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# EHR USABILITY TEST REPORT

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## **MDVision PM EMR, Version 5.1**

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

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# Table of Contents

<b>1. Executive Summary</b> .....	4
1.1 Major findings .....	5
1.2 Areas for Improvement .....	5
<b>2. Introduction</b> .....	6
<b>3. Method</b> .....	6
3.1 Participants .....	6
3.2 Study Design .....	7
3.3 Tasks .....	8
3.4 Procedure .....	10
3.5 Test Location .....	12
3.10 Data Scoring .....	14
<b>4. Results</b> .....	15
4.1 Data Analysis and Reporting .....	15
4.2 Discussion of Findings .....	17
4.2.1 Task 1: Access, record and modify Medication Orders .....	17
4.2.2 Task 2: Access, record and modify Lab Orders .....	17
4.2.3 Task 3: Access, record and modify Radiology Orders .....	17
4.2.4 Task 4: Record, Review and Modify Medication Allergy List .....	18
4.2.5 Task 5: Record Medication Order and Drug-Drug Interaction .....	18
4.2.6 Task 6: Record Medication Order and Drug-Allergy Interaction .....	18
4.2.7 Task 7: Record and Modify Demographics .....	19
4.2.8 Task 8: Access, Record and Modify Problems .....	19
4.2.9 Task 9: Record and modify a Clinical Decision Support Rule .....	19
4.2.10 Task 10: Trigger a Clinical Decision Support Rule .....	19
4.2.11 Task 11: Add an Implantable Device .....	20
4.2.12 Task 12: Inactivate an Implantable Device .....	20

4.2.13 Task13: Clinical Information Reconciliation and Incorporation .....	20
4.2.14 Task14: E-prescribe a Medicine.....	20
Appendices .....	21
Appendix 1: DEMOGRAPHIC INFORMATION FORM.....	21
Appendix 2: SYSTEM USABILITY SCALE QUESTIONNAIRE.....	24

# 1. Executive Summary

A usability test of MDVision PM EMR 5.1 was conducted in November 2017 at MDVision headquarters, 85 Harristown Road, Glen Rock, NJ 07452. The purpose of this study was to test and validate the usability of the current user interface, and provide evidence of usability in the EHR Under Test (EHRUT).

During the usability test, a total of 12 healthcare personnel including physicians and administrative staff members matching the target demographic criteria served as participants and used MDVision PM EMR 5.1 in simulated, but representative tasks.

This study collected performance data 14 tasks typically conducted on an EHR:

- Access, Record and Modify Medication Orders
- Access, Record and Modify Lab Orders
- Access, Record and Modify Radiology Orders
- Record, Review and Modify Medication Allergy List
- Record and Modify Demographics information
- Access, Record and Modify Problems
- Record, Modify a Clinical Decision Support Rule
- Trigger a Clinical Decision Support Rule
- Add an Implantable Device
- Inactivate an Implantable Device
- Record Medication Order and Drug - Drug Interaction
- Record Medication Order and Drug - Allergy Interaction
- Clinical Information Reconciliation and Incorporation
- E-Prescribe a medication

During the 50 minutes one-on-one usability test, each participant was greeted by the administrator and asked to review and sign an informed consent; they were instructed that they could withdraw at any time. Most of the participants that were part of this activity had no or little prior experience with the software. The administrator introduced the test, and instructed participants to complete a series of tasks (given one at a time) using the EHRUT. During the testing, the administrator timed the test and recorded user performance data electronically. The administrator did not give participants assistance in how to complete the task.

The following types of data were collected 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
- Participant's verbalizations
- Participant's satisfaction ratings of the system

All participant data was de-identified – no correspondence could be made from the identity of the participant to the data collected. Following the conclusion of the testing, participants were asked to complete a post-test questionnaire to rate the tasks and entire application. None of the participants were compensated for their participation as they volunteered for this activity. Various recommended metrics, in accordance with the examples set forth in the NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records, were used to evaluate the usability of the EHRUT.

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be: 85.71%. In addition to the performance data, the following qualitative observations were made:

### 1.1 Major findings

The participants found the MDVision PM EMR (5.1) to be user friendly, straightforward and efficient. The participants completed the task with very low failure rate and less time. The feedback of participants helped us in analyzing the effectiveness of the application usability.

### 1.2 Areas for Improvement

Some modules can be improved by changing the user interface and introducing tool tips.

## 2. Introduction

The EHRUT for this study was MDVision PM EMR (5.1) Designed to present medical information to healthcare providers in ambulatory outpatient clinics. The EHRUT consists of Electronic Health records of Patient, Clinical Module, CCM, Smart Billing, Scheduling and Practice Management. The usability testing attempted to represent realistic exercises and conditions.

The purpose of this study was to test and validate the usability of the current user interface, and provide evidence of usability in the EHR Under Test (EHRUT). To this end, measures of effectiveness, efficiency and user satisfaction, such as Task success, Task time, Path Deviation, Time Deviation, Task Errors and Task Rating were captured during the usability testing.

The aim of testing this product was to evaluate the system current interface, design and functionalities in accordance to NISTIR 7741 usability standard. The characteristics that were considered during this process were product efficiency, level of user satisfaction and degree of effectiveness of system. We made a fair attempt to conduct the experiment so that results come out to be more realistic and valid.

## 3. Method

### 3.1 Participants

A total of 12 participants were tested on the EHRUT(s). Participants in the test were mostly clinical employees and configuration specialists. Participants were requested by MDVision CSD, LLC administration and volunteered for this test so they were not compensated in any way. In addition, participants had no direct connection to the development of or organization producing the EHRUT(s). Participants were not from the testing or supplier organization. Participants were given the opportunity to have the same orientation and level of training as the actual end users would have received.

Participants had a mix of backgrounds and demographic characteristics conforming to the recruitment screener. 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.

ID	Gender	Age	Education	Occupation /Role	Professional Experience	Computer Experience	Product Experience	Assistive Technology Needs
U1	Female	30-39	Bachelor's Degree	RN	120	228	72	No
U2	Female	30-39	Doctorate degree (e.g., MD, DNP, DMD, PhD)	Physician	72	240	48	No
U3	Male	40-49	Trade/technical/vocational training	Clinical Informatics Coordinator	49	210	37	No
U4	Male	30-39	Master's Degree	Office/IT Manager	60	240	32	No
U5	Male	30-39	Doctorate degree (e.g., MD, DNP, DMD, PhD)	Internal Medicine	70	180	60	No
U6	Male	20-29	Trade/technical/vocational training	Medical Assistant	29	130	20	No
U7	Female	50-59	Master's Degree	EHR Analyst	204	204	70	No
U8	Female	40-49	Doctorate degree (e.g., MD, DNP, DMD, PhD)	Pediatrician	240	310	140	No
U9	Male	30-39	Master's Degree	EMR Coordinator	95	175	95	No
U10	Male	50-59	Associate degree	LPN	370	120	4	No
U11	Male	20-29	Bachelor's Degree	RN	10	210	46	Yes
U12	Female	20-29	High school graduate, diploma or the equivalent (for example: GED)	Medical Assistant	6	240	48	No

All the participants were present for the usability test. The administrators scheduled participants for 50 minutes' session with 5-10 minutes break in between for debriefing.

### 3.2 Study Design

Overall, the objective of this test was to uncover areas where the application performed well – that is, effectively, efficiently, and with satisfaction – and 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 with an updated version of the same EHR and/or comparison with other EHRs provided the same tasks are used. In short, this testing serves as both a means to record or benchmark current usability, but also to identify areas where improvements must be made.

During the usability test, participants interacted with MDVision PM EMR Version 5.1. Each participant was provided with the same instructions. The system was evaluated for effectiveness, efficiency and satisfaction as defined by measures collected and analyzed for each participant:

- Number of tasks successfully completed within the allotted time without assistance= 153
- Time to complete the tasks = 30 minutes
- Number and types of errors = 15
- Path deviations (Average)= 1.25
- Participant's satisfaction ratings of the system = 85.71%

### 3.3 Tasks

A test patient “Mary” was created for this activity so that the tasks can easily be tracked and for better understanding of participants.

#### Task 1:

Access Mary’s current medication, which contains Lisinopril 30 mg. Remove Lisinopril from the list and prescribe a new medication to the patient for cough. The details of the drug to be added should be:

Drug Name	Amoxicillin 25mg
Frequency	3 days
Dose	2 tablets
Route	Oral

#### Task 2:

Create a lab order for investigating following in blood culture test.

#### Observations:

57021-8 CBC W Auto Differential panel in Blood

13005-4 2,4,5-Trichlorophenoxyacetate [Type] in Serum or Plasma

Modify Calcium carbonate measurement test with following details:

Diet: Fasting

Collected At: Office

#### Task 3:

Create a radiology order of brain needle biopsy to investigate brain tumor.

61750 - Needle biopsy, brain

#### Task 4:

Add amoxicillin medication allergy to list of Mary’s existing allergies list.

#### Details:

Allergy: Amoxicillin

Reaction: difficulty breathing

Medication: Amoxicillin 250mg

**Task 5:**

Prescribe amoxicillin to patient and view patient allergy alert.

**Task 6:**

Mary is taking Benadryl for cold and allergy. Create a Prescription for Vicodin with details mentioned below. An alert of Drug – Drug Interaction will appear as a warning of Drug-Drug interaction. Override the alert with the specified reason, “Can be overridden.” and prescribe the medication.

Drug Name	Vicodin 5-300mg
Frequency	3 days
Dose	2 tablets
Route	Oral

**Task 7:**

Edit patient race, ethnicity, preferred language, sexual orientation and gender identity.

Details:

Race: Black or African American

Ethnicity: Dominican

Preferred Language: English

Sexual Orientation: Straight or heterosexual

Gender Identity: Identifies as Female

**Task 8:**

Add, “Head ache” to Mary’s problems and remove “High blood pressure disorder” problem from patient problems list and mark it as resolved.

**Task 9:**

Create a CDS rule with following information:

Title: Test Rule

Rule Type: Medications

Gender: Female

Provider: Steve Austin

Medications: Lipitor (atorvastatin) 80mg

Alert Note: Proceed with caution

**Task 10:**

Trigger created CDS rule by adding Lipitor medication to Mary's visit. Override the alert by marking it done.

**Task 11:**

Add "left ventricular assist device" (LVAD) implantable device in left upper abdomen of Mary.

**Task 12:**

Deactivate "left ventricular assist device" (LVAD) implantable device from Mary's implantable devices list.

**Task 13:**

Mary previously went to Dr. John to some other practice. Now she is has come to visit Dr. Steve. Import CCDA file and reconcile her Medications, allergies and diagnosis.

**Task 14:**

Review CDS alert and E-prescribe required medication to Mary.

Tasks were selected as recommended by study objectives defined by NIST.

### 3.4 Procedure

Upon arrival, participants were greeted; their identity was verified and matched with a name on the participant schedule. Participants were then assigned a participant ID.

Each participant reviewed and signed an informed consent. A representative from the test team witnessed the participant's signature.

To ensure that the test ran smoothly, two staff members participated in this test, the usability administrator and the data logger. The usability testing staff conducting the test was experienced usability practitioners with approximately 4 to 25 years of experience from Medical and Postgraduate backgrounds. The administrator moderated the session including administering instructions and tasks. The administrator also monitored task times, obtained post-task rating data, and took notes on participant comments. A second person served as the data logger and took notes on task success, path deviations, number and type of errors, and comments.

Participants were instructed to perform the tasks:

- As quickly as possible making as few errors and deviations as possible.

- Without assistance; administrators were allowed to give immaterial guidance and clarification on tasks, but not instructions on use.
- Without using a think aloud technique

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

Participants demographics information, task success rate, time on task, errors and deviations were logged in excel spreadsheet provided by Drummond and was validated with Drummond SED checklist validator.

Following screenshot shows how the demographics were recorded for the participants.

Participant Identifier	Participant Gender	Participant Age	Participant Education	Participant Occupation/Role	Participant Professional Experience	Participant Computer Experience	Participant Product Experience
I1	Female	30-39	Bachelor's Degree	RN	120	228	72
I2	Female	30-39	Doctorate degree (e.g., MD, DNP, DMD, PhD)	Physician	72	240	48
I3	Male	40-49	Trade/technical/vocational training	Clinical Informatics Coordinator	49	210	37
I4	Male	30-39	Master's Degree	Office/IT Manager	60	240	32
I5	Male	30-39	Doctorate degree (e.g., MD, DNP, DMD, PhD)	Internal Medicine	70	180	60
I6	Male	20-29	Trade/technical/vocational training	Medical Assistant	29	130	20
I7	Female	50-59	Master's Degree	EHR Analyst	204	204	70
I8	Female	40-49	Doctorate degree (e.g., MD, DNP, DMD, PhD)	Pediatrician	240	310	140
I9	Male	30-39	Master's Degree	EMR Coordinator	95	175	95
I10	Male	50-59	Associate degree	LPN	370	120	5
I11	Male	20-29	Bachelor's Degree	RN	10	210	46
I12	Female	20-29	High school graduate, diploma or the equivalent	Medical Assistant	6	240	48

Figure 1 - Participants Demographics Data

Following screenshot shows an example how the characteristics were recorded and calculated for each measure.

Task Identifier	Task Description	Task Success - Mean (%)	Task Success - Std Dev (%)	Task Path Deviation - Observed #	Task Path Deviation - Optimal #	Task Time - Mean (seconds)	Task Time - Standard Deviation (seconds)	Task Time Deviation - Mean Observed Seconds	Task Time Deviation - Mean Optimal Seconds	Task Errors - Mean(%)	Task Errors - Std Dev (%)	Task Rating - Scale Type	Task Rating	Task Rating - Standard Deviation	Participant Identifiers	UCD Process Selected	UCD Process Details
1.1	Access, record and modify Medication	91	6.015604708	19	16	125	1.5	150	100	8.33	1.321372	System usability scale	90	1.699673171	U1;U2;U3;U4;U5; NISTIR	7741	7741 was

Figure 2 - CPOE Medications Task Analysis

Following the session, the administrator gave the participant the post-test questionnaire for tasks rating according to System Usability Scale and thanked each individual for their participation.

### 3.5 Test Location

The test facility included a waiting area and a quiet testing room with a table, computer for the participant, and recording computer for the administrator. Only the participant and administrator were in the test room. All observers and the data logger worked from a separate room where they could see the participant's screen.

### 3.6 Test Environment

The EHRUT would typically be used in a healthcare office or facility. In this instance, the testing was conducted on Intel® Core i7 desktop computers running Windows 10 operating system. The participants used mouse and keyboard when interacting with the EHRUT. The EHRUT used 20 inches' screen size and 1920x1080 resolution. The application was set up by MDVision personnel according to the documentation describing the system set-up and preparation. The application itself was running on Windows Server 2012 R2, using a demo database on WAN connection. Technically, the system performance (i.e., response time) was representative to what actual users would experience in a field implementation. Additionally, participants were instructed not to change any of the default system settings (such as control of font size).

### 3.7 Test Forms and Tools

During the usability test, various documents and instruments were used, including:

1. Informed Consent
2. Participant instructions sheet
3. System Usability Scale Questionnaire
4. Excel Spreadsheet (Data Logging)
5. Drummond SED checklist validator

### 3.8 Participant Instructions

The administrator read the following instructions aloud to each participant.

Thank you for participating in this study. Your input is very important. Our session today will last about 50 minutes. During that time, you will use an instance of an electronic health record. I will ask you to complete a few tasks using this system and answer some questions. You should complete the 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, and therefore if you have difficulty this entire 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 instruct you or provide help in how to use the application.

Overall, we are interested in how easy (or how difficult) this system is to use, what in it would be useful to you, and how we could improve it. All of 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 EHR and as their first task, were given time 10 minutes to explore the system and make comments. Once this task was complete, the administrator gave the following instructions:

For each task, I will read the description and instruction to you and I will raise poll which will end as per time associated with task. After task completion, I will raise another poll which will collect data and feedback of each participant. I would like to request that you not talk aloud or verbalize while you are doing the tasks.

Participants were then given 14 tasks to complete.

### 3.9 Usability Metrics

According to the NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records, EHRs 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 the usability testing. The goals of the test were to assess:

1. Effectiveness of MDVision PM EMR (5.1) by measuring participant success rates and errors.
2. Efficiency of MDVision PM EMR (5.1) by measuring the average task time and path deviations.
3. Satisfactions with MDVision PM EMR (5.1) by measuring ease of use ratings.

### 3.10 Data Scoring

The following table details how tasks were scored, errors evaluated, and the time data were analyzed.

Measures	Rationale and Scoring
<p><b>Effectiveness:</b> Task Success</p>	<p>A task was counted as a “Success” if the participant was able to achieve the correct outcome, without assistance, within the time allotted on a per task basis.</p> <p>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.</p> <p>Task times were recorded for successes. Observed task times divided by the optimal time for each task is a measure of optimal efficiency.</p> <p>Optimal task performance time, as benchmarked by expert performance under realistic conditions, is recorded when constructing tasks. Target task times used for task times in the Moderator’s Guide must be operationally defined by taking multiple measures of optimal performance and multiplying by some factor (1.3) that allows some time buffer because the participants are presumably not trained to expert performance. Thus, if expert, optimal performance on a task was “60” seconds then allotted task time performance was “60*1.3=78” seconds. This ratio should be aggregated across tasks and reported with mean and variance scores.</p>
<p><b>Effectiveness:</b> Task Failures</p>	<p>If the participant abandoned the task, did not reach the correct answer or performed it incorrectly, or reached the end of the allotted time before successful completion, the task was counted as an “Failures.” No task times were taken for errors.</p> <p>The total number of errors was calculated for each task and then divided by the total number of times that task was attempted. Not all deviations would be counted as errors. This should also be expressed as the mean number of failed tasks per participant.</p> <p>On a qualitative level, an enumeration of errors and error types should be collected.</p>
<p><b>Efficiency:</b> Task Deviations</p>	<p>The participant’s path (i.e., steps) through the application was recorded. Deviations occur if the participant, for example, went to a wrong screen, clicked on an incorrect menu item, followed an incorrect link, or interacted incorrectly with an on-screen control. This path was compared to the optimal path. The number of steps in the observed path is divided by the number of optimal steps to provide a ratio of path deviation.</p> <p>It is strongly recommended that task deviations be reported. Optimal paths (i.e., procedural steps) should be recorded when constructing tasks.</p>

<p><b>Efficiency:</b> Task Time</p>	<p>Each task was timed from when the administrator 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. Only task times for tasks that were successfully completed were included in the average task time analysis. Average time per task was calculated for each task. Variance measures (standard deviation and standard error) were also calculated.</p>
<p><b>Satisfaction:</b> Task Rating</p>	<p>Participant’s subjective impression of the ease of use of the application was measured by administering both a simple post-task question as well as a post session questionnaire. After each task, the participant was asked to rate “Overall, this task was:” on a scale of 1 (Very Difficult) to 5 (Very Easy). These data are averaged across participants.</p> <p>Common convention is that average ratings for systems judged easy to use should be 3.3 or above.</p> <p>To measure participants’ confidence in and likeability of the MDVision PM EMR (5.1) overall, the testing team administered the System Usability Scale (SUS) post-test questionnaire. Questions included, “I think I would like to use this system frequently,” “I thought the system was easy to use,” and “I would imagine that most people would learn to use this system very quickly.”</p>

## 4. Results

### 4.1 Data Analysis and Reporting

The results of the usability test were calculated according to the methods specified in the Usability Metrics section above. Participants who failed to follow session and task instructions had their data excluded from the analysis.

The usability testing results for the EHRUT are detailed below.

The results should be seen in light of the objectives and goals outlined in Study Design section. The data should yield actionable results that, if corrected, yield material, positive impact on user performance.

Task Identifier	Task Description	Task Success - Mean (%)	Task Path Deviation	Task Time Deviation (seconds)
A1.1	Access, record and modify Medication Orders	91	1.2	1.5
A2.1	Access, record and modify Lab Orders	100	1.25	1.28
A3.1	Access, record and modify Radiology Orders	91	1.6	1.35
A4.1	Access, record and modify Allergy List	83.3	1.25	1.06
A4.2	Record Medication Order and Drug-Drug Interaction	91	1.17	1.25

A4.3	Record Medication Order and Drug-Allergy Interaction	91	1.147	1.17
A5.1	Record and modify Demographics	100	1.06	1.2
A6.1	Access, record and modify Problems	100	1.13	1.5
A9.1	Record and modify a Clinical Decision Support rule	83.3	1.5	1.14
A9.2	Trigger and override CDS rule	91	1.25	1.12
A14.1	Add an Implantable Device	91	1.36	1.25
A14.2	Inactive an Implantable Device	100	1.14	1.21
B2.1	Clinical Information Reconciliation and Incorporation	83.3	1.18	1.11
B3.1	E-prescribe a Medicine	75	1.23	1.06

Table 1 - Task Success, Task Path Deviation, Task Time Deviation

Task Time Deviation= Time taken by 12 participants / Optimal Time for task for 12 participants

Task Path Deviation = No of observed steps by 12 participants / No of optimal steps

Task Identifier	Task Description	Task Errors Mean(%)	Task Rating (%)
A1.1	Access, record and modify Medication Orders	8.33	90
A2.1	Access, record and modify Lab Orders	0	85
A3.1	Access, record and modify Radiology Orders	8.33	80
A4.1	Access, record and modify Allergy List	16.3	75
A4.2	Record Medication Order and Drug-Drug Interaction	8.33	90
A4.3	Record Medication Order and Drug-Allergy Interaction	8.33	75
A5.1	Record and modify Demographics	0	95
A6.1	Access, record and modify Problems	0	95
A9.1	Record and modify a Clinical Decision Support rule	16.3	85
A9.2	Trigger and override CDS rule	8.33	90
A14.1	Add an Implantable Device	8.33	85
A14.2	Inactive an Implantable Device	0	100
B2.1	Clinical Information Reconciliation and Incorporation	16.3	85
B3.1	E-prescribe a Medicine	25	70

Table 2 - Task Errors, Task Ratings

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be: 85.71%. Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average.

## Effectiveness

MDVision PM EMR (5.1) effectiveness was calculated on the basis of task success for all 14 tasks conducted during the whole activity and then taking average. The effectiveness value comes around 91% which is a good figure.

## Efficiency

After analyzing the task time and task time deviation data it can be seen that many participants were able to do within the allocated time. A few participants couldn't complete the given task and stated that they couldn't interpret the task properly. Application Efficiency: Average path deviation recorded as 1.25. Average Time deviation recorded as 1.23.

## Satisfaction

Participants were quite satisfied with the MDVision PM EMR (5.1) application and rated it as 86% out of 100.

## 4.2 Discussion of Findings

### 4.2.1 Task 1: Access, record and modify Medication Orders

In this task participants were asked to access a patient's current medication, add a new one and update an existing medication.

#### Major Findings:

Participants had little difficulty in understanding the interface design of 3<sup>rd</sup> party vender while accessing medication. Most of the participants were able to complete the task.

#### Areas for Improvement:

No major suggestions other than the interface improvement were suggested.

### 4.2.2 Task 2: Access, record and modify Lab Orders

In this task participants were asked to create a lab order for a specific test and modify a test in pending order.

#### Major Findings:

All the participants were able to complete this task. Some of them completed it in a very short time.

#### Areas for Improvement:

No major suggestions for improvement were given as they found this task easy and doable.

### 4.2.3 Task 3: Access, record and modify Radiology Orders

In this task participants were asked to view current orders and create a radiology order of brain biopsy.

#### Major Findings:

All the participants were able to complete this task. Some of them completed it in a very short time.

#### Areas for Improvement:

No major suggestions for improvement were given as they found this task easy and doable.

#### 4.2.4 Task 4: Record, Review and Modify Medication Allergy List

In this task participants were instructed to add a medicine allergy to patient allergies list.

#### Major Findings:

All the participants were able to complete this task. Some of them completed it in a very short time.

#### Areas for Improvement:

No major suggestions for improvement were given, as adding allergies in the system is quite straightforward.

#### 4.2.5 Task 5: Record Medication Order and Drug-Drug Interaction

In this task participants were instructed to create a medication order, view drug interaction alert and override the alert after entering specified comments.

#### Major findings:

Most of the participants were able to complete the task with ease as user sees a very clear notification of drug –drug interaction and cannot proceed without overriding the mandatory alert.

#### Areas for Improvement:

No major suggestions for improvement were given as they found this task easy and doable.

#### 4.2.6 Task 6: Record Medication Order and Drug-Allergy Interaction

In this task participants were instructed to prescribe a medicine to patient to which he/she is allergic to and view drug-allergy interaction.

#### Major findings:

Almost all of the participants were able to complete this task without help and in less time.

#### Areas for Improvement:

No major suggestions for improvement were given as they completed the task easily.

#### 4.2.7 Task 7: Record and Modify Demographics

In this task participants were instructed to add specified demographic information of the patient.

Major findings:

All the participants were able to complete this task, as it is quite straightforward in the application.

Areas for Improvement:

No major suggestions for improvement were given as they completed the task easily.

#### 4.2.8 Task 8: Access, Record and Modify Problems

In this task participants were instructed to add specified demographic information of the patient.

Major findings:

All the participants were able to complete this task, as it is quite straightforward in the application.

Areas for Improvement:

No major suggestions for improvement were given as they completed the task easily.

#### 4.2.9 Task 9: Record and modify a Clinical Decision Support Rule

In this task participants were instructed to view the previous CDS rules for a patient and create a CDS rule with specific information given.

Major findings:

User found this task difficult, as 9 out of 12 participants were able to complete this task. They had difficulty in creating a CDS rule from application.

Areas for Improvement:

Most of the participants had no prior experience with the software; they were convinced that if they had been trained before, it would not be a tedious task. The participants which had prior experience of the software were able to complete this task. Participants suggested improvements in user interface to increase readability.

#### 4.2.10 Task 10: Trigger a Clinical Decision Support Rule

In this task participants were asked to review CDS alert for the patient and override the alert by adding specific comments.

Major Findings:

The participants found this task relatively easier than creating the CDS rule. Most of the participants were able to complete this task before time. Those who were unable to complete it could not comprehend the task properly.

Areas for Improvement:

Participants were mainly stuck at the point where they were to take recommended action on CDS alert.

#### 4.2.11 Task 11: Add an Implantable Device

In this task participants were asked to add a specific implantable device to patient record.

##### Major Findings:

The participants found this task easy and were able to complete it in time as they found the workflow easy.

##### Areas for Improvement:

No major suggestions were given for improvement.

#### 4.2.12 Task 12: Inactivate an Implantable Device

In this task participants were asked to inactivate an implantable device.

##### Major Findings:

All the participants were able to perform this task as only toggling a button can do this.

##### Areas for Improvement:

The participants suggested no improvement.

#### 4.2.13 Task13: Clinical Information Reconciliation and Incorporation

In this task, participants were required to import a CCDA file for a patient and then perform reconciliation for patient's allergies.

##### Major Findings:

Participants found this task a bit tricky and some were not able to complete it as they had problem with reconciling.

##### Areas for Improvement:

Importing CCDA was an easier task for participants but they found reconciliation difficult as a task due to less understanding of the task.

#### 4.2.14 Task14: E-prescribe a Medicine

In this task participants were required to review patient's CDS information and then prescribe a medication accordingly.

##### Major Findings:

Participants who were unable to view CDS alerts found this task difficult to perform.

##### Areas for Improvement:

Participants were mainly stuck at the point where they had to take action on the basis of CDS alert. CDS alert workflow can be better.

# Appendices

## Appendix 1: DEMOGRAPHIC INFORMATION FORM

1. Name:
2. Credentials:
3. Highest Level of Education:
  - a. High school graduate/GED
  - b. Some college
  - c. College graduate
  - d. Postgraduate
  - e. Other
4. Organization:
5. Primary Work Location:
6. Contact method (please provide one of the following):
  - a. Work phone:
  - b. Cell phone:
  - c. Email:
7. What is your gender?
  - a. Male
  - b. b. Female
  - c. c. Other (please specify): \_\_\_\_\_
8. Which of these best describes your current age?
  - a. <20
  - b. b. 20-29
  - c. c. 30-39
  - d. d. 40-49
  - e. e. 50-59
  - f. f. 60-69
  - g. g. 70-79
  - h. h. ≥80
9. Is English your first language?
  - a. Yes
  - b. No
10. Are you a fluent English speaker? [if No, disqualify]
  - a. Yes
  - b. No
11. Due to logistical restraints and the parameters of this study, we cannot provide assistive technologies during the testing session. Do you require any assistive technologies to use a computer? [if Yes, disqualify]
  - a. Yes

- b. No
12. Do you, or does anyone in your household, have a commercial interest in an electronic health record software or consulting company? [if Yes, disqualify]
- a. Yes
  - b. No
13. How many years of experience do you have using computers for personal and professional activities (such as email, shopping, record keeping, etc.)?
- a. <5 years
  - b. 5-10 years
  - c. 10-20 years
  - d. >20 years
14. What is your current role? [if not Nurse or Physician, disqualify]
- a. Analyst
  - c. Application Coordinator
  - d. Certified Nursing Assistant (CNA)
  - e. CEO, CMIO, CIO, etc.
  - f. Consultant
  - g. Director
  - h. Information Technology
  - i. Licensed Practical Nurse (LPN)
  - j. Marketing/Communications
  - k. Medical Assistant (MA)
  - l. Nurse
  - m. Nurse Practitioner (NP)
  - n. Office Manager
  - o. Pharmacist
  - p. Physician
  - q. Physician Assistant (PA)
  - r. Project Manager
  - s. SVP, AVP, VP, etc.
  - t. Trainer
  - u. Other (please specify)
15. Do you currently provide direct patient care? [if No, disqualify]
- a. Yes
  - b. No
16. In which setting do you primarily work? [if Ambulatory or Emergency Department, disqualify]
- a. Inpatient
  - b. Emergency Department
  - c. Ambulatory

17. What is your specialty? [if role is Physician and specialty is Radiology, Ophthalmology or Pathology, disqualify]

18. How many years have you been working in your field?

- a. <5 years
- b. 5-10 years
- c. 10-20 years
- d. >20 years

19. Have you participated in MDVision usability testing previously?

- a. Yes
- b. No

If yes, please describe.

20. How do you capture patient data in your organization? [if Primarily on paper, disqualify]

- a. Primarily on paper
- b. Primarily electronically

## Appendix 2: SYSTEM USABILITY SCALE QUESTIONNAIRE

Strongly disagree

Strongly agree

1. I think that I would like to use this system frequently.

1	2	3	4	5

2. I found the system unnecessarily complex.

1	2	3	4	5

3. I thought the system was easy to use.

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.

1	2	3	4	5

5. I found the various functions in this system were well integrated.

1	2	3	4	5

6. I thought there was too much inconsistency in this system

1	2	3	4	5

7. I would imagine that most people would learn to use this system very quickly.

1	2	3	4	5

8. I found the system very cumbersome to use.

1	2	3	4	5

9. I felt very confident using the system.

1	2	3	4	5

10. I needed to learn a lot of things before I could get going with this system.

1	2	3	4	5