ONC SAFETY ENHANCED DESIGN NISTIR 7742 REPORT

TIER 9.0
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Executive Summary

Netsmart is highly focused on solution usability. A core part of our Software Development Lifecycle (SDLC) includes integration of a UX (User Experience) team with a focus of usability based upon a safety-enhanced, user-centered design. This includes patient safety, effectiveness, efficiency, and satisfaction. A user centered design process is integrated into the SDLC to ensure a safety-enhanced design is achieved.

The User Centered Design process that is utilized at Netsmart is the ISO/IEC 62366. Netsmart incorporates the steps outlined in *Part 1: Application of usability engineering to medical devices* of this standard into our usability engineering process. Netsmart utilizes this process because it very closely aligns with the requirements of Safety-Enhanced Design, and we find it provides us with the most accurate presentation of risks to safety. It also provides the most clarity on what the best practice is for execution of each step.

This standard was applied to the usability test of TIER Certification Edition version 90 which was conducted November 6-10, 12, and 13th at Netsmart's facility in Kansas and in Illinois. This test measured the usability of the application by tracking efficiency, effectiveness, and satisfaction. Ten participants with a clinical background and varying experience levels completed tasks which were reflective of common clinical reconciliation and clinical decision support tasks in the system.

The test sessions were recorded to assist in measuring data. Key metrics that were tracked include task completion rate, task time, error rate, task deviations, satisfaction ratings, and participant verbalizations and recommendations.

The testing showed a 100% task completion rate with an error rate of only 10%, all of which were user errors and not errors of the system. The participants were able to efficiently maneuver the system, with 89% of the tasks being completed in under a minute. The SUS score of the system was 95.25, which is considered above average.

While the above metrics support the usability of the application, there is always room for improvement. Based on the error rate and success rate of the tasks and suggestions from the participants, there are a few notable areas for improvement. For instance, some participants were held up with the format of valid names in client search fields. Also, one participant had trouble reconciling the data imported during the clinical reconciliation. Lastly, it was mentioned that that the placement of the search fields was inconsistent between functions and could improve ease in use if the search was more consistent.

Introduction

Full Product Description

TIER Certified Edition is designed to maximize the workflows for managing outpatient lab, radiology and medications orders. TIER Certified Edition also provides users with an efficient workflow to review, add, and change medication, laboratory, and radiology orders as well as laboratory order results. Information like allergies, diagnoses, and interactions are displayed to the user as they work with the various orders. Users can also review, add, and change problems, demographics, and implantable devices as well. In addition, TIER Certified Edition provides our users with an efficient workflow to match clinical documents and complete clinical reconciliation. Clinical decision support is also provided to users at carefully analyzed decision points within each specific workflow and users can easily view and acknowledge clinical decision support interventions.

Test Objectives

This test was to evaluate the efficiency, effectiveness, and satisfaction of TIER Certified Edition. The content of the TIER Certified Edition was a similar depiction of what a participant would see in the production application. Aside from test patients in the application, all other libraries were the same as they would be in production, e.g. diagnosis codes, medication libraries, etc.

The system was tested against 11 different areas being certified:

- 170.315(a)(1) CPOE – Medications
- 170.315(a)(2) CPOE – Laboratory
- 170.315(a)(3) CPOE – Diagnostic Imaging
- 170.315(a)(4) Drug-drug, Drug-allergy Interaction Checks
- 170.315(a)(5) Demographics
- 170.315(a)(6) Problem List
- 170.315(a)(7) Medication List
- 170.315(a)(8) Medication Allergy List
- 170.315(a)(9) Clinical Decision Support
- 170.315(a) (14) Implantable Device List
- 170.315(b)(2) Clinical Information Reconciliation and Incorporation
- 170.315(b)(3) Electronic Prescribing *

Methods

Participants

Ten participants were tested in this study. Our intended users are clinicians, so all of our participants had a clinical background which gave us more accurate and reliable results. We also used participants with varying professional computer experience levels and product experience levels. We used these varying experience levels because we understand that in a real-world setting, users would have varying computer and product experience levels. The table below represents the demographics that were collected from each participant. The participants chosen were not compensated fiscally, as to decrease in biased results. These participants were also not directly involved in the development of the application.

Participant Identifier	Participant Gender	Actual Age	Professional Degree / Credentials	Participant Education	Education	Participant Occupation /Role	Computer Experience	Product Experience
Participant 01	Female	52	RN	Bachelor's Degree	Bachelor's Nursing	Product Manager	20 + Years	18 + Years
Participant 02	Female	39	MS	Master's Degree	Master's Professional Counseling	HHS Community Manager	15+ Years	Minimal
Participant 03	Male	38	MS, NCC, LPC-MHSP	Master's Degree	Master's Professional Counseling	Sr. Director, Solution Consulting	15+ Years	Minimal
Participant 04	Female	39	MS	Master's Degree	Master's Professional Counseling	Business Analyst	20 + Years	Minimal

Participant 05	Male	54	PhD	Doctorate degree (PhD)	PhD Industrial/Organizational Psychology, Masters - Psychology, Masters-Counseling Psychology	Director of Medication Management	25 + Years	Minimal
Participant 06	Male	52	RN	Bachelor's Degree	BA Nursing	Chief Nursing Officer	20 + Years	Minimal
Participant 07	Female	60	RN	Master's Degree	RN, BA, MA, MCSE	Strategic Solutions Consultant	20 + Years	Minimal
Participant 08	Female	42	MS, MBA	Master's Degree	MA Counseling	Consulting Operations Manager	20 + Years	9 Years
Participant 09	Female	35	RN	Master's Degree	ASN, BSN, MSN	Project Manager	10+ Years	3 Years
Participant 10	Female	41	BS	Bachelor's Degree	Bachelors	Business Analyst	15 years	4 Years

Participant Instructions

All participants were given a short explanation of what the tests entail and were given the ability to ask questions before the test was administered. The test moderator read the tasks/scenarios off to each participant and the participant then attempted the explained task. Participants had to opportunity to ask for clarification of tasks. We measured task success rate, task time, error rate, task deviations, and satisfaction ratings. We observed their behavior and documented verbalizations to see patterns across participants. The information collected was reviewed after the session to calculate metrics.

Experimental/Study Design

The objective of this test was to measure effectiveness, efficiency, and satisfaction and discover areas where the system performed well and areas for improvement. The participants' vocal feedback and reactions were recorded. This qualitative feedback was analyzed for patterns in

their responses. The quantitative metrics measured were task success rate, task failure rate, task deviation rate, error rate, task time, and user satisfaction rating. The participants filled out the SUS questionnaire to assess the satisfaction of the participant after using the application.

Tasks/Scenarios

The participant was given a set of tasks based on the 2015 Edition Health IT Certification criteria and were reflective of tasks that a user of the application would complete in a typical workflow. The tasks were chosen because of their importance in regard to functionality, criticality in regards to safety, and frequency of use in the application. The participants were welcome to ask the moderator questions and refer back to the task sheet given. Below are tasks that were completed by the test participants.

170.315(a)(1) Computerized Provider Order Entry (CPOE) – Medications

Tasks:

- Access the client's medication orders
- Record a new medication order
- Change a medication order

170.315(a)(2) Computerized Provider Order Entry CPOE – Laboratory

Tasks:

- Access the client's lab orders
- Record a new lab order
- Change a lab order

170.315(a)(3) Computerized Provider Order Entry CPOE – Diagnostic Imaging

Tasks:

- Access the client's lab diagnostic imaging orders
- Record a diagnostic imaging orders
- Change a diagnostic imaging orders

170.315(a)(4) Drug-drug, Drug-allergy Interaction Checks for CPOE

Tasks:

- Review and act upon drug-drug interaction (before placing medication order)
- View source of interaction (citation box)
- Review and act upon drug-allergy interaction (before placing medication order)
- View source of interaction (citation box)
- Adjust the severity level of drug-drug interactions being displayed (specific user)

Notes:

- The adjusting of severity levels of drug-drug interactions can be configured based on role or user credentials. For this test, the participants logged in with credentials of a user that could configure the severity levels.

170.315(a)(5) Demographics

Tasks:

- Access the client's demographic information
- Record the client's race
- Record the client's ethnicity
- Record the client's preferred language
- Record the client's sex
- Record the client's sexual orientation
- Record the client's gender identity
- Record the client's date of birth
- Change the client's demographics

Notes:

- While the system allows for multiple races to be recorded, this testing only included the recording of one race.
- While the ability to choose that the client "declines to specify" a sexual orientation, ethnicity, race, gender identity, and preferred language is in the system, the tasks in this test were to choose a specific value for each demographic.

170.315(a)(6) Problem List

Tasks:

- Access the client's problem list, created across multiple encounters
- Record a problem
- Change a problem

170.315(a)(7) Medication List

Tasks:

- Access the client's medication list, created across multiple encounters
- Record a medication
- Change a medication

170.315(a)(8) Medication Allergy List

Tasks:

- Access the client's medication allergy list, created across multiple encounters
- Record a medication allergy
- Change a medication allergy

170.315(a)(9) Clinical Decision Support

Tasks:

- View problem/intervention alert and identify the source attributes
- View medication alert/intervention and identify the source attributes
- View medication allergy alert and identify the source attributes
- View demographic alert/intervention and identify the source attributes
- View lab test alert/intervention and identify the source attributes
- View vital signs alert/intervention and identify the source attributes
- View combination (medication and medication allergy) alert/intervention and identify the source attributes
- Locate linked education materials related to a problem and identify the source attributes

- Identify the source of drug-drug interaction alert and identify the source attributes
- Identify the source of drug-allergy interaction alert and identify the source attributes
- Configure MU alerts (problem, medication, medication allergy, demographic, lab test, vital signs, and combination) being displayed

170.315(a)(14) Implantable Device List

Tasks:

- Access the client's Implantable Device List/Unique Device Identifiers
- Record a new device
- Review the parsed device information including (device identifier, batch/lot number, expiration date, production date, serial number) of the device being recorded
- Review the device description of the device recorded
- Change a device

170.315(b)(2) Clinical Information Reconciliation and Incorporation

Tasks:

- Receive a CCD document and match it to the correct client
- Reconcile medications from two sources (importing items from the CCD and removing duplicate items)
- Reconcile problems from two sources (importing items from the CCD and removing duplicate items)
- Reconcile medication allergies from two sources (importing items from the CCD and removing duplicate items)
- Confirm the reconciled list to be imported into the client's record
- Verify a CCD file has been created with the reconciled information

170.315(b)(3) Electronic Prescribing

Tasks:

- Prescribe a medication (including the input of reason for the prescription)
- Verify that liquid medication units are shown in metric standard units of mL
- Verify there are leading zeros before the decimal point for amounts less than one and no trailing zeros after the decimal point
- Cancel a prescription (including the viewing of reason for the prescription)
- Refill a prescription (including the viewing of reason for the prescription)
- Change a prescription (including the viewing of reason for the prescription)
- View client's medications (including fill status notifications and reason for the prescription)

Notes:

- The system automatically displayed medication history information; the user does not need to do anything to request or receive medication history information, so this was not tested in the system.

Test Procedure

The tests were moderated by experienced TIER users. The moderators gave each participant a brief explanation of what they could expect in the test, read through each task and scenario to the user, and tracked comments and behaviors of the participants. Participants were instructed

that they could ask for clarification along the way and were able to refer to a printed copy of the task. Task timing began at the point that the task was read and ended once the participant had completed that task. Participants were asked to give and ease of use score for each task. Following the test, the participant was given an SUS questionnaire to complete. Metric information was stored into a report following the testing.

Test Location

Testing was conducted on November 6-10, 12, and 13th. All tests were completed remotely from the participant's own location. The moderators of the tests were located at Netsmart Technologies, 801 Warrenville Road Suite 350 Lisle, IL 60532.

Test Environment

The intended facility would be an inpatient or outpatient behavioral health facility where users are completing clinical data such as ordering medications, reconciling information, adding information to the client's chart, etc. In this instance, the testing was conducted remotely from the participant's own location. The sessions were conducted over GoToMeeting or Skype calls in which the participants gained control of the moderator's screen to complete the tasks or connected via Citrix to a test environment. . This method was used so that quantitative metrics could be gathered from the moderator's machine. Testing was conducted on 1366x768 resolution DELL and Lenovo laptops. The participants used a mouse and keyboard for data entry during the test. The participants used a standard keyboard and mouse for input. The TIER environment being used during the test had content similar to what appears in the field on this application. The system performance during the testing is reflective of what would be experienced in the field.

Test Forms and Tools

. GoToMeeting and Skype programs were also used for remote testing calls to allow for screen sharing. Documents that were used during testing included the test script the participants used to complete tasks, the SUS (system usability scale) questionnaire, and a form for participants to write their demographic information.

Usability Metrics

The usability metrics captured during the test were based on the 170.315.g.3 Safety Enhanced Design criteria. These metrics include effectiveness, efficiency, and satisfaction. Risk level was calculated based on the task success rate and error rate of the task. The metrics tested are detailed below:

Effectiveness

- **Task success (Mean and standard deviation percentages):** A task was considered a success if the user was able to complete the task without assistance from the test administrator. If the participant abandoned the task, it was counted as a failure. If a participant deviated away from the optimal path to complete a task or performed errors, but ultimately was still able to accomplish the task, then the task was marked as a success.

- **Error rate (Mean and standard deviation percentages):** Errors were considered a system or user error if they were reconcilable and did not lead to a failed task.

Efficiency

- **Task time (Mean and standard deviation in seconds):** Task time was measured for each task. This was the total time to complete a task, from the point in which the user began the task to the point in which it was successfully completed.
- **Task path deviation (Mean observed and optimal seconds):** Task path deviations were deviations in the participant's path to complete a task compared to the optimal path to complete the path.

Satisfaction

- **Rating (Task and overall):** A Likert scale ease of use rating was used for each task, with values ranging from 1 to 5 for very difficult to very easy. At the completion of the test, the participants completed an SUS (system usability scale) measuring usability across the whole system. In systems engineering, the SUS is a simple, ten-item attitude Likert scale giving a global view of subjective assessments of usability. It was developed by John Brooke at Digital Equipment Corporation in the UK in 1996 as a tool to be used in usability engineering of electronic systems. An SUS questionnaire was given to each participant after completing the tasks in the application. Common conventions find that systems with a rating of 68 or higher can be seen as easy to use or above average. See J. Sauro, Measuring Usability With the System Usability Scale (SUS)

Risk Level

- **Risk level:** The risk level of each task was calculated by likelihood (task success rate and error rate) and severity of consequences. The risk levels were prioritized to discover which tasks were the most risk prone.

Results

Summary of Data Analysis and Reporting (by Task)

The findings and details of the usability testing are detailed below. The results were measured based on the explanations in the "Usability Metrics" section above.

Measure	N	Mean Success Rate (SD)	Observed Path Deviation/ Optimal	Mean Task Time (SD)	Observed Time Deviation /Optimal	Mean Error Rate (SD)	Rating (SD)

Task	#	%	#	Seconds	#	#	#
(a.1) CPOE –Meds							
Record medication via CPOE	10	100 (0)	7/6	112 (27)	112/78	.2(.42)	4.8 (.42)
Change medication via CPOE	10	100 (0)	11/6	103 (27)	103 (77)	.3(.48)	4.8 (.42)
Display changed CPOE medication order	10	100 (0)	4/4	43(12)	43(33)	.1(.32)	4.8 (.42)
(a.2) CPOE – Labs							
Record Lab order via CPOE	10	100 (0)	6/5	42(8)	42(30)	.2(.42)	4.8 (.42)
Change Lab order via CPOE	10	100 (0)	4/4	31(8)	31(25)	0(0)	5.0 (0)
Display changed CPOE Lab order	10	100 (0)	1/1	5(5)	5(2)	0(0)	5.0 (0)
(a.3) CPOE – Diagnostic Imaging							
Record Imaging order via CPOE	10	100 (0)	7/4	55(29)	55(34)	.4(.7)	4.8 (.42)
Change Imaging order via CPOE	10	100 (0)	6/5	63(84)	63(24)	.1(.32)	4.8 (.42)
Display changed CPOE Imaging order	10	100 (0)	1/1	4(3)	4(1)	0(0)	5.0 (0)
(a.4) Drug-drug, drug-allergy interaction checks for CPOE							
Using CPOE, trigger a drug-drug interaction by entering a new medication order	10	100 (0)	1/1	24(17)	24(2)	.1(.32)	4.8 (.42)
Using CPOE, trigger a drug-allergy interaction by entering a new medication order	10	100 (0)	9/8	106 (20)	106 (82)	.2(.42)	4.8 (.42)
Adjust the severity level of a displayed drug-drug interaction	10	100 (0)	4/3	77(19)	77(50)	.3(.48)	4.8 (.42)
(a.5) Demographics							
Record a patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity,	10	100 (0)	31/29	272 (60)	272 (204)	.2(.42)	4.8 (.42)

Change the patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity	10	100 (0)	11/10	102 (36)	102 (58)	.2(.42)	4.8 (.42)
Display the patient's changed preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity	10	100 (0)	2/2	13(3)	13(8)	0(0)	5.0 (0)
(a.6) Problem List							
Record a problem to the problem list	10	100 (0)	6/5	58(17)	58(38)	.2(.42)	4.8 (.42)
Change a problem on the problem list	10	100 (0)	3/3	13(3)	13(9)	0(0)	5.0 (0)
Display the active problem list	10	100 (0)	1/1	6(5)	6(1)	0(0)	5.0 (0)
Display the historical problem list	10	100 (0)	1/1	2(1)	2(1)	0(0)	5.0 (0)
(a.7) Medication list							
Record a medication to the medication list	10	100 (0)	6/5	118 (59)	118 (45)	.1(.32)	4.8 (.42)
Change a medication on the medication list	10	100 (0)	6/6	122 (28)	122 (95)	0(0)	5.0 (0)
Display the active medication list	10	100 (0)	2/2	22(36)	22(2)	.1(.32)	4.8 (.42)
Display the historical medication list	10	100 (0)	2/2	9(4)	9(2)	0(0)	5.0 (0)
(a.8) Medication allergy list							
Record a medication allergy	10	100 (0)	11/8	69(20)	69(37)	.4(.7)	4.8 (.42)
Change a medication allergy	10	100 (0)	1/1	6(2)	6(3)	0(0)	5.0 (0)
Display the active medication allergy list	10	100 (0)	9/8	67(20)	67(37)	.1(.32)	4.8 (.42)
Display the historical medication allergy list	10	100 (0)	3/3	26(4)	26(18)	0(0)	5.0 (0)
(a.9) Clinical Decision support							
Problem list	10	100 (0)	9/9	71(18)	71(45)	0(0)	5.0 (0)
Medication list	10	100 (0)	9/9	71(18)	71(45)	0(0)	5.0 (0)

Medication Allergy List	10	100 (0)	12/11	162 (25)	162 (127)	.1(.32)	4.8 (.42)
At least one Demographic	10	100 (0)	11/11	162 (25)	162 (127)	0(0)	5.0 (0)
Laboratory Test	10	100 (0)	9/9	69(18)	69(45)	0(0)	5.0 (0)
Vital Signs	10	100 (0)	12/11	162 (25)	162 (127)	.1(.32)	4.8 (.42)
And a combination of at least 2 of the elements listed above	10	100 (0)	12/11	162 (25)	162 (127)	.1(.32)	4.8 (.42)
View the intervention/resource information using the Infobutton standard for data elements in the problem list, medication list, and demographics	10	100 (0)	8/8	108 (12)	108 (94)	0(0)	5.0 (0)
Trigger the CDS interventions/resources based on data elements in the problem list, medication list, and medication allergy list by incorporating patient information from a transition of care/referral summary	10	100 (0)	4/3	30(17)	30(17)	.1(.32)	4.8 (.42)
Access the following attributes for one of the triggered CDS interventions/resources: bibliographic citation, developer, funding source, release/revision date	10	100 (0)	3/3	40(12)	40(26)	0(0)	5.0 (0)
(a.14) Implantable Device List							
Record UDI	10	100 (0)	6/4	66(43)	66(26)	.3(.48)	4.8 (.42)
Change UDI Status	10	100 (0)	5/5	32(7)	32(19)	0(0)	5.0 (0)
Access UDI, device description, identifiers, and attributes	10	100 (0)	4/4	66(43)	66(26)	0(0)	5.0 (0)
(b.2) Clinical Information Reconciliation and Incorporation							
Incorporate a CCDA and conduct reconciliation of the medications, medication allergies, and problems in the CCDA with the information currently in the patient's record	10	100 (0)	30/29	267 (22)	267 (240)	.1(.32)	4.8 (.42)
Generate a new CCDA with reconciled data	10	100 (0)	21/20	216 (55)	216 (137)	.1(.32)	4.8 (.42)

(b.3) E-Prescribing**							
Create a new prescription (including the input of reason for prescription)	10	90 (33)	12/10	54 (16)	54/31	.1 (.3)	4.4 (.9)
Verify liquid medication units are shown in metric standard form of mL	10	100 (0)	2/2	6 (2)	6/4	0 (0)	4.8 (.4)
Verify there are leading zeros before the decimal point for amounts less than one and no trailing zeros after the decimal point	10	100 (0)	2/2	6 (2)	6/4	0 (0)	4.8 (.4)
Cancel a prescription (including viewing of reason for prescription)	10	100 (0)	5/4	23 (8)	23/14	0 (0)	4.6 (.5)
Refill a prescription (including viewing of reason for prescription)	10	100 (0)	5/4	23 (8)	23/14	0 (0)	4.6 (.5)
Change a prescription (including viewing of reason for prescription)	10	80 (44)	8/7	25 (9)	25/16	.2 (.4)	4.6 (.5)
View client's medications (including fill status notifications and reason for prescription)	10	100 (0)	3/3	8 (2)	8/3	0 (0)	4.6 (.5)

Summary of Data Analysis and Reporting (by Participant)

Measure / Participant	Mean Success Rate	Mean Task Time	Errors	Type of Errors	SUS	Comments
	%	Seconds	#	User/System	#	
1	100	87	8	User	100	N/A
2	100	87	2	User	100	N/A
3	100	75	2	User	100	N/A
4	100	93	12	User	87.5	N/A
5	100	77	3	User	100	N/A
6	100	90	5	User	75	N/A
7	100	87	2	User	97.5	N/A
8	100	65	2	User	100	The search fields were looking for different values – The searches should

						always use last name as the first search parameter.
9	100	65	3	User	92.5	N/A
10	100	71	2	User	100	N/A

Error Analysis

The below table analyzes the user errors that occurred during testing and are ordered by the risk level of the errors, based on error rate and success rate of the tasks in which the errors occurred.

Task	Error Rate	Success Rate	Explanation of Errors
a.8 Recording a medication Allergy	40	100	The scenario switched interfaces which the users were not familiar with the order of required steps. Users jumped ahead to the next step without prompting which caused the user to choose and incorrect selection.
a.3 Recording an imaging Order	40	100	The user's errors in the system surrounded user's unfamiliarity with the system.

Participant Feedback

Participant	Feedback
3.	He thought the system was easy to use.
7	The More I used the system the more familiar I got with where to naviagte next. I wasn anticipating the next steps in the process.
8	The seach functions seems inconsistent between functions. Sometimes you were searching for first name first and then others you were searching for Last name first.

Major Findings

Effectiveness

There was an average task success rate of 100% with an overall error rate of 4% Of the errors that occurred, 100% of them were still able to be successfully completed by the participants.

Efficiency

83% of the tasks in the test were completed in under 2 minutes. There was an average task completion time of 78 seconds. Task path deviations were very minimal with an average of 27 additional steps being observed than the optimal amount amongst the 42 tasks.

Satisfaction

The average task ease of use rating was 4.8, with an average SUS score of 95.25, which is seen as above average usability according to SUS standards.

Risk Level

Measure / Task	Success Rate	Error Rate	Severity of Errors Occurred /Consequences
	%	%	Low, Medium, High
a. 3 Record Imaging order via CPOE	100	0.40	Medium
a. 8 Record a medication allergy	100	0.40	Medium
a.1 Change medication via CPOE	100	0.30	Medium
a.4 Adjust the severity level of a displayed drug-drug interaction	100	0.30	Medium
a.14 Record UDI	100	0.30	Medium
a.1 Record medication via CPOE	100	0.20	Medium
a.2 Record Lab order via CPOE	100	0.20	Medium
a.4 Using CPOE, trigger a drug-allergy interaction by entering a new medication order	100	0.20	Medium

a.5 Record a patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity,	100	0.20	Medium
a.5 Change the patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity	100	0.20	Medium
a.6 Record a problem to the problem list	100	0.20	Medium
a.1 Display changed CPOE medication order	100	0.10	Low
a. 3 Change Imaging order via CPOE	100	0.10	Low
a.4 Using CPOE, trigger a drug-drug interaction by entering a new medication order	100	0.10	Low
a. 7 Record a medication to the medication list	100	0.10	Low
a. 7 Display the active medication list	100	0.10	Low
a. 8 Display the active medication allergy list	100	0.10	Low
a. 9 Trigger a CDS from Medication Allergy List	100	0.10	Low
a. 9 Trigger a CDS from Vital Signs	100	0.10	Low
A. 9 Trigger a CDS from two sources	100	0.10	Low
a . 9 Trigger the CDS interventions/resources based on data elements in the problem list, medication list, and medication allergy list by incorporating patient information from a transition of care/referral summary	100	0.10	Low

b.2. Incorporate a CCDA and conduct reconciliation of the medications, medication allergies, and problems in the CCDA with the information currently in the patient's record	100	0.10	Low
b. 2 Generate a new CCDA with reconciled data	100	0.10	Low

The above errors are classified as medium or low since the error rate was rather low and the success rate was high for all the errors. Of the tasks that were considered medium risk, 70% or less of the users experienced this problem, while the rest were able to complete these tasks successfully. The remaining items were ranked as low risk because they had very low frequency and 100% or greater of the participants were still able to successfully complete the task despite the user errors.

Risk Level

Based on the results found from the errors seen during the test, the highest risk tasks are:

- a.3 Recording Imaging order via CPOE
- a.8 recoding a medication allergy
- a.1 Changing a medication via CPOE

These are considered the highest risk due to these being the only tasks in which errors occurred. However, the second two tasks listed had a very small error rate, so while there was a user error encountered, they tasks aren't necessarily considered high risk tasks. You'll also notice that while these three tasks did have user errors, the success rate of those tasks were still very high at 100%, meaning that the error rates didn't greatly impact the participants' ability to successfully complete tasks.

Considering that six of the ten participants had very minimal experience with TIER only having a 10% error rate is very indicative of a user-friendly system. While analyzing the risk level of the tasks, we found that the small number of user errors which did occur were due to unfamiliarity with the system. Once the participants began completing more tasks, they were less likely to repeat the same error because they were learning the system and becoming more familiar with the interface and functionality. The participants seemed to pick up on the system rather quickly after they figured out how to complete a task once.

Summary

It can be deduced that with a 100% average success rate, 10% error rate, and SUS rating of 95.25, that the system is indeed user-friendly and safety-enhanced based on the criteria

measured. Although there were errors that occurred, the participants were able to still complete those tasks 100% successfully, so these errors did not impede on the user's overall interaction with the system or greatly affect patient safety.

Areas for Improvement

Although the application measured well in regard to efficiency, effectiveness, and satisfaction, there is always room for improvement. A few of the participants made recommendations throughout their sessions. Netsmart's User Experience team values all recommendations mentioned during testing and consider all recommendations when improving the usability of our solutions. We were pleased to discover that all of these recommendations mentioned were already known by the User Experience team and have been addressed in development for future releases. These recommendations included:

- Looking into how the system client names were searched between functions
- Looking into how the data is displayed when using drop down fields.
- Looking into shortening the steps for reconciliation of data when imported from an outside source.

That being said, the application overall performed very well in the three areas being measured: efficiency, effectiveness, and satisfaction. We take pride in these results and the user-centered design and safety-enhanced design that our application includes.

Shelly Casale, GM, Sr. Director- TIER

Date

Appendix A

During the usability testing TIER 9.0 usability testers did not perform all of the E-Prescribe testing. Included in this report is the data metrics captured during the myAvatar certification. TIER 9.0 and myAvatar use the same technology to perform E-Prescribing tasks.