emergency	1	2	2	4	4	4	2	1	1	2	4	1	2	1	1	1
Albany	Participant #6	RN	Behavioral	1	4	3	4	4	4	1	1	1	3	4	1	3	1	2	1
Albany	Participant #7	RN	Medical / Surgery	1	4	2	4	4	4	2	1	1	3	4	1	4	1	3	3
Albany	Participant #8	RN	Primary Care	1	4	1	4	1	4	4	1	1	1	4	4	1	3	1	3
Albany	Participant #9	RN	Medicine / Emergency	1	4	3	4	4	4	2	1	1	4	4	1	1	3	1	4
Baltimore	Participant #10	MD	Managed Care	1	4	2	4	4	4	1	1	1	3	4	1	2	1	2	1
Baltimore	Participant #11	MD	Surgery	1	4	2	3	4	3	1	1	1	2	4	1	2	1	3	1
Baltimore	Participant #12	MD	Psychiatry	1	4	2	4	4	4	2	1	3	4	4	3	3	1	2	1
Baltimore	Participant #13	RN	Primary	1	2	1	3	3	3	1	1	1	2	4	1	2	1	1	1

Facility	Name	MD/ RN	Service	Seconds															
				1:00	7:00	2:00	10:00	15:00	10:00	1:00	0:25	0:50	7:00	15:00	0:25	5:00	0:50	5:00	2:00
			Care																
Baltimore	Participant #14	RN	MICU	2	3	2	4	4	3	1	1	1	3	4	1	2	2	2	1
Baltimore	Participant #15	RN	5B Surgical	1	3	2	4	4	3	1	1	1	3	4	1	2	1	2	2
Baltimore	Participant #16	RN/CAC	CIS	1	3	2	3	4	3	1	1	1	3	4	2	2	1	2	2
Bay Pines	Participant #17	MD	Medicine	1	4	2	4	4	4	2	1	1	4	4	1	4	1	4	3
Bay Pines	Participant #18	MD	Surgery	1	3	1	3	4	4	1	1	1	3	4	1	2	1	3	1
Bay Pines	Participant #19	MD	Primary Care	1	3	1	4	4	4	1	1	1	4	4	3	1	3	2	1
Bay Pines	Participant #20	RN	Psychiatry	1	4	4	4	4	1	1	1	2	1	1	2	1	2	1	1
Bay Pines	Participant #21	RN	Geriatrics	1	3	4	4	4	1	1	1	3	4	1	3	1	2	1	2
Bay Pines	Participant #22	RN	Medical / Surgery / Neurology	2	4	3	4	4	4	1	1	1	4	4	1	4	2	4	3
Bay Pines	Participant #23	RN	Primary Care	1	3	1	4	4	4	1	1	1	4	4	4	1	4	1	4
West Roxbury	Participant #24	MD	Medical Service	2	4	4	4	4	4	2	1	1	4	4	1	4	1	4	4
West Roxbury	Participant #25	MD	Primary Care	1	4	1	4	4	4	1	1	1	4	4	1	3	1	2	2
West Roxbury	Participant #26	MD	Primary Care	1	2	1	2	3	3	1	2	1	2	4	1	1	2	1	2
West Roxbury	Participant #27	MD	Medical Service	1	4	2	4	4	2	1	1	1	4	4	1	3	1	3	1
West Roxbury	Participant #28	MD	Primary Care	2	4	3	4	4	4	3	3	2	4	4	1	3	1	4	3

Facility	Name	MD/ RN	Service	Seconds															
				1:00	7:00	2:00	10:00	15:00	10:00	1:00	0:25	0:50	7:00	15:00	0:25	5:00	0:50	5:00	2:00
West Roxbury	Participant #29	NP	Medical Service	2	2	1	3	4	2	1	1	1	2	3	1	2	1	2	2
West Roxbury	Participant #30	RN	Primary Care	1	3	2	4	4	4	1	1	1	4	4	1	3	1	4	3
West Roxbury	Participant #31	RN	Primary Care	1	3	1	4	4	4	1	1	1	3	4	1	2	1	2	1
West Roxbury	Participant #32	RN	NVR	1	4	2	4	4	2	1	1	1	3	4	1	2	1	3	1
West Roxbury	Participant #33	RN	3 North	1	2	1	2	3	2	1	1	1	2	3	1	2	1	2	1
West Roxbury	Participant #34	RN	NSG	1	2	1	3	3	3	1	1	1	2	3	1	2	1	2	1

Appendix E. As-Is to To-Be Functionality Comparison Matrix

Table E-1 below maps the modified screens and/or functionality in the To-Be Model back to the corresponding, current CPRS environment.

Table E-1. As-Is To-Be Functionality Matrix

To-Be Screen:	Added or changed Fields	Maps To CPRS Function
<i>Print Patient List</i>	Patient Names	Patient Select Screen
	Patient Location	Patient Select Screen
	Priority	Alerts
	Appointment Time	Cover Screen
	Encounter status	Cover Screen
<i>Dashboard</i>	List of Patient Names	Patient Select Screen
	Admitting Diagnosis	Patient Encounter
	Patient Location	Patient Select Screen
	Current Medications	Cover Screen/Medications Tab
	Labs	Cover Screen/Labs Tab
	Results	Results Tab
	Vitals	Cover Screen
	Notes	Notes Tab
	Unverified Orders	Orders Tab
	Appointment Time	Cover Screen
	Admitting Team (Care Team)	Cover Screen
	Encounter Status	Cover Screen
	Priority	Alerts
<i>Cover Screen</i>	Last Signed Note	Notes Tab
	Note in progress	Notes Tab
	HIPAA, DNR, PCP	Postings/imaging
<i>Medication Info Screen</i>	Shortcut option menu	Medication Tab
<i>Lab Information Screen</i>	Shortcut option menu	Orders Tab
<i>Orders Tab</i>	STAT Status (for Stat view)	Medication or Lab order
	Medication & Lab View	Orders Tab Custom view
<i>Meds Tab</i>	Match field	
	Type	Indicators in Order column
<i>All tables</i>	Ability to sort by column	Reports Tab (e.g. discharge summary or surgical pathology)

Appendix F. CPRS Analysis Report: Recommendations (RCMD) and Requirements (REQ)

The following Tables F-1 through F-8 show which requirements described in the main document are needed to satisfy the recommendations described in the main document.

Table F-1. Changes to Print Patient List Recommendation/Requirements Matrix

Print Patient List (PPL)	
Recommendation	Requirements
RCMD PPL #001 - Modify the CPRS Patient Selection Screen to include a button to print the clinician's patient list.	REQ PPL #001 - The system shall provide the ability to print a list of patients from the patient select.
RCMD PPL #002 - Modify the list to display basic information tailored to clinician preference. (e.g., an outpatient clinician could see complete/incomplete status and appointment times while an inpatient clinician could view patient location and priority status).	REQ PPL #002 - The system shall provide the ability to print a list of the clinician's assigned patients.
	REQ PPL #003 - The system shall provide the ability to print a patient list based on location.
	REQ PPL #004 - The system shall provide the ability to print a date specific list of patients scheduled for a specific outpatient clinic.
	REQ PPL #005 - The system shall print a patient list that contains the appointment times for each outpatient.
	REQ PPL #006 - The system shall print a patient list that contains the completion status for each outpatient.
	REQ PPL #007 - The system shall print a patient list that contains the location for each inpatient.
	REQ PPL #008 - The system shall print a patient list that contains the priority level for each inpatient.
	REQ PPL #009 - The system shall print the patient list with specific patient information in a logical grouping.

Table F-2. Changes to Dashboard Functionality Recommendation/Requirements Matrix

Dashboard (DB)	
Recommendation	Requirements
RCMD DB #001 - Modify CPRS to contain a single dashboard screen that displays multiple patients' data.	REQ DB #001 - The Dashboard shall display patients selected on the patient selection screen.
	REQ DB #002 - The system shall maintain role based default configurations.
	REQ DB #003 - The system shall display a dashboard of clinicians' assigned patients.
	REQ DB #004 - The system shall display multiple patients on a single dashboard.
	REQ DB #040 The system shall link the dashboard to the print patient list.
RCMD DB #002 - Highlight critical individual patient information.	REQ DB #012 - The system shall display the patient's name.
	REQ DB #013 - The system shall display the patient's admitting diagnosis.
	REQ DB #014 - The system shall display the patient's room number.
	REQ DB #015 - The system shall display the patient encounter status as complete or incomplete.
	REQ DB #016 - The system shall display a link to a patient's list of current medications.
	REQ DB #018 – The system shall display a link to the patient's laboratory results.
	REQ DB #020 – The system shall display a link to the patient's vital signs.
	REQ DB #021 - The system shall display the vital signs link with the last date and time of the vital sign.
	REQ DB #024 - The system shall provide the ability for clinicians to set the default note to view.
	REQ DB #026 - The system shall display a priority level for all laboratory results.
	REQ DB #029 - The system shall display a priority level of high if a laboratory alert is identified as critical.
	REQ DB #030 - The system shall display a priority level of one if a laboratory alert is identified as critical.
	REQ DB #031 - The system shall display a priority level of moderate if a laboratory alert is identified as abnormal.

Recommendation	Requirements
	REQ DB #032 - The system shall display a priority level of two if a laboratory alert is identified as abnormal.
	REQ DB #033 - The system shall display a priority level of low if a laboratory alert is identified as normal.
	REQ DB #034 - The system shall display a priority level of three if a laboratory alert is identified as normal
	REQ DB #035 - The system shall display an indicator when there are unverified orders.
	REQ DB #036 – The system shall display a link to unverified orders.
	REQ DB #038 - The system shall display appointment times for outpatients.
	REQ DB #039 - The system shall display the names of the admitting team.
	REQ DB #009 - The system shall allow clinicians to customize the dashboard screen.
RCMD DB #003 - Allow clinicians to specify the Dashboard data columns.	REQ DB #010 - The system shall allow clinicians to customize the dashboard list of patients by inpatient location.
	REQ DB #011 - The system shall allow clinicians to customize the dashboard list of patients by outpatient location.
	REQ DB #007 - The system shall allow users to set data retrieval parameters.
RCMD DB #004 - Allow clinicians to set data retrieval parameters.	REQ DB #017 - The system shall provide the ability to view the patient specific list of medications when the link is clicked.
RCMD DB #005 - Allow clinicians to see expanded data from Dashboard links.	REQ DB #019 - The system shall provide the ability to view the patient specific laboratory results when the link is clicked.
	REQ DB #022 – The system shall provide the ability to view the patient's last vital signs.
	REQ DB #023 - The system shall display a link notes.
	REQ DB #025 - The system shall display the default note when clicked.
	REQ DB #027 - The system shall display a link to laboratory tests from the priority level.
	REQ DB #028 - The system shall display the laboratory result when the link is clicked.
	REQ DB #037 - The system shall display all unverified orders when the link is clicked.
RCMD DB #006 - Allow clinicians to sort information by specific column headers.	REQ DB #005 - The system shall provide the ability to sort data.
	REQ DB #006 - The system shall display sorted patient data in a logical format.

Recommendation	Requirements
RCMD DB #007 - Link the dashboard to the patient selection screen.	REQ DB #008 - The system shall provide a link to the patient selection screen.

Table F-3. Changes to Cover Sheet Postings Recommendation/Requirements Matrix

Cover Sheet Postings (CS)	
Recommendation	Requirements
RCMD CS#001 - Modify the Posting's section to include specific DNR status information in the Advanced Directives record header.	REQ CS #001 - Modify the Posting's section to include specific DNR status information in the Advanced Directives record header.
RCMD CS#002 - Modify the Posting's section to include the HIPAA designees' information in the HIPAA record header.	REQ CS #002 - Modify the Posting's section to include the HIPAA designees' information in the HIPAA record header.
RCMD CS#003 - Modify the Posting's section to include the patient's non-VA Primary Healthcare Provider (PCP) name and phone number in the Non-VA PCP record header.	REQ CS #003 - Modify the Posting's section to include the patient's non-VA Primary Healthcare Provider (PCP) name and phone number in the Non-VA PCP record header.

Table F-4. Changes to the Cover Sheet Screen Recommendation/Requirements Matrix

Cover Sheet Functionality (CSF)	
Recommendation	Requirements
RCMD CSF #001 - Provide clinicians with the same ability to view the details and administration history, change, discontinue, refill, renew or create a medication order with the same shortcut menu selections that are currently available when right clicking highlighted medications on the CPRS Medications screen.	REQ CSF #001 - The system shall provide clinicians with the same ability to view the details and administration history utilizing the current shortcut menu selections that are available when right clicking highlighted medications on the CPRS Medications screen.
	REQ CSF #002 - The system shall provide clinicians with the same ability to discontinue a medication utilizing the current shortcut menu selections that are available when right clicking highlighted medications on the CPRS Medications screen.
	REQ CSF #003 - The system shall provide clinicians with the same ability to refill a medication order utilizing the current shortcut menu selections that are available when right clicking highlighted medications on the CPRS Medications screen.
	REQ CSF #004 - The system shall provide clinicians with the same ability a renew a medication order utilizing the current shortcut menu selections that are currently available when right clicking highlighted medications on the CPRS Medications screen.

Recommendation	Requirements
	REQ CSF #005 - The system shall provide clinicians with the same ability create a medication order utilizing the current shortcut menu selections that are available when right clicking highlighted medications on the CPRS Medications screen.
	REQ CSF #008 - The system shall provide clinicians with the same ability to change a medication order utilizing the current shortcut menu selections that are available when right clicking highlighted orders on the CPRS Orders screen.
RCMD CSF #002 - Provide the clinicians with the same ability to view the details, results, results history, change, change release event, copy to new order, discontinue, renew or sign a laboratory order with the same shortcut menu selections that are currently available when right clicking highlighted orders on the CPRS Orders screen.	REQ CSF #006 - The system shall provide clinicians with the same ability to view the details of a laboratory order utilizing the current shortcut menu selections that are available when right clicking highlighted orders on the CPRS Orders screen.
	REQ CSF #007 - The system shall provide clinicians with the same ability to view results history of a laboratory order utilizing the current shortcut menu selections that are available when right clicking highlighted orders on the CPRS Orders screen.
	REQ CSF #009 - The system shall provide clinicians with the same ability to change a laboratory order utilizing the current shortcut menu selections that are available when right clicking highlighted orders on the CPRS Orders screen.
	REQ CSF #010 - The system shall provide clinicians with the same ability to change a release event of a laboratory order utilizing the current shortcut menu selections that are available when right clicking highlighted orders on the CPRS Orders screen.
	REQ CSF #011 - The system shall provide clinicians with the same ability to copy to new laboratory order utilizing the current shortcut menu selections that are available when right clicking highlighted orders on the CPRS Orders screen.
	REQ CSF #012 - The system shall provide clinicians with the same ability to discontinue a laboratory order utilizing the current shortcut menu selections that are available when right clicking highlighted orders on the CPRS Orders screen.
	REQ CSF #013 - The system shall provide clinicians with the same ability to renew a laboratory order utilizing the current shortcut menu selections that are available when right clicking highlighted orders on the CPRS Orders screen.
	REQ CSF #014 - The system shall provide clinicians with the same ability to sign a laboratory order utilizing the current shortcut menu selections that are available when right clicking highlighted orders on the CPRS Orders screen.
RCMD CSF #003 - Allow a clinician to start, edit an unsigned note and sign a new note from the cover screen.	REQ CSF #015 - The system shall allow clinicians to start a new note from the cover sheet screen.

Recommendation	Requirements
	REQ CSF #016 - The system shall allow clinicians to edit an unsigned note from the cover sheet screen.
	REQ CSF #017 - The system shall allow clinicians to sign a note from the cover sheet screen.
RCMD CSF #004 - Display actual lab results as opposed to collection dates.	REQ CSF #018 - The system shall display the actual laboratory results on the cover sheet screen.
	REQ CSF #019 - The system shall not display the collection dates of the laboratory test on the cover sheet screen.

Table F-5. Changes to the Templates and Consults Screens Recommendation/Requirements Matrix

Templates & Consults (TC)	
Recommendation	Requirements
RCMD TC #001 - Allow clinicians to switch to other Tabs within CPRS without closing out of the template or consult.	REQ TC #001 - The system shall allow clinicians to switch to other Tabs within CPRS without closing the template screen.
	REQ TC #004 - The system shall remain active and provide the ability to navigate throughout the patient's medical record when the template screen is minimized or window focus is shifted.
	REQ TC #007 - The system shall allow clinicians to switch to other Tabs within CPRS without closing the consult screen.
	REQ TC #010 - The system shall remain active and provide the ability to navigate throughout the patient's medical record when the consult order screen is minimized or window focus is shifted.
RCMD TC #002 - Allow clinicians to change window focus and, or minimize the template or consult without losing data already entered in the template or consult.	REQ TC #002 - The system shall provide the ability for all CPRS template screens to be minimized or allow window focus to be shifted.
	REQ TC #003 - The system shall provide the ability for all CPRS template screens to be maximized after having been minimized.
	REQ TC #006 - The system shall retain any information that is entered by the clinician into the template before it is minimized or window focus is shifted.
	REQ TC #008 - The system shall provide the ability for all CPRS consult order screens to be minimized or allow window focus to be shifted.
	REQ TC #009 - The system shall provide the ability for all CPRS consult order screens to be maximized after having been minimized

Recommendation	Requirements
	REQ TC #012 - The system shall retain any information that is entered by the clinician into the consult order before it is minimized or window focus is shifted.
RCMD TC #003 – Allow clinicians the ability to expand the template (or consult) screen itself when the template (or consult) window is maximized to the full screen.	REQ TC #011 - The system shall provide the ability to expand the consult order screen itself when the consult window is maximized to the full screen.
	REQ TC #005 - The system shall provide the ability to expand template screen itself when the window is maximized to the full screen.

Table F-6. Changes to the Medication Screen Recommendation/Requirements Matrix

Medication Screen (MS)	
Recommendation	Requirements
RCMD MS #001 - Modify the system to allow clinicians to sort orders by each column header.	REQ MS #001 - The system shall allow clinicians to sort orders by each column header.
	REQ MS #003 - The system shall display inpatient, outpatient, and non-VA medications on one screen.
RCMD MS #002 - Allow clinicians to navigate easily between Medication List, Medication Reconciliation and Medication History views with a single click.	REQ MS #002 - The system shall allow the user to navigate using one click between the Medication List, Medication Reconciliation and Medication History view.
RCMD MS #003 - Modify the system so medication orders can be custom color-coded by the clinician using a system wide standard color palette (for example, STAT orders displayed in Red and New orders in Green).	REQ MS #011 - The system shall allow clinicians to custom color-code medication orders utilizing a system wide standard color palette (for example, STAT orders displayed in Red and New orders in Green).
	REQ MS #012 The system shall display the key medication order indicators (STAT, ASAP, New, Now and Flagged) as a separate and distinct column.
RCMD MS #004 - Modify the screen to allow clinicians to compare medications side-by-side.	REQ MS #004 - The CPRS system shall distinguish between outpatient medications and inpatient medications.
	REQ MS #005 - The CPRS system shall display all outpatient and inpatient medications side-by-side on the same screen.
	REQ MS #008 - The system shall display each medication in full context with the specific name, dosage, and route of administration.
RCMD MS #005 - Allow clinicians to compare inpatient to outpatient medications.	REQ MS #006 - The system shall provide the ability to compare inpatient to outpatient medications on the same screen.

Recommendation	Requirements
	REQ MS #009 - The system shall display an identifier that designates a match between inpatient and outpatient medications if the medication exactly matches the name, dosage and route of administration
	REQ MS #010 - The system shall display an identifier that when name only is matched between inpatient and outpatient medications.
RCMD MS #006 – Allow clinicians to compare current inpatient medications to medication history of the current hospitalization.	REQ MS #007 - The system shall provide the ability to compare current inpatient medications to the medication history of the current hospitalization on the same screen.

Table F-7. Changes to the Order Screen Recommendation/Requirements Matrix

Order Screen (OS)	
Recommendation	Requirements
RCMD OS #001 - Modify the system to allow clinicians to sort orders by each column header.	REQ OS #001 - The system shall provide the ability to sort medical orders on the Order screen by the column header.
RCMD OS #002 - Modify the system to allow clinicians to create multiple custom views to save on the Orders screen for future use.	REQ OS #002 - The system shall allow clinicians to create custom views that will be accessible from the View Orders box.
	REQ SO #003 - The system shall enable clinicians to save a new custom order sort view from the custom view order screen.
	REQ OS #004 - The system shall provide the ability to display saved custom views in the view orders box of the Orders screen for future use.
RCMD OS #003 - Allow clinicians to navigate easily between multiple preferred views with a single click.	REQ OS #005 - The system shall allow clinicians to navigate easily between multiple custom views with a single click.
RCMD OS #004 - Modify the system so orders can be custom color coded by the clinician using a system wide standard color palette (for example, STAT orders displayed in Red font color and New orders in Green).	REQ OS #006 - The system shall allow clinicians to custom color-code orders utilizing a system wide standard color palette (for example, STAT orders displayed in Red and New orders in Green)
RCMD OS #005 - Modify the system so that the order key indicators: STAT, ASAP, New, Now and Flagged are visually distinct and separate from the order.	REQ OS #007 - The system shall display order key indicators: STAT, ASAP, New, Now and Flagged so they are visually distinct and separate from the order.
RCMD OS #006 - Allow clinicians to sort by order key indicator.	REQ OS #008 - The system shall allow clinicians to sort by order key indicator.

Recommendation	Requirements
RCMD OS #007 - Modify the system so that clinicians are allowed to access CPRS Graphing with a single click.	REQ OS #009 - The system allows clinicians to access CPRS Graphing with a single click.
RCMD OS #008 - Modify the system so that the definition of the Status (e.g. "pending" or "active") when the cursor hovers over the word in the column.	REQ OS #010 - The system shall display the definition of the Status (e.g. "pending" or "active") when the cursor hovers over the word in the column.

Table F-8. Changes to Interaction of CPRS with BCMA Recommendation/Requirements Matrix

Bar Code Medication Administration (BCMA)	
Recommendation	Requirements
RCMD BCMA #001 - Modify the system to provide a link between an open session of CPRS and BCMA to automatically synchronize to the same patient medical record if a patient bracelet is scanned in BMCA	REQ BCMA #001 - CPRS and the BCMA application shall automatically synchronize to the same patient when a wristband is scanned.
	REQ BCMA #002 - When synchronization occurs, the CPRS system shall display the cover sheet of the patient whose wristband was scanned by BCMA.

Appendix G. Terms and Abbreviations

This section defines (or points to reference documents that define) all terms and acronyms used within this document.

Table G-1. Definitions of Terms used in this document

Term	Definition
As-Is	The current CPRS functionality
Clinician	Refers to VHA physicians, nurses and nurse practitioners.
Finding	A finding is a statement of fact based on one or more observations by a BI analyst.
Functional Requirement	A functional requirement is a statement of needed capability for CPRS.
Model	A model is a collection of simulated high-value, frequently performed tasks.
Observation	An observation is data collected during a site visit by an observing BI analyst or data collected by a BI analyst during the interviews and group discussions.
Recommendation	A recommendation is an action statement based on one or more findings by a BI analyst.
Scenario	A specific clinical workflow task or process
To-Be	Recommended future state of CPRS
Validated Functional Requirement	A validated functional requirement is a candidate functional requirement that has been reviewed with the clinicians and determined to be a valid functional requirement during those discussions.

Table G-2. Definitions of Abbreviations used in this document

Abbreviation	Definition
ASAP	An abbreviation used by the VHA that means to do immediately unless there are STAT or more critical items before it.
BCMA	Bar Code Medication Administration
BI	Business Intelligence, Inc.
CAC	Clinical Administrative Coordinator
CIS	Clinical Information Systems
CPRS	Computerized Patient Record System
CS	Cover Sheet Postings
CSF	Cover Sheet Functionality
DB	Dashboard
DNR	Do Not Resuscitate
DoD	Department of Defense

Abbreviation	Definition
EHT	Emerging Health Technologies
HIPAA	Health Insurance Portability and Accountability Act
ICU	Intensive Care Unit
IM	Intramuscular
IT	Information Technology
IV	Intravenous
MICU	Medical Intensive Care Unit
MS	Medication Screen
NVR	Neuro-Vascular Rehabilitation
OI	Office of Information
PCP	Primary Care Provider
PO	Per Os (Latin term meaning per mouth)
PPL	Print Patient List
RCMD	Recommendation
REQ	Requirement
STAT	Medical abbreviation for “to do immediately”
TC	Templates & Consults
VA	Veterans Administration
VHA	Veterans Health Administration
VistA	Veterans Health Information Systems and Technology Architecture

Statistical Definitions

Confidence Interval¹

A confidence interval (CI) of a statistic is bounded by two values of the statistic between which there is a certain specified level of confidence that where the population parameter lies.

Statistically, the use of confidence intervals is the most prevalent form of interval estimation.

Confidence levels are typically given alongside statistics resulting from sampling.

For example:

In a statement: “We are 95% confident that between 35% and 45% of voters favor Candidate A, 95% is our confidence level and 35% -45% is our confidence interval.”

Confidence Interval for the difference of two means²

The confidence Interval for the difference between two means is

$$(X - Y) \pm Z \sqrt{S_1^2/n_1 + S_2^2/n_2}$$

Where X is the mean for the first sample, S_1 is the standard deviation for the first sample and n_1 is the size of the first sample, and Y is the mean for the second sample, S_2 is the standard deviation for the second sample and n_2 is the size of the second sample. Z is the confidence level value.

To calculate the CI for the difference between two sample means:

1. For the purpose of this study the Z value was 1.96.
2. Find the difference between the two sample means: $(X-Y)$.
3. Square S_1 and divide it by n_1 ; square S_2 and divide it by n_2 . Add the results together and take the square root.
4. Multiply the answer from step 3 by 1.96. The product is the margin of error.
5. Take $(X-Y)$ plus or minus the margin of error to obtain the CI. The lower end of the CI is $(X-Y)$ minus the margin of error, while the upper end of the CI is $(X-Y)$ plus the margin of error.

Confidence Level³

The confidence level indicates how sure one can be of a statistical result and is expressed as a percentage. The confidence level is the certainty or “confidence” one has predicting often the true percentage of the population would pick an answer or produce a result that lies within the confidence interval. Thus 95% confidence level means one can be 95% certain the true parameter lies within the Confidence Interval; the 99% confidence level means one can be 99% certain. Most researchers use the 95% confidence level.

Lower Confidence Interval (LCI)⁴

The Lower Confidence Interval is the Sample Mean minus the margin of error. The UCI and LCI range estimates with a 95% confidence level that the true population mean should fall somewhere in that range.

Z – Value for 95% Confidence Level = 1.96, s is the Sample Standard Deviation, n is the Sample Size

$$LCL = \text{Sample Mean} - (1.96 * (s / \text{SQRT}(n)))$$

Margin of Error⁵

The margin of error expresses the amount of the random variation underlying a survey's results. A margin of error is usually prepared for one of three different levels of confidence; 99%, 95% and 90%. For the purposes of this study the 95% confidence level was used. Calculating the margin of error using this confidence level and using it to determine the upper and lower control limits it is assumed that the "true" timing for the entire population would be within the UCI and LCI 95% of the time.

$$\text{Margin of Error} = Z * (s / \text{SQRT}(n))$$

Z – Value for 95% Confidence Level = 1.96, s is the Sample Standard Deviation, n is the Sample Size

Mean⁶

The mean is the average, which is more correctly called the arithmetic mean. Sample mean is often used as an estimator of the population mean. However, other estimators are also used. For example, the median is a more robust estimator of the central tendency than the sample mean.

For a data set, the mean is just the sum of all the observations divided by the number of observations. Once we have chosen this method of describing the communality of a data set, we usually use the standard deviation to describe how the observations differ.

The mean is the unique value about which the sum of squared deviations is a minimum. If you calculate the sum of squared deviations from any other measure of central tendency, it will be larger than for the mean.

Standard Deviation (σ)⁷

Standard deviation is the most commonly used measure of statistical dispersion. Simply put, it measures the spread between values in a data set.

The standard deviation is defined as the square root of the variance. This means it is the root mean square (RMS) deviation of the data points from their average. It is defined this way in order to give us a measure of dispersion that is (1) a non-negative number, and (2) has the same units as the data.

Upper Confidence Interval (UCI)⁴

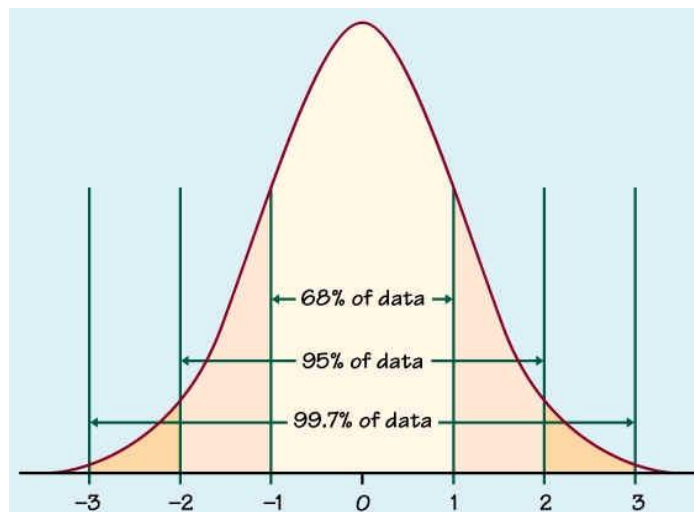
The Upper Confidence Interval is Sample Mean plus the margin of error. The UCL and LCL range estimates with a 95 percent confidence level that the true population mean should fall somewhere in that range.

Z – Value for 95% Confidence Level = 1.96, s is the Sample Standard Deviation, n is the Sample Size

$$\text{UCI} = \text{Sample Mean} + (1.96 * (s / \text{SQRT}(n)))$$

Z value (Z)⁸

Assuming a normal distribution, it is the number of standard deviations away from the mean that is the boundary of the confidence interval. For the purposes of this report a 95% confidence interval was used. That is two standard deviations, which translates to a Z value of 1.96.



(Graph - see Reference 9)

Appendix H. Assumptions and Limitations

1. Assumption was made that VistA and the network were functioning at normal levels.
2. In order to obtain the largest sample size possible, all clinicians performed all scenarios even though the actual task may fall outside their prescribed duties.
3. With respect to number 2 above, a clinician's unfamiliarity with the task would reflect a new or inexperienced user and thus is valid to the current study.
4. The number of medications used in the Sorting and Comparing Medications Scenarios was arbitrary based upon averaging several CPRS test patient profiles. Sample results do not reflect all actual timings due to variations in the number of medications a patient may be receiving.
5. The number of orders used in the Finding and Sorting Orders Task Scenarios was arbitrary based upon averaging several CPRS test patient profiles. Sample timing results do not reflect all actual timings due to variations in the number of orders a patient may have.
6. The Cover Sheet Postings scenario represents a best case situation in trying to determine posting information. It assumes that the information needed is actually located in the posting itself. What the BI Team observed and what this scenario does not reflect, is that if the information exists in a scanned image, a clinician must go into VistA imaging to retrieve the image. The purpose of this scenario is to highlight efficiencies in the use of well-placed first-glance data.

Appendix I. References

This report is framed by the following documents listed in Table I-1 and I-2.

Table I-1. List of References

Document Name	Version/Date	Produced By
Request For Proposal (RFQ) No. 776-07-986	3 July 2007	Veterans Health Administration Office of Information Chief Health Informatics Office Emerging Health Technologies
Emerging Health Technologies Solicitation No. 766-07-986 Technical Response	30 July 2007	Business Intelligence, Inc.
Purchase Order 776-C70397 for Supplies or Services	12 September 2007	Dept of Veterans Affairs Service Center
Combined Industrial Engineering and Workflow Engineering Methodology Proposal for Tasks 6 and 7 – Deliverable 6.1/7.1	17 December 2007 As revised 21 April 2008	Business Intelligence, Inc
Bay Pines Visit Trip Report—Task 6 (Final)	14 March 2008	Business Intelligence, Inc
West Roxbury VAMC Site Visit Trip Report—Task 6 (Final)	14 March 2008	Business Intelligence, Inc
Baltimore VAMC Site Visit Trip Report—Task 6 (Final)	14 March 2008	Business Intelligence, Inc
Albany VAMC Site Visit Trip Report—Task 6 (Final)	14 March 2008	Business Intelligence, Inc
Baseline Response Time & Workflow Efficiency Data—Deliverables 6.2 and 7.2—Draft	24 April 2008	Business Intelligence, Inc.
Baseline Response Time & Workflow Efficiency Data—Deliverables 6.2 and 7.2—Draft	24 April 2008	Business Intelligence, Inc.
Response Time Simulation Testing Report (summary & detail)—Deliverables 6.4 and 7.4	24 April 2008	Business Intelligence, Inc.
Simulation Model to Modify and Assess Acceptable Response Times and Workflow Efficiency—Deliverables 6.3 and 7.3—Draft	09 May 2008	Business Intelligence, Inc.
Bay Pines Visit Trip Report—Task 6 (Final)	May 21, 2008	Business Intelligence, Inc
West Roxbury VAMC Site Visit Trip Report—Task 6 (Final)	May 29, 2008	Business Intelligence, Inc
Baltimore VAMC Site Visit Trip Report—Task 6 (Final)	June 5, 2008	Business Intelligence, Inc
Albany VAMC Site Visit Trip Report—Task 6 (Final)	June 11, 2008	Business Intelligence, Inc

Table I-2. List of Statistical References

Reference Number	Document Name	Produced By
1	http://www.stat.yale.edu/Courses/1997-98/101/confint.htm	Department of Statistics, Yale University
2	http://www.itl.nist.gov/div898/software/dataplot/refman1/auxillar/diffmean.htm	Statistical Engineering Division, National Institute of Standards and Technology
2	http://www.itl.nist.gov/div898/handbook/prc/section4/prc435.htm	Engineering Statistics Handbook, National Institute of Standards and Technology
3	http://www.isixsigma.com/library/content/c040607a.asp	Pamela Hunter, Director of the Center for Survey Research and Analysis at the University of Connecticut's Stamford campus
4	http://ltconline.net/greenl/courses/201/Estimation/confIntMean.htm	Larry Green – Department of Mathematics, Lake Tahoe Community College
5	http://mathworld.wolfram.com/MarginofError.html <i>Introduction to the Practice of Statistics</i> . New York: W. H. Freeman, p. 443, 1999	David Moore Ph.D. Professor of Statistics, Emeritus, Purdue University and George McCabe Ph.D. Professor of Statistic, Purdue University – Wolfram Research
6	"Mean." From <i>MathWorld</i> --A Wolfram Web Resource. http://mathworld.wolfram.com/Mean.html	Eric W Weisstein Ph.D. – Wolfram Research
7	"Standard Deviation." From <i>MathWorld</i> --A Wolfram Web Resource. http://mathworld.wolfram.com/StandardDeviation.html	Eric W Weisstein Ph.D. – Wolfram Research
8	<i>An Introduction to Mathematical Statistics and Its Applications, Third Edition</i> , p. 282.	Richard J. Larsen Professor (retired) Department of Mathematics, Vanderbilt University and Morris L. Marx Ph.D. Department of Mathematics, University of West Florida
9	www.ltconline.net/greenl/courses/201/probdist/zScore.htm	Larry Green – Department of Mathematics, Lake Tahoe Community College