

EHR Usability Test Report of myCare iMedicWare V8.1

Report based on ISO/IEC 25062:2006 Common Industry Standard Format for Usability Test Reports

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EXECUTIVE SUMMARY

A usability test of myCare iMedicWare V 8.1 EHR was conducted by the clinical director of iMedicware, based on the *ISO/IEC 25062:2006 Common Industry Standard Format for Usability Test Results as outlined in the NISTIR publication 7742, version 0.2*. The test was conducted at two physicians' offices -- one in Louisiana and one in Colorado. An online test was also conducted during October and November.

The purpose of the test was to validate the usability of the current user interface, and to provide evidence of the usability of myCare iMedicWare V8.1. The target audience for myCare iMedicWare includes ophthalmologists, optometrists, and opticians, as well as their office staff, including front desk workers and technicians. During the test, 10 healthcare providers participated, all representative of typical users of myCare iMedicWare V8.1 (ophthalmologists, optometrists, technicians, and administrators). The participants used myCare iMedicWare V8.1 to perform several simulated tests representative of those required by ONC criteria and standards. Several technicians who participated in the study also serve as part-time administrative staff in their respective offices.

The study collected performance data on the following 42 tasks. A risk scale of 1-5 (with 1 being least risk and 5 being greatest risk) was used to account for the patients' safety in performing each of these tasks.

- 170.315(a.1) CPOE Record Medication Order (3)
- 170.315(a.1) CPOE Change Medication Order (2)
- 170.315(a.1) CPOE Access Medication Order (1)
- 170.315(a.2) CPOE Record Laboratory Order (5)
- 170.315(a.2) CPOE Change Laboratory Order (4)
- 170.315(a.2) CPOE Access Laboratory Order (1)
- 170.315(a.3) CPOE Record Radiology Order (3)
- 170.315(a.3) CPOE Change Radiology Order (2)
- 170.315(a.4) Drug Drug Interaction Check (5)
- 170.315(a.4) Drug Allergy Interaction Check (5)
- 170.315(a.4) Drug Drug Drug Allergy Interaction Check Adjust Severity Level (2)
- 170.315(a.5) Record Demographics (1)
- 170.315(a.5) Change Demographics (1)
- 170.315(a.5) Access Demographics (1)
- 170.315(a.6) Record Problem (3)
- 170.315(a.6) Change Problem (2)

- 170.315(a.6) Access Problem (1)
- 170.315(a.6) Access Problem List History (1)
- 170.315(a.7) Record Medication List (5)
- 170.315(a.7) Change Medication (4)
- 170.315(a.7) Access Active Medication List (1)
- 170.315(a.7) Review Current Medication List (1)
- 170.315(a.7) Access Historical Medication List (1)
- 170.315(a.8) Record Current Allergy List (2)
- 170.315(a.8) Change Allergy List(1)
- 170.315(a.8) Access Allergy List (1)
- 170.315(a.8) Access Current Allergy List (1)
- 170.315(a.8) Access Historical Allergy List (1)
- 170.315(a.9) Trigger Problem List Clinical Decision Support Interaction (CDSI) (2)
- 170.315(a.9) Trigger Medication CDSI (2)
- 170.315(a.9) Trigger Allergy CDSI (2)
- 170.315(a.9) Trigger Demographic CDSI (1)
- 170.315(a.9) Trigger Lab CDSI (2)
- 170.315(a.9) Trigger Vital Sign CDSI (2)
- 170.315(a.9) Trigger CDSI utilizing at least two elements from above (2)
- 170.315(a.9) Trigger CDSI based on information from CCDA (2)
- 170.315(a.9) Identify CDSI Supporting Material
- 170.315(a.9) Configure CDSI (2)
- 170.315(a.14) Record UDI (2)
- 170.315(a.14) Change UDI Status (1)
- 170.315(a.14) Access UDI Information (1)
- 170.315(b.2) Reconcile Medications from CCDA (3)
- 170.315(b.2) Reconcile Medication Allergies from CCDA (2)
- 170.315(b.2) Reconcile Problem List from CCDA (3)

Each participant was greeted by the test proctor prior to the 45-minute one-on-one usability test. Each participant was told what the test would involve and what they would need to do during the test. The proctor then demonstrated one time for each participant how to perform each of the tasks. Each participant was told they were free to withdraw at any time. All participants are current users of myCare iMedicWare V6.3.7 (the previous version of myCare iMedicWare v8.1). None of the participants had used the current iteration of the software prior to testing, and while there are significant similarities to the previous version of the software, the look and feel of the new software is much different.

The test proctor introduced the test and instructed the participants to complete a series of 42 tasks, one at a time. During the test, the proctor served as both timekeeper and secretary, noting the participants' actions during each task and recording their comments. The test proctor did not assist participants during the study.

The test proctor did not record any screens or head shots, nor was any video or audio taken during the test. However, the proctor did record what each participant did, the length of time it took them to perform each task, any errors they made, any deviations they took from the optimal path, and any comments they made during and after each test procedure.

The following types of data were collected for each participant:

- Number of tasks successfully completed without assistance
- Time to complete tasks
- Number and types of errors
- Path deviations
- Participants verbalization
- Participant satisfaction ratings of the system

All participant data is de-identified. Following the conclusion of the testing each participant was asked to complete a post-test questionnaire. No participant was compensated for their time. Various recommended metrics in accordance with the example set forth in the *NIST Guide to Processes Approach*, for improving the usability of electronic health records were used to evaluate the usability of myCare IMedicWare V8.1.

Below is a summary of the performance and rating data collected on myCare iMedicWare v8.1 for each measure:

TABLE 1

Measure Task	N	Task Success	Path Deviation	Task Time	Task Time	Errors	Task Ratings 1-5 (5=Easy)
		Mean	Deviation Observed/ Optimal	Mean (sec)	Standard Deviation	Mean %	Mean
Record Medication Order	10	100%	1.3	16.88	8.05	1.5	5.0
Change Medication Order	10	100%	1.0	13.46	3.83	0	5.0
Review Medication Order	10	100%	1.0	5.59	2.21	0	5.0
Record Lab Order	10	100%	1.3	4.60	1.57	5	5.0
Change Lab Order	10	100%	1.0	5.41	1.15	0	5.0
Review Lab Order	10	100%	1.0	7.14	1.29	0	5.0
Record Radiology Order	10	100%	1.0	4.54	2.26	0	5.0
Change Radiology Order	10	100%	1.0	3.70	1.25	0	5.0
Review Radiology Order	10	100%	1.0	6.75	1.09	0	5.0
Adjust Severity Level DDDA	10	100%	1.7	78.37	8.06	0	5.0
Drug Drug Interaction	10	100%	1.0	28.36	7.27	2.5	5.0
Drug Allergy Interaction	10	100%	1.0	11.03	2.75	1	4.3
Record Demographics	10	100%	1.9	74.58	22.64	5.5	4.2
Change Demographics	10	100%	1.0	18.70	4.35	3	4.9
Access Demographics	10	100%	1.1	14.25	11.17	0	5.0
Record Problem List	10	100%	1.4	22.75	15.10	6.6	5.0
Change Problem List	10	100%	1.2	11.15	2.72	1.3	5.0
Review Problem List	10	100%	1.0	13.50	3.12	0	5.0
Review Problem List History	10	100%	1.0	20.03	2.35	0	4.4
Record Current Medications	10	100%	1.2	26.64	7.32	5	4.1
Change Current Medications	10	100%	1.0	21.73	9.92	2.5	4.6
Review Current Medications	10	100%	1.0	13.24	1.94	0	4.5
Review Historical Medications	10	100%	1.0	17.80	4.62	0	4.8
Record Allergies	10	100%	1.0	22.46	4.94	0	5.0
Change Allergy List	10	100%	1.0	27.08	4.04	0	4.3
Review Allergy List	10	100%	1.0	7.29	1.05	0	5.0

Review Historical Allergy List	10	100%	1.0	8.79	2.26	0	4.8
Trigger Problem List CDSI	10	100%	1.0	56.02	12.68	3.3	5.0
Trigger Medication CDSK	10	100%	1.0	40.19	14.42	0	5.0
Trigger Allergies CDSI	10	100%	1.0	29.42	5.02	0	5.0
Trigger Demographic CDSI	10	100%	1.0	20.67	3.73	0	5.0
Trigger Lab CDSI	10	100%	1.4	51.78	26.45	0	4.0
Trigger Vital Sign CDSI	10	100%	1.1	22.86	4.74	0	5.0
Trigger Combination CDSI	10	100%	1.0	57.58	20.18	0	5.0
Trigger CDSI based on CCDA	10	100%	1.4	57.29	8.90	5	4.5
View CDSI References	10	100%	1.0	30.78	14.60	0	5.0
Record UDI	10	100%	1.0	36.99	6.80	0	4.8
Change Status for UDI	10	100%	1.0	5.71	0.79	0	5.0
Access UDI List	10	100%	1.0	17.28	3.56	0	5.0
Reconcile Meds from CCDA	10	100%	1.3	30.58	9.52	3	5.0
Reconcile Allergies from CCDA	10	100%	1.0	18.16	3.22	0	5.0
Reconcile Problems from CCDA	10	100%	1.0	15.95	2.42	0	5.0

Notes:

1. Deviations recorded were the total for all participants
2. Errors were all noted as minor
3. Errors recorded in the table above = total errors for all participants/10. Technicians generally deviated from the optimal path more often because of their lack of familiarity with CPOE and looking for historical data which they were not used to doing.

The results from the System Usability Score (the subjective satisfaction with the system based on performance with these tasks) was: **90.825**

In addition to the performance data, there were a number of qualitative observations were made by the study participants including:

1. Software was easy to use
2. Software was intuitive and I was able to grasp the changes that had been made
3. There really isn't much change in the way we do things with the updated software
4. I am surprised how quickly I can get tasks done
5. I believe I can incorporate the new software into my office with a minimum of disruption

Major findings included:

1. Users were pleasantly surprised with how intuitive the work flow was
2. Minimal key stroke errors
3. Minimal issues participants had finding their way around the software
4. Screen design were clear and easy to grasp
5. Overall the software tested well

Areas for improvement

1. The addition of online help documentation
2. Making the work flow for medication reconciliation more intuitive
3. Implement tight integration between CPOE and eRX

4. Adding auto save in all areas of the system
5. Difficult to select specific menu from the new pull down menus
6. Contrast is too low – difficult to read screens
7. Miss background coloring

This information is discussed in detail in DISCUSSION OF FINDINGS that can be found on page 9 through 11.

INTRODUCTION

The electronic health record tested for this study was myCare iMedicWare v8.1. The original version of iMedicWare (iDOC) was designed by a group of ophthalmologists to be used by ophthalmologists, optometrists and opticians. Since that time, the product has been significantly enhanced and improved incorporating the suggestions of multiple users during field testing and actual hands on use.

The purpose of this study was to test and validate usability of the current version of the user interface of myCare iMedicWare V8.1 as well as to provide evidence of myCare iMedicWare’s overall functionality, efficiency, and usability. To this end, measures of effectiveness, efficiency and user satisfaction were captured during usability testing and are discussed in detail later in this report.

METHOD

A total of ten participants were tested on the electronic health record under test (myCare iMedicWare V8.1). Participants included in this test were 2 ophthalmologists, 1 optometrist, and 5 ophthalmic technicians, 1 administrator/technician, and 1 front desk staff member. Participants were recruited by iMedicWare and were not compensated for their time. All participants are current users of iMedicWare. None of the participants were iMedicWare employees. All received the same orientation with V8.1 as all users will receive when they start using this new version of myCare iMedicWare.

The following is a table of participants by characteristics including demographics, professional experience, computing experience and user needs for assistive technology. Participant names were replaced with participant IDs so that an individual's data cannot be tied back to individual identities.

TABLE 2

ID	Gender	Age	Education	Role	Prof Experience	Computer Experience	EHR Experience
1	M	70-79	MD	Ophthalmologist	360	240	36
2	F	30-39	Masters	Administrator	120	360	36
3	F	30-39	HS	Technician	96	360	36
4	F	40-49	HS	Technician	204	204	36
5	F	30-39	HS	Front Office/T	72	204	12
6	F	30-39	HS	Technician	96	96	12
7	F	50-59	BS	Technician	244	120	36

8	F	60-69	BS	Technician/Adm	480	360	60
9	M	60-69	MD	Ophthalmologist	384	240	60
10	M	60-69	OD	Optometrist	420	360	60

Participants were scheduled for 45 min. sessions. Following the sessions, the system was then reset for the next participant.

STUDY DESIGN

Overall, the objective of this test was to uncover areas where the application performed well – that is, effectively, efficiently, and with user satisfaction as well as areas where the application failed to meet the needs of the participants. The data from this test may serve as a baseline for future tests for an updated version of the same electronic health record and/or comparison with other electronic health records, provided the same tasks are used. In short, this testing serves as both a means to record or benchmark current usability, as well as to identify areas where improvements must be made.

During the usability test, participants interacted with myCare IMedicWare V8.1 only. Each participant used the system in the same manner and were provided with the same instructions. The system was evaluated for effectiveness, efficiency, and satisfaction as defined by the following measures that were collected and analyzed for each participant:

- Number of tasks successfully completed within the allotted time without assistance
- Time to complete the tasks
- Number and types of errors
- Path deviations
- Participants comments
- Participants satisfaction ratings of the system

Additional information about the various measures can be found in the section on usability metrics.

TASKS

42 tasks were constructed that would be realistic and representative of activities a user might perform with this electronic health record. These tasks included: entering a patient problem list, checking if a patient had any allergies, finding results of recent lab work, checking and recording ophthalmic information, and others. Tasks were selected based on the requirements of a CMS and ONC-ATB script and associated guidelines, and *were prioritized in accordance with the risk of user error as follows:*

1. *CPOE*
2. *Medication Interactions*
 - a. *Drug Drug Interaction*
 - b. *Drug Allergy Interaction*
3. *Adding Patient Medications*
4. *Adding Patient Allergies*

5. *Clinical Decision Making*
6. *Clinical Information Reconciliation*

Electronic prescribing was not tested as it had been tested and validated previously by our channel partner Change Healthcare.

Test procedures are described in detail in Appendix C.

TEST ENVIRONMENT

myCare iMedicWare (the electronic health record under test) is typically used by ophthalmologists, optometrists and opticians in an office setting.

The tests described in this report were conducted in two physician's offices using Windows based computers running Windows 10, Microsoft Edge or Google Chrome, a 17-21 inch monitor, and a broadband internet connection.

Subjects logged on to myCare iMedicWare V8.1 using a login and password supplied by the test proctor. The look and feel of the application that they were tested on (myCare iMedicWare V8.1) had been completely revised from the application that test subjects have been currently using (iDOC R7 v6.3.7). However basic functionality remained essentially the same. Because of the changes in display and the new menu system, performance was not as good as with their old system as users had minimal time to familiarize themselves with the new system architecture. System performance – response time – was representative to what actual users would experience in a field implementation using a cloud based server.

Participants were instructed not to change any of the default settings.

PROCEDURES

Testing was performed by the clinical director of iMedicWare who served as the test proctor for all testing. The clinical director has had extensive experience in product development, user training, product use as well as usability testing. The test proctor moderated the session administering instructions and tasks. The data logger monitored task times, obtained post task rating data and took notes on participant comments.

Participants were instructed to perform the tasks:

1. As quickly as possible
2. Without assistance. The proctor could give immaterial guidance and clarification on tasks, but not instructions on use.
3. Without using a think aloud technique.

For each task, the participants were given a written copy of the task. Task timing began once the test proctor finished reading the question. The task time was stopped once the participant indicated they had successfully completed the task. Scoring is discussed below.

Following the session, the administrator gave each participant a post-test questionnaire (see Appendix D) and thanked each individual for their participation.

Participants' demographic information, task success rate, time on task, errors, deviations, verbal responses, and post-test questionnaire were recorded in the attached spreadsheet.

TEST FORMS AND TOOLS

During the usability test, various documents and instruments were used, including a moderator's guide and a post-test questionnaire. The moderator's guide was made to capture required data. Each participant received a detailed list of instructions that included screenshots of the tasks to be performed. After receiving initial instructions and being shown how each task was to be performed, the participants were encouraged to review the instruction sheet before beginning each task.

PARTICIPANTS INSTRUCTIONS

The test Proctor read the following instructions to each participant:

“Thank you for participating in this study. Your input is very important. Our session today will last about 30 minutes. During that time you will use the newest version of myCare IMedicWare V8.1 which has been modified to meet the requirements of meaningful use Stage 3. I will ask you to complete a few tasks using this system and then to answer some questions. You should complete tasks as quickly as possible making as few errors as possible. Please try to complete the tasks on your own following the instructions very closely. Please note that we are not testing you, we are testing the system, therefore if you have difficulty all this means is that something needs to be improved in the system. I will be here in case you need specific help, but I am not able to give instructions or provide you information how to use the application. Overall we are interested in how easy or how difficult this system is to use, what changes would be useful to you and how we can improve the overall functionality. All the information that you provide will be kept confidential and your name will not be associated with your comments at any time. Should you feel it necessary, you are able to withdraw at any time during the testing.”

Following the procedural instructions, participants were shown the new updated electronic health record and as their first task were given 5 min. to explore the system and make comments. Once this task was complete the test proctor gave the following instructions:

“For each task, I will read the description to you, demonstrate exactly what to do and say begin. At that point, please perform the task and say done when you believe you have successfully completed the task. I will ask you your impressions about the task when you are done.”

Participants were tested in 7 categories detailed above.

USABILITY METRICS

According to the *NIST Guide to the Processes Approach* for improving the usability of electronic health records, electronic health records should support a process that provides a high level of usability for all users. The goal is for users to interact with the system effectively, efficiently, and with an acceptable level of satisfaction. To this end metrics for effectiveness, efficiency and user satisfaction were captured during usability testing.

The goals of the test were to assess:

1. Effectiveness of myCare iMedicWare by measuring participant success rates and errors.
2. Efficiency of myCare iMedicWare by measuring the average task time and path deviations.
3. Satisfaction with myCare iMedicWare by measuring ease of use settings.

For reporting purposes, we categorized errors into slips and mistakes.

Slips are defined as an unintended action made while trying to do something on an interface, even though the goal is correct (e.g., a typo). A mistake is defined as an incorrect goal, even if that goal was accomplished.

Examples of slips include

1. Mistyping a password
2. Accidentally clicking an adjacent link
3. Accidentally starting to select the wrong medication

Here are examples of some mistakes

1. Typing first and last name in a first name field
2. Entering social security number in a DOB field
3. Actually selecting the wrong medication

When observing users in a usability test, the proctor recorded every time an error occurred, even if it was the same error by the same user on the same task. In general, most errors were slips – for example, a user would accidentally select *meds* when they meant to select *lab*, the icon next to *meds*. Some of the errors were mistakes, because users were seeing the software for the first time and had had no experience performing some of the tasks (e.g., performing medication reconciliation).

DATA SCORING METHODOLOGY

EFFECTIVENESS - TASK SUCCESS

A task was counted as a success if a participant was able to achieve the correct outcome, without assistance, within the time allotted on a per test basis.

The total number of successes were calculated for each task and then divided by the total number of times that task was attempted. The results are provided as a percentage.

The observer recorded the time each participant took to complete each task. These results were recorded and are shown in Tables 1 and 3.

Optimal task performance time, as benchmarked by expert performance under realistic conditions, is recorded when constructing tasks. Target test times were operationally defined by taking multiple measures of optimal performance as performed by one of iMedicWare's trainers and multiplied by 1.50.

EFFECTIVENESS - TASK FAILURES

If the participant abandoned the task, did not reach the correct answer or performed incorrectly or did not reach the end of the allotted time for successful completion, the task was counted as a failure. No task times were taken for errors.

The total number of errors were calculated for each task and then divided by the total number of times that task was attempted.

On a quantitative level, an enumeration of errors and error type was also collected.

EFFICIENCY - TASK DEVIATIONS

The participants' path through the application was recorded. Deviations that might occur at the participant level included the user going to a wrong screen, clicking an incorrect menu item, following an incorrect link, or interacting incorrectly with an on-screen control. This path was compared to the applicable path. The number of steps in the observed processes were divided by the number of optimal steps to provide ratio of path deviations.

Task deviations were also recorded as errors.

EFFICIENCY - TASK TIME

Each task was timed from when the test Proctor said begin until the participant said done. If he or she failed to say done the time was stopped when the participant stopped performing the task. Average time per task was calculated for each task. Variance measures (standard deviation) were also calculated.

SATISFACTION TASK RATING

Participants' subjective impression of the application's ease-of-use of was measured by administering both simple post-test questions as well as a post-session questionnaire. After each task, the participant was asked to rate the task overall on a scale of one (very difficult) to five (very easy). This data was then averaged across participants.

Common convention is that the average ratings for systems judged to be very easy to use should be 3.3 or above.

To measure participants' likability of myCare iMedicWare overall, the system team administered a system usability scale post-test questionnaire. Questions included: "I think I would like to use the

system frequently”, “I thought the system was easy to use”, and “I would imagine that most people would learn to use the system very quickly.” (See Appendix A).

RESULTS

DATA ANALYSIS AND REPORTING

The results of the usability test were calculated according to the methods specified in the usability metrics section above. No participants failed to follow instructions and no participants were excluded from the results.

Usability testing results for myCare iMedicWare are detailed below. The result should be seen in light of the objective goals outlined in the study design noted above.

Following is a summary of the performance and rating data collected on myCare iMedicWare version v8.1

TABLE 3

Measure Task	N	Task Success	Path Deviation	Task Time	Task Time	Errors	Task Ratings 1-5 (5=Easy)
		Mean	Deviation Observed/Optimal	Mean (sec)	Standard Deviation	Mean %	Mean
Record Medication Order	10	100%	1.3	16.88	8.05	1.5	5.0
Change Medication Order	10	100%	1.0	13.46	3.83	0	5.0
Review Medication Order	10	100%	1.0	5.59	2.21	0	5.0
Record Lab Order	10	100%	1.3	4.60	1.57	5	5.0
Change Lab Order	10	100%	1.0	5.41	1.15	0	5.0
Review Lab Order	10	100%	1.0	7.14	1.29	0	5.0
Record Radiology Order	10	100%	1.0	4.54	2.26	0	5.0
Change Radiology Order	10	100%	1.0	3.70	1.25	0	5.0
Review Radiology Order	10	100%	1.0	6.75	1.09	0	5.0
Adjust Severity Level DDDA	10	100%	1.7	78.37	8.06	0	5.0
Drug Drug Interaction	10	100%	1.0	28.36	7.27	2.5	5.0
Drug Allergy Interaction	10	100%	1.0	11.03	2.75	1	4.3
Record Demographics	10	100%	1.9	74.58	22.64	5.5	4.2
Change Demographics	10	100%	1.0	18.70	4.35	3	4.9
Access Demographics	10	100%	1.1	14.25	11.17	0	5.0
Record Problem List	10	100%	1.4	22.75	15.10	6.6	5.0
Change Problem List	10	100%	1.2	11.15	2.72	1.3	5.0
Review Problem List	10	100%	1.0	13.50	3.12	0	5.0
Review Problem List History	10	100%	1.0	20.03	2.35	0	4.4
Record Current Medications	10	100%	1.2	26.64	7.32	5	4.1
Change Current Medications	10	100%	1.0	21.73	9.92	2.5	4.6
Review Current Medications	10	100%	1.0	13.24	1.94	0	4.5
Review Historical Medications	10	100%	1.0	17.80	4.62	0	4.8
Record Allergies	10	100%	1.0	22.46	4.94	0	5.0
Change Allergy List	10	100%	1.0	27.08	4.04	0	4.3
Review Allergy List	10	100%	1.0	7.29	1.05	0	5.0
Review Historical Allergy List	10	100%	1.0	8.79	2.26	0	4.8

Trigger Problem List CDSI	10	100%	1.0	56.02	12.68	3.3	5.0
Trigger Medication CDSK	10	100%	1.0	40.19	14.42	0	5.0
Trigger Allergies CDSI	10	100%	1.0	29.42	5.02	0	5.0
Trigger Demographic CDSI	10	100%	1.0	20.67	3.73	0	5.0
Trigger Lab CDSI	10	100%	1.4	51.78	26.45	0	4.0
Trigger Vital Sign CDSI	10	100%	1.1	22.86	4.74	0	5.0
Trigger Combination CDSI	10	100%	1.0	57.58	20.18	0	5.0
Trigger CDSI based on CCDA	10	100%	1.4	57.29	8.90	5	4.5
View CDSI References	10	100%	1.0	30.78	14.60	0	5.0
Record UDI	10	100%	1.0	36.99	6.80	0	4.8
Change Status for UDI	10	100%	1.0	5.71	0.79	0	5.0
Access UDI List	10	100%	1.0	17.28	3.56	0	5.0
Reconcile Meds from CCDA	10	100%	1.3	30.58	9.52	3	5.0
Reconcile Allergies from CCDA	10	100%	1.0	18.16	3.22	0	5.0
Reconcile Problems from CCDA	10	100%	1.0	15.95	2.42	0	5.0

Notes:

1. Deviations recorded were the total for all participants
2. Errors were all noted as minor
3. Errors recorded in the table above = total errors for all participants/10
4. Technicians generally deviated from the optimal path more often because of their lack of familiarity with CPOE.

SYSTEM USABILITY SCALE RESULTS

The results from the SUS (System Usability Scale) scores the objective satisfaction with the system based on performance with these tasks tested. Broadly interpreted, scores under 60 represent systems with poor usability while usability scores over 80 would be considered above average.

myCare iMedicWare scored a 90.825 on the System Usability Test.

DISCUSSION OF FINDINGS

EFFECTIVENESS

Task Success

Participants were able to achieve the correct outcome without assistance within the time allotted for each task for all tasks. The total number of successes were calculated for each task and then divided by the total number of times that task was attempted. The results are provided as a percentage.

TOTAL SUCCESS RATIO: 100%

Optimal Efficiency Calculation

We then calculated optimal efficiency by taking the observed task times and dividing the optimal time for each task and then aggregating it across all tasks.

To obtain the optimal task performance time, we measured the time it took one of the most experienced trainers to complete each of these tasks. As the trainer knew the system much better than any of the participants, we multiplied his or her time by 1.5. We then calculated the optimal efficiency by taking the observed task times divided by the optimal time for each task as a measure of optimal efficiency, and aggregating the results.

OPTIMAL EFFICIENCY = 1.28 +/- 0.12

Task Failures

1. No participant abandoned any task,
2. No participant did any not reach the correct answer
3. No participant was unable to perform any task
4. No participant exceeded the allotted time

TASK FAILURES = 0

EFFICIENCY:

Task Deviations

The participant's path through the application was observed and compared to the optimal path noted when calculating the optimal time. Deviations were noted when a participant went to a wrong screen, clicked an incorrect menu item, followed an incorrect link or interacted incorrectly with an on-screen control. These path deviations were also counted as errors.

The number of steps in the observed path was divided by the number of optimal steps to provide a ratio of path deviation.

PATH DEVIATION FOR ALL PARTICIPANTS IN THE STUDY = 0.14

SATISFACTION:

Participants in general were very satisfied in the way the software performed. They especially commented positively on the responsiveness of the software, the speed at which they could complete the tasks. They especially liked the fact that they did not have to save in most cases when moving from field to field or tab to tab.

Finally, in response to the last question on the user questionnaire - all users would recommend this

software to their colleagues.

MAJOR TEST FINDINGS

The major findings of this study confirm what the developers of myCare iMedicWare EHR have observed from previous versions -- that the software is very easy to use, and once users are shown how to interact with the system, they are able to grasp the concepts quickly and can execute the tasks required of a complete ophthalmological exam.

Minimal changes were necessary to implement and meet Stage 3 requirements. Four significant changes in work flow were noted:

1. The ability to easily integrate transition of care CCDA into the daily workflow.
2. The ability to directly take a CCDA from a new patient and use that data to create a patient chart and to easily and seamlessly incorporate their medications, allergies and problem list into the chart.
3. The ability to customize the clinical chart to individual provider's workflow. This was especially appreciated by the subspecialty ophthalmologists.
4. The addition of a new landing page which consolidates information from multiple locations in the medical record so providers don't have to search for their schedule, messages, secure messages, new tests, prescription refills.

While this is not new to myCare iMedicWare v 8.1, nonetheless users commented and appreciated the functionality that allows them to view drug drug and drug allergy interactions prior to completing a computerized physician order. This process takes place automatically within the software requiring no user intervention other than starting to order a medication and does not require opening Emdeon as a separate step. This significantly speeds up this process and significantly improving safety and usability.

RISK ANALYSIS

As noted above, errors can be classified into two types -- slips and mistakes. Slips occur when a user starts to select a wrong link, and a mistake is when the user does something that could have an adverse clinical impact, such as recording the wrong data or selecting an incorrect medication.

All errors noted in this study were classified as slips, but they could have easily been converted to mistakes in a busy clinical setting. The majority of these which could have had clinical consequences were caused by the current Emdeon interface, which presents multiple medications to select from when ordering medications or recording allergies.

We are working on several levels to reduce these types of errors

1. We have developed new training materials so that users enter the entire name of the drug that they are searching on. By doing this, the users are less likely to select the wrong drug.
2. Now that we have implemented Infobuttons - we now have the users reconfirm that the drug that they have selected is the drug they meant to select through the use of the FDB database.

Other errors noted were mistyping a name or a diagnosis. Several ways we now use to reduce these errors include:

1. Additional staff training
2. Use of pre-populated databases with correct names and spellings.

One change that caused problems was users not understanding how to merge and consolidate transitions of care summaries received from other practices. We are studying the current interface and will carefully observe the issues users have adapting to the new release. If necessary, we may choose to redesign the user interface to make it more intuitive. The addition of online support should also help reduce these types of errors.

There are multiple built-in safeguards to reduce error in myCare iMedicWare: an intuitive interface; clearly labeled icons; drug/drug and drug/allergy interaction information; and the ability to look up information on preferred practice patterns while physicians are interacting with a patient. All these safeguards should significantly reduce the chance of user error.

Finally, iMedicWare constantly monitors their help desk tickets, as well as onsite feedback at different practices to see how users interact with our software. User suggestions are carefully monitored. With this information, we can make changes to improve usability and reduce users error.

AREAS FOR IMPROVEMENT

While users overall were very satisfied with the work flow and how easy it was to grasp how to use the new software, there were several areas where the users felt the work flow could be improved. These included the following:

1. The addition of online help documentation
2. Making the work flow for medication reconciliation more intuitive
3. Increase background contrast
4. Eliminate scrolling for workview chart

SUMMARY

Testing confirmed that myCare iMedicWare usability is excellent. While there were a few areas that could be more tightly integrated to improve the overall work flow the metrics show that users can use the system efficiently and effectively.

APPENDICES

APPENDIX A

SYSTEM USABILITY SCALE QUESTIONNAIRE

	Strongly disagree				Strongly agree
1. I think that I would like to use this system frequently	<input type="checkbox"/>				
	1	2	3	4	5
2. I found the system unnecessarily complex	<input type="checkbox"/>				
	1	2	3	4	5
3. I thought the system was easy to use	<input type="checkbox"/>				
	1	2	3	4	5
4. I think that I would need the support of a technical person to be able to use this system	<input type="checkbox"/>				
	1	2	3	4	5
5. I found the various functions in this system were well integrated	<input type="checkbox"/>				
	1	2	3	4	5
6. I thought there was too much inconsistency in this system	<input type="checkbox"/>				
	1	2	3	4	5
7. I would imagine that most people would learn to use this system very quickly	<input type="checkbox"/>				
	1	2	3	4	5
8. I found the system very cumbersome to use	<input type="checkbox"/>				
	1	2	3	4	5
9. I felt very confident using the system	<input type="checkbox"/>				
	1	2	3	4	5
10. I needed to learn a lot of things before I could get going with this system	<input type="checkbox"/>				
	1	2	3	4	5

In 1996, Brooke published a “low cost usability scale that can be used for global assessments of system usability” known as the System Usability Scale or SUS. Computation of the SUS score can be found in Brooke’s paper, in at <http://www.usabilitynet.org/trump/documents/Suschapt.doc> or in Tullis and Albert (2008).

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APPENDIX B: PARTICIPANT DEMOGRAPHICS

ID	Gender	Age	Education	Role	Prof Experience	Computer Experience	EHR Experience
1	M	70-79	MD	Ophthalmologist	360	240	36
2	F	30-39	Masters	Administrator	120	360	36
3	F	30-39	HS	Technician	96	360	36
4	F	40-49	HS	Technician	204	204	36
5	F	30-39	HS	Front Office/T	72	204	12
6	F	30-39	HS	Technician	96	96	12
7	F	50-59	BS	Technician	244	120	36
8	F	60-69	BS	Technician/Adm	480	360	60
9	M	60-69	MD	Ophthalmologist	384	240	60
10	M	60-69	OD	Optometrist	420	360	60

APPENDIX C: MODERATORS GUIDE

INTRODUCTION/INSTRUCTIONS

Thank you for participating in this test/study that we are performing as part of the requirements of ONC 2015 (Stage 3) certification. You will be using myCare IMedicWare V8.1 - our latest release that will that has been designed to meet all Stage 3 requirements. Most of the software you will be familiar with but some you will not. Our test proctors will be demonstrating how to use any features you may not be familiar with. If you have any questions - please do not hesitate to ask them to demonstrate any feature that you are not sure how to use.

The test proctor will ask you to complete a few tasks using this system and then to answer some questions about the tasks you have completed. We are interested in how difficult or how easy the system is to use and how you think it can be improved. You will be asked to complete the tasks on your own trying to perform them as quickly as possible with the fewest errors. Do not do anything more than is asked. If you get lost, just stop and state that you cannot finish the task. Please save any detailed comments until the end of the session - so we can discuss them at length.

The tasks you will be asked to perform are tasks that the Office of the National Coordinator requires us to ask you to do and are not necessarily indicative of what you might do in your daily use of the system. All EHR that are seeking certification are required to test their system usability in the same way.

Prior to testing

1. Internet connectivity was checked
2. Software was checked to make sure it was functioning properly

Prior to testing each participant

1. Application was reset
2. Any data left from previous test was deleted
3. All patient data from previous tests was removed
4. New patient data was appropriate to each test was inserted

Prior to each task

1. Stopwatch was reset
2. Participant was informed as to what the next test would be
3. Application was reset to work view screen

After each task

1. Proctor recorded timing results
2. Proctor recorded any comments participants made during the test
3. Proctor completed work sheet noting:
 - a. Success data
 - b. Task time
 - c. Optimal path information
 - d. Ratings

After all testing was completed

1. Proctor reset application
2. Proctor erased all data entered during the test
3. Proctor recorded any comments participants made

TESTING PROTOCOL

TESTING WAS DONE IN THE FOLLOWING ORDER:

1. Demographics
2. Patient Medications
3. Patient Allergies
4. Problem List
5. CPOE Medications
6. CPOE Laboratory Tests
7. CPOE Imaging (Radiology)
8. Drug – Drug Interactions
9. Drug – Allergy Interactions
10. Clinical Decision Support
11. Implantable Device List
12. Clinical Information Reconciliation

a.1 CPOE PATIENT MEDICATIONS

Task 1 Record Medications

Mr. Test, an established patient comes to your office for his eye exam. He has been diagnosed with blepharitis. Using CPOE, order Blephamide 1 gtt OU QID.

Task 2 Change Medication

Mr. Test blepharitis upon return to the office has significantly improved. Provider decides to reduce his medication. Using CPOE change Blephamide from 1 gtt OU QID to 1 gtt BID.

Task 3 Display Changed Medication Order

Pharmacy calls to confirm medication order. Check Mr. Test's chart to confirm his medication order.

a.2 CPOE LABORATORY

Task 1 Order Laboratory Test

Provider decides to culture eyelid. Using CPOE to order culture of right eyelid.

Task 2 Change Laboratory Test Order

Provider decides he would like to have both eyelids cultured. Using CPOE, change order to culture both eyelids.

Task 3 Display changed laboratory order

Provider wants to make sure that new order was placed. Open chart to review current laboratory orders

a.3 CPOE IMAGING

Task 1 Order Imaging Study

Mr. Test is complaining of decreased vision OD. Provider decides he would like to have an OCT of the macula. Using CPOE, order OCT of the macula OD.

Task 2 Change Imaging Study

Provider reviews patients chart and decides that vision may be decreased because of the high degree of astigmatism the patient is manifesting. He decides to change the order from an OCT to corneal topography OD. Using CPOE change the order from OCT to corneal topography OD.

Task 3 Review Imaging Study

Provider would like to confirm that the order was changed. Open Mr. Test's chart to confirm that the order was actually changed to Corneal Topography OD.

a.4 DRUG-DRUG DRUG-ALLERGY TESTING

As part of your regular routine, you will be checking to make sure that none of the medications that you are ordering will produce a drug or allergic reaction.

This test consists of three parts

1. Testing for a drug drug interaction when a new medication is prescribed
2. Testing for a drug allergy interaction when a new medication is prescribed
3. Adjusting severity of displayed drug drug interaction

Task 1 Adjust severity of displayed drug-drug interaction

1. Go to Admin/eRX Preferences/CPOE DUR Severity Level
2. Set to Severe

Task 2 Trigger a drug drug interaction using CPOE.

1. Using CPOE Order the following medications
 - a. Verapamil
 - i. Show drug drug interaction alert
 - b. Synthroid
 - i. Show drug drug interaction alert

Task 3 Trigger a drug allergy interaction using CPOE

1. Using CPOE order Pencillin
2. Show drug allergy alert

a.5 DEMOGRAPHICS

TASK 1: Enter Patient Information

A new patient has called to make an appointment for an eye examination. He gives you the following information which you will enter into the chart:

1. Name: John Test
2. Date of Birth: 1/1/1990
3. Phone Number 303-777-1212
4. Birth Sex: Male
5. Sexual Orientation: Straight
6. Gender Identity: Male
7. Race: White
8. Ethnicity: American

Task 2 Change Demographics

Mr. Test calls to say that he now has a cell phone. Add his new cell phone number 303-808-8888 to his chart. Save the information

Task 3 Access Demographics:

Mrs. Test calls to make sure that his record reflects his new cell phone number. Search for Mr. Test's record and check to see if the phone number she supplies you

a.6 PROBLEM LIST

Task 1 Record a problem to the problem list

Mr. Test arrives at the office for his eye examination. Initial examination reveals the following problems:

1. Primary open angle glaucoma, both eyes, mild
2. Diabetic Mellitus Type 2, no retinopathy
3. Blepharitis, right upper lid, right lower lid, left upper lid, left lower lid
4. Nuclear sclerosis, visually significant left eye

Taks 2 Change a problem on the problem list

After fundus photography was performed, the provider upon looking at the photograph notices that the patient has mild NPDR in both eyes without macular edema.

Task 3 Display the active problem list

Mr. Test's PCP calls later that day and would like to know the results of his examination. Look up Mr. Test's chart, go to patient general health and relate to her what the provider found today.

Taks 4 Display the historical problem list

The PCP asks what have you found in the past. While in the same screen you can relate all the ophthalmological findings that had been found in the past.

a.7 MEDICATION LIST

Task 1 Record a medication to the medication list

The technician working up Mr. Test asks him what medications he is taking. He tells him that he is taking the following medications:

1. Blephamide 1 gtt OU QID
2. Xalatan 1 gtt OU HS
3. Atenolol 50 mgm QD

Task 2 Change a medication on the medication list

Mrs. Test who is also there reminds Mr. Test that at the last visit, the PCP changed his Atenolol to 100 mgm QD. The appropriate change in the chart is made.

Task 3 Display the active medication list

When the ophthalmologist comes in the room he quickly checks the medication list to see what medications the patient is taking (patient at a glance)

Task 4 Display the historical medication list

At this point because the patient general health screen lists all patients complete medical history, the ophthalmologist can review not only the current medications the patient is on but also is able to see the entire medication history

a.8 MEDICATION ALLERGY LIST

Task 1 Record a medication history

While taking Mr. Test's history, the technician asks what medications he is on. He tells him that he is allergic to:

1. Bactrim which causes diarrhea
2. Penicillin which gives him diarrhea and makes him itch

Task 2 Change a medication allergy

Mrs. Test reminds him that his PCP said he wasn't allergic to Bactrim that this is just a side effect of the medication. The technician deletes Bactrim from the allergy list

Task 3 Display the active medication allergy list

When the ophthalmologist arrives, he quickly checks the allergy list in the patient general history.

Task 4 Display the historical medication allergy list

While there he decides to check to see to see if there have been any changes to the patients allergy list. (Patient General Health/Allergies/Filter All).

a.9 CLINICAL DECISION SUPPORT

1. You will be asked to enter a number of clinical findings. Sometimes after entering the finding an alert will pop up. PLEASE TELL ME WHAT THAT ALERT SAYS.
2. Task 1 Problem List Interventions
 - a. Add Ocular Hypertension to the problem list
 - b. Now go to Work View and enter IOP of TA 24 OU
 - c. What alert appears?
3. Task 2 Medication List Interventions
 - a. Add Atenolol to medication list
 - b. Save
 - c. What alert appears?
4. Task 3 Medication Allergy List Interventions
 - a. Add Sulfasalazine to medication allergy list
 - b. Save
 - c. What alert appears?
5. Task 4 Demographics Interventions
 - a. Add to patient demographics race = Black or African American
 - b. Save
 - c. What alert appears
6. Task 5 Lab Tests and Results Interventions
 - a. Go to Med Hx, Lab
 - b. Add LDL = 300
 - c. Save
 - d. What alert appears
7. Task 6 Vital Signs Interventions
 - a. Go to Med Hx/VS
 - b. Enter BP = 240/140
 - c. Save
 - d. What alert appears
8. Task 7 Combination of at least 2 elements above

- a. Go to Demographics – enter African American
 - b. Go to IOP – enter TA 25
 - c. Save
 - d. What alert appears?
9. Task 9 Trigger the CDS interventions/resources from CCDA information
 - a. SCP/Ocular Hypertension
 - b. Go to User Group
 - c. Pull down menu - Check all
10. Task 10 Access bibliographic information for ocular hypertension including resource material for data elements in the problem list and medication list
 - a. Go to site care plan
 - b. Select sulfa allergy
 - c. Click on reference box

a.14 IMPLANTABLE DEVICE LIST

Mr. Test tells you that he has an implantable device and gives you a card with the following number on it:

+B066000325011NS1/\$\$420020216LOT123456789012345/SXYZ456789012345678/16D20130202C1

1. Record UDI
 - a. Copy this number into the chart (Medical History/Surgery/UID).
 - b. Click detail
 - c. Then click insert and then save.
2. Change Status of the UDI
 - a. Change status of UDI from Active to Inactive
3. Access UDI device description, identifiers and attributes
 - a. Click on UDI Number
 - b. Click on details
 - c.** Review details of the device including Serial Number, Lot Number and any available safety information

b.2 CLINICAL INFORMATION RECONCILIATION

After Mr. Test’s visit today, the ophthalmologist received a summary of care document sent by direct mail about Mr. Test from his PCP. To complete the record, you will incorporate the findings from the PCP into the patients record.

Here are the tasks you will be performing

- Reconcile patient’s active medication list with another source
- Reconcile patient’s active problem list with another source
- Reconcile patient’s active medication allergy list with another source

Task 1 Incorporate CCDA and reconcile medications

1. Click on user (physician Console) console
2. The click on import CCDA
3. Click Browse. In the list that appears select Mr. Test's name and upload the file
4. The import medical history screen will appear with the current list of medications that Mr. Test has been prescribed by his PCP
5. Review the list for accuracy then select the patients chart information and then select PCP medication list. Consolidate the two lists and then merge them.
6. If successful, you will receive a message import successful.

Task 2 Incorporate CCDA and reconcile medication allergies

1. Now click on the allergies tab
2. Follow the same procedure to import the patient allergy list

Task 3 – Incorporate CCDA and consolidate and merge two problem lists

1. Finally click on Problem List
2. Merge and consolidate the two problem list as appropriate

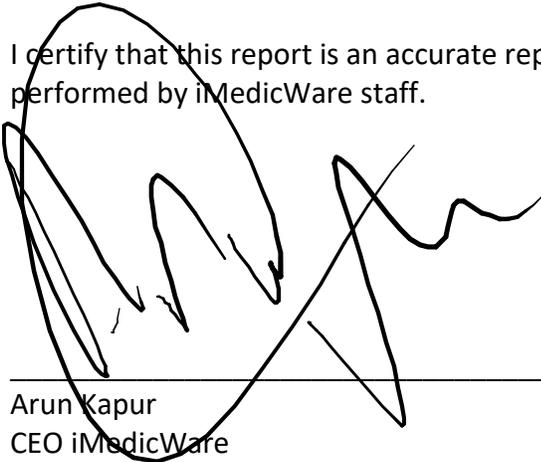
APPENDIX D

POST TEST QUESTIONNAIRE

1. What was your overall impression of this system?
2. What was your overall impression of this system?
3. What aspects of this system did you like most?
4. What aspects of this system did you like least?
5. Were there features you were surprised to see?
6. What features did you expect to encounter, but did not see. That is, is there anything that is missing in the application?
7. Would you recommend this system to your colleagues?

ATTESTATION

I certify that this report is an accurate representation of the usability testing that was performed by iMedicWare staff.

A large, stylized handwritten signature in black ink, appearing to read 'Arun Kapur', is written over a horizontal line. The signature is highly fluid and somewhat abstract.

12/6/17

Arun Kapur
CEO iMedicWare

Date