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**EHR Usability Test Report of ManagementPlus, Version 7.0.**

Report based on NISTIR 7742 Customized Common Industry Format Template for Electronic Health Record Usability Testing

ManagementPlus, Version 7.0

Date of Usability Test: 10/19/2017

Date of Report: 10/28/2017

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## EXECUTIVE SUMMARY

A usability test of ManagementPlus EHR, Version 7.0 was conducted from October 5, 2017 to October 19, 2017 by ManagementPlus employees. The purpose of this test was to test and validate the usability of the current user interface and provide evidence of usability in the ManagementPlus EHR, Version 7.0. Each user evaluator participated by accessing a test computer. The same test computer was used for each session. During the usability test, 11 Healthcare Providers matching the target demographic criteria served as participants and used EHR under test (EHRUT) in simulated, but representative tasks.

This study collected performance data on 43 tasks typically conducted on an EHR. The tasks are correlated to the twelve certification criteria in 45 CFR Part 170 Subpart C of the Health Information Technology: 2015 Edition Health Information Technology (Health IT) Certification Criteria, 2015 Edition Base Electronic Health Record (EHR) Definition, and ONC Health IT Certification Program Modifications:

- §170.315(a)(1) Computerized Provider Order Entry – Medications
- §170.315(a)(2) Computerized Provider Order Entry – Laboratory
- §170.315(a)(3) Computerized Provider Order Entry – Diagnostic Imaging
- §170.315(a)(4) Drug-Drug, Drug-Allergy Interactions 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

During the 60 minutes, one-on-one usability tests, the participants were greeted by the test administrator and asked to review and sign the informed consent shown in Appendix 3. The participants were instructed that they could quit at any time. The Participants were current users of ManagementPlus, so they had prior experience with this EHR software, though not with all the tasks being tested. Product overview was provided to each participant prior to the test. The administrator introduced the test and instructed participants to complete a series of tasks given one at a time using ManagementPlus EHR, Version 7.0. During the testing, the administrator timed the test and along with the data logger, recorded user performance data on paper and



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electronically. The administrator did not give the participant assistance in how to complete the task except in areas of clarification or rewording of instructions when the directions seemed uncertain.

The following quantitative data were collected for each participant:

- Number of tasks successfully completed within the allotted time without assistance
- Time to complete each task
- Number and types of errors
- Path deviations
- Participant’s familiarity, ease-of-use, and satisfaction ratings of the system and its components

In addition, results include the following qualitative observations:

- Major findings
- Areas for improvement

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.

The UCD process used was based on NISTIR 7741 and various recommended metrics were used to evaluate the usability of the ManagementPlus EHR. Use was in accordance with the examples set forth in the NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records.

Following is a summary of the performance and rating data collected on the ManagementPlus EHR, Version 7.0:

Task Identifier	Task Description	N	Task Success	Path Deviation	Task Time	Errors	Task Ratings

		#	Mean (SD)	Deviations (Obs/ Opt)	Mean (SD)	Deviations (Ob/ Op)	Mean (SD)	Mean (SD)
a.1.1	Record CPOE medication order for Tab Simvastatin-20mg OD FOR 1month	1 1	95.45 (2.68)	0.2	53 (5)	0.02	0 (0)	4.3 (0.80)
a.1.2	Change CPOE medication order to Tab Atorvastatin-20mg OD FOR 1month	1 1	100 (0)	0	40 (3)	0	0 (0)	4.3 (0.46)
a.1.3	Display changed CPOE medication order for Tab Atorvastatin- 20mg OD FOR 1month	1 1	100 (0)	0	9 (3)	0	0 (0)	4.7 (0.46)
a.2.1	Record CPOE lab order for Creatinine 24H renal clearance panel, LOINC® code: 34555-3	1 1	100 (0)	0	34 (3)	0	0 (0)	4.9 (0.30)
a.2.2	Change CPOE lab order to Carboxyhaemoglobin/ Hemoglobin, LOINC® code: 2031-3	1 1	100 (0)	0	29 (1)	0	0 (0)	4.8 (0.40)
a.2.3	Display changed CPOE lab order for Carboxyhaemoglobin/ Hemoglobin, LOINC® code: 2031-3	1 1	100 (0)	0	6 (1)	0	0 (0)	4.8 (0.60)
a.3.1	Record CPOE image order for Corneal Topography, CPT code: 92025	1 1	100 (0)	0	28 (2)	0	0 (0)	4.2 (0.78)
a.3.2	Change CPOE image order to External Photo, CPT code: 92285	1 1	100 (0)	0	23 (2)	0	0 (0)	4.3 (0.82)

a.3.3	Display changed CPOE image order for- External Photo, CPT code: 92285	1 1	100 (0)	0	4 (0)	0	0 (0)	4.7 (0.46)
a.4.1	Using CPOE trigger a drug-drug interaction by entering a new medication order for Tab Amoxicillin 400MG, RxNorm code: 262073; one capsule by mouth daily for 10 days.	1 1	100 (0)	0	49 (4)	0	0 (0)	4.8 (0.40)
a.4.2	Using CPOE trigger a drug-allergy interaction by entering a new medication order for Tab Glucosamine 100MG; 1 capsule 2 times a day; for 5 days.	1 1	100 (0)	0	36 (5)	0	0 (0)	4.6 (0.67)
a.4.3	Adjust the severity level of a displayed drug-drug interaction	1 1	100 (0)	0	10 (1)	0	0 (0)	4.8 (0.40)
a.5.1	Record patient's demographics for Date of Birth(05/09/1987), Sex(Female), Race(American Indian), Ethnicity(Declined to specify), Preferred Language(English), Sexual Orientation(Bisexual), Gender Identity(Male-to-Female (MTF)/Transgender)	1 1	100 (0)	0	34 (6)	0	0 (0)	4.8 (0.40)
a.5.2	Change patient's demographics for Race(White), Ethnicity(Not Hispanic or Latino), Preferred Language(French), Date of	1 1	95. 45 (2.6 8)	0.2 5	33 (7)	0.05	0 (0)	4.4 (0.82)

	Birth-(02/10/1986, Sex(Male), Sexual Orientation(Homosexual), Gender Identity(Female-to- Male(FTM)/Transgender)							
a.5.3	Display patient's changed preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity.	1 1	100 (0)	0	8 (2)	2	0 (0)	4.9 (0.3 0)
a.6.1	Record a new problem to the problem list: Diabetes Mellitus Type 2 (disorder) with Hyperosmolarity; SNOMED code: 190329007, ICD 10 code: E11.00	1 1	90. 9 (1.9 0)	1.1 6	53 (7)	0.04	0 (0)	3.5 (0.5 2)
a.6.2	Change a problem on the problem list: Resolve Non- proliferative Diabetic Retinopathy; SNOMED code: 390834004, ICD 10 code: E08.321	1 1	100 (0)	0	27 (3)	0	0 (0)	4.6 (0.6 7)
a.6.3	Display the active problem list: Diabetes Mellitus Type 2 (disorder) with Hyperosmolarity; SNOMED code: 190329007, ICD 10 code: E11.00	1 1	95. 45 (2.6 8)	1	7 (2)	0.3	0 (0)	4.2 (0.7 8)

a.6.4	Display the historical problem list: Active Diabetes Mellitus Type 2 (disorder) with Hyperosmolarity; SNOMED code: 190329007, ICD 10 code: E11.00 and Resolved Non-proliferative Diabetic Retinopathy; SNOMED code: 390834004, ICD 10 code: E08.321	1 1	95. 45 (2.6 8)	1	7 (3)	0	0 (0)	4.3 (0.8 0)
a.7.1	Record a medication to the medication list: Augmentin XR 1000MG one capsule by mouth every 12 hours for 7 days; RxNorm code: 861689	1 1	90. 0 (1.9 0)	0.5	33 (6)	0.1	0 (0)	3.6 (0.6 7)
a.7.2	Change a medication on the medication list: Discontinue Lisinopril 20 MG; RxNorm code: 314077	1 1	95. 45 (2.6 8)	1.5	27 (6)	0.1	0 (0)	4.1 (0.7 5)
a.7.3	Display the active medication list: Augmentin XR 1000MG one capsule by mouth every 12 hours for 7 days; RxNorm code: 861689.	1 1	100 (0)	0	31 (5)	0	0 (0)	4.7 (0.4 6)
a.7.4	Display the historical medication list: Discontinued Lisinopril 20 MG; RxNorm code: 314077 and Active Augmentin XR 1000MG one capsule by mouth	1 1	100 (0)	0	27 (5)	0	0 (0)	4.8 (0.4 0)

	every 12 hours for 7 days; RxNorm code: 861689							
a.8.1	Record a new medication allergy: Codeine; RxNorm code: 2670; Reaction: Skin rash	1 1	100 (0)	0	47 (9)	0	0 (0)	4.8 (0.40)
a.8.2	Change a medication allergy: Inactive Penicillin V; RxNorm code: 7984; Reaction: Dizziness	1 1	95. 45 (2.68)	0.2 5	23 (5)	0.14	0 (0)	4.3 (0.80)
a.8.3	Display the active medication allergy list: Codeine; RxNorm code: 2670; Reaction: Skin rash	1 1	100 (0)	0	8 (2)	0	0 (0)	4.7 (0.46)
a.8.4	Display the historical medication allergy list: Codeine; RxNorm code: 2670; Reaction: Skin rash and Inactive Penicillin V; RxNorm code: 7984; Reaction: Dizziness	1 1	100 (0)	0	8 (2)	0	0 (0)	4.6 (0.67)
a.9.01	Add a CDS intervention and/or reference resource for each of the required elements,- • Problem list- Diabetes Mellitus Type 2 (disorder) with Hyperosmolarity SNOMED: 190329007, ICD10: E11.00 • Medication list – Augmentin XR 1000mg	1 1	100 (0)	0	77. 45 (6.5)	0	0 (0)	4 (1.27)

	<p>RxNorm code- 861689</p> <ul style="list-style-type: none"> <li>• Medication Allergy List- Codeine, RxNorm: 2670</li> <li>• At least one Demographic- Gender: Female</li> <li>• Laboratory Test- Creatinine 24H renal clearance panel, LOINC: 34555-3</li> <li>• Vital Signs- BP: &lt;120/&lt;80</li> <li>• And add a combination of at least 2 of the elements- Demographics, Age: &gt;20 years an Drug-allergy interaction checks, drug: Glucosamine Sulphate 1000mg RxNorm code: 359572</li> </ul>							
a.9.02	<p>Trigger the CDS interventions/resources added using the applicable data elements from each of the required elements. Vital Signs- Blood Pressure: 90/60 mm/Hg</p>	1 1	100 (0)	0	249 .72 (37.81)	0	0 (0)	4.5 (0.67)
a.9.03	<p>View the intervention/resource information using the Infobutton standard for data elements in the problem list, medication list, and demographics</p>	1 1	100 (0)	0	31.89 (1.81)	0	0 (0)	4.8 (0.38)

a.9.04	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	1 1	100 (0)	0	23. 41 (3.4 4)	0	0 (0)	4.8 (0.3 8)
a.9.05	Access the following attributes for one of the triggered CDS interventions/resources: bibliographic citation, developer, funding source, release/revision date	1 1	95. 8 (1.2 0)	0.3	31. 58 (3.6 1)	0.05	0 (0)	4.9 (0.2 8)
a.14.1	Record UDI: +B066000325011NS1/\$\$4 20020216LOT1234567890 12345/SXYZ45678901234 5678/16D20130202C1	1 1	100 (0)	0	88 (8)	0	0 (0)	4.8 (0.4 0)
a.14.2	Change UDI status: Mark =/W4146EB0010T0475=,0 00025=A99971312345600 =>014032=}013032&,100 0000000000XYZ123 as Inactive	1 1	100 (0)	0	16 (2)	0	0 (0)	4.9 (0.3 0)
a.14.3	Access UDI, device description, identifiers, and attributes	1 1	100 (0)	0	9 (2)	0	0 (0)	4.8 (0.4 0)

b.2.1	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	1 1	100 (0)	0	49 (3)	0	0 (0)	4.3 (0.80)
b.2.2	Generate a new CCDA with reconciled data	1 1	100 (0)	0	38 (3)	0	0 (0)	4.4 (0.82)
b.3.1	Create new prescription for Amoxicillin 400 MG; RxNorm code: 262073; one capsule by mouth daily for 10 days	1 1	100 (0)	0	44 (5)	0	0 (0)	4.7 (0.46)
b.3.2	Change prescription (dosage or duration) for Glucosamine Sulphate 100MG Capsule; Two times a day for 5 days to once a day for 15 days.	1 1	100 (0)	0	22 (3)	0	0 (0)	4.8 (0.40)
b.3.3	Cancel prescription- Amoxicillin 400mg; RxNorm code- 262073; one capsule by mouth, once daily for 10 days.	1 1	100 (0)	0	17. 95 (2.30)	0	0 (0)	4.6 (0.49)
b.3.4	Refill prescription for Tylenol 325mg, RxNorm code- 209387, add refill as "5"	1 1	100 (0)	1	27 (3)	0.05	0 (0)	4.4 (0.82)
b.3.5	Receive fill status notification	1 1	100 (0)	0	6.0 1 (0.94)	0	0 (0)	4.7 (0.45)

b.3.6	Request and receive medication history information	1 1	100 (0)	0	5.0 8 (0.8 5)	0	0 (0)	4.8 (0.3 8)
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Table 1: Summary of Performance and Rating Data

### Overall Ease of Use and Satisfaction of Tasks Performed During the Study

#### Ease of Use

- Overall the subjective ease of use mean was 4.6 out of 5.
- Overall the percentage of ease of use was 92%.

#### Satisfaction

- Overall the subjective satisfaction mean was 4.55 out of 5.
- Overall the percentage satisfaction of use was 91%.

### Major Findings

Majority of the tasks performed by the participants during the testing process were observed to be successful, without any errors. Though some of the participants observed deviations in terms of expected path, while completing the tasks under clinical information reconciliation.

In some cases, participants exceeded the expected time range while performing the test scenarios under certain components like problem list, clinical decision support and implantable device list.

The implantable device list was recognized as the high risk module because it requires a manual entry of the UDI, which is a long alphanumeric number with special characters; which might result into errors. In order to access the attributes and details regarding the implantable device list; the module is dependent over a third party GUDID API.

For most of the part, users followed the instructions and were able to perform the functions as instructed and were able to easily locate fields to record patient data. The user interface, processes and features for the tasks in the table above have not changed significantly from the last year. However, participants noted that most expected tasks were intuitive, logical, straight-forward and required minimal clicks.



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### Areas for Improvement

We found that the first area of improvement pertains to the Implantable device list, which includes manual entry of the unique device identifier which is time consuming. The second area of improvement belongs to Clinical information reconciliation; which evidenced the need for a good hands-on experience. This needs to be thoroughly reviewed with the help of trainings in order to improve the user experience.



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## INTRODUCTION

The EHRUT tested for this study was ManagementPlus, Version 7.0 which is a clinical application designed to present medical information to healthcare providers in ambulatory ophthalmology and optometry offices. The usability testing attempted to represent realistic exercises and conditions that occur in a typical medical practice environment.

The purpose of this study was to test and validate the usability of the current user interface, and provide evidence of usability in the ManagementPlus EHR, Version 7.0. To this end, measures of effectiveness, efficiency and user satisfaction, such as time required to complete tasks and path deviations attempted as well as overall impression of ease of use were captured during the usability testing.

## METHOD

### Participants

A total of 11 participants were tested on the ManagementPlus EHR, Version 7.0. Participants in the test were healthcare providers or other healthcare personnel. Participants were recruited by ManagementPlus staff and were not compensated for their time. In addition, participants had no direct connection to the development of or to the organization producing the ManagementPlus EHR, Version 7.0. Participants were not from the testing or supplier organization. However, the participants represented the intended user base and role composition of our intended users. Participants were given the opportunity to have the same orientation and level of training as the actual end users would have received.

Recruited participants had a mix of backgrounds and demographic characteristics representing to cohort of the intended users. 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 IDs so that an individual’s data cannot be tied back to individual identities.

Participant Identifier	Participant Gender	Participant Age	Participant Education	Participant Occupation /Role	Participant Professional	Participant Computer	Participant Product
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					Experie nce	Experie nce	Experie nce
MP01	Male	20-29	Bachel or's Degree	Business Analyst	30	144	10
MP02	Male	20-29	Master' s Degree	Customer Support Executive	72	180	30
MP03	Female	40-49	Doctor ate degree	Physician	160	200	24
MP04	Female	20-29	Master' s Degree	Customer Support Executive	78	204	30
MP05	Female	20-29	Bachel or's Degree	Business Analyst	28	144	18
MP06	Male	30-39	Bachel or's Degree	Quality Analyst	78	204	10
MP07	Female	40-49	Associ ate degree	Ophthalmic Technician	180	240	30
MP08	Male	30-39	High school graduat e	Practice Administra tor	168	60	240
MP09	Female	30-39	Master' s Degree	Senior Business Analyst	84	120	30
MP10	Female	20-29	Bachel or's Degree	Ophthalmic Technician	24	168	10
MP11	Male	20-29	High school graduat e	Lead Technician	96	72	240

## Table 2: Participant Details

Eleven participants matching the demographics in the Participants section were recruited and all eleven participated in the usability test. No participants failed to show up for the study.

Participants were scheduled for 1 session of 60-minutes. A minimum time interval of 15 minutes was scheduled for the overview of the testing process, between the sessions, by the administrator and data logger, and to reset systems for proper test conditions. A spreadsheet was used to keep track of the participant schedule and included key identification details for each participant.

### 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 ManagementPlus.

In short, this testing serves as both a means to record or benchmark current usability, but also to identify areas where improvements can be made.

During the usability test, participants interacted with ManagementPlus EHR, Version 7.0. 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
- Time to complete the tasks
- Number and types of errors
- Path deviations
- Participant’s verbalizations (comments)
- Participant’s satisfaction ratings of the system

## Tasks

A number of tasks were constructed that would be realistic and representative of the kinds of activities a user might perform with this EHR. The Safety-Enhanced Design tasks for the twelve ONC CEHRT2015 certification criteria included:

1. (a.1) CPOE –Meds
2. (a.2) CPOE – Labs
3. (a.3) CPOE – Diagnostic Imaging
4. (a.4) Drug-drug, drug-allergy interaction checks for CPOE
5. (a.5) Demographics
6. (a.6) Problem List
7. (a.7) Medication list
8. (a.8) Medication allergy list
9. (a.9) Clinical Decision support
10. (a.14) Implantable Device List
11. (b.2) Clinical Information Reconciliation and Incorporation
12. (b.3) e-Prescribing

(See Appendix 5: Safety Enhanced Design Test Scenario)

## 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 had already reviewed, signed and returned the non-disclosure agreement and the informed consent as shown in Appendix 2 & 3 respectively. 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 were experienced usability practitioners.

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.
- Withholding questions until the end of the test.
- Without using a think aloud technique

The administrator read the tasks aloud to the participants and then instructed them to begin now. The participants had the written copies of just the tasks. Exact details of the tasks performed are shown in Appendix 5. Time was recorded from the pronouncement to begin now until the participant either completed the task successfully or failed the task.

Following the session, the administrator gave the participant the post-test questionnaire (e.g., System Usability Scale, see Appendix 6). Participants were thanked for their time.

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

### **Task Location**

The test facility included a quiet testing room with a table and computer for the participant. Only the participant, the administrator and the data logger were in the test room. To ensure the environment was comfortable for users, noise levels were kept to a minimum with the ambient temperature within a normal range. All of the safety instruction and evacuation procedures were valid, in place, and visible to the participants.

### **Test Environment**

The ManagementPlus EHR, Version 7.0 would typically be used in a healthcare office or facility. In this instance, the testing was conducted at ManagementPlus' Faridabad, India office. The participants were given keyboard and mouse control to access the test computer when interacting with the ManagementPlus EHR. ManagementPlus can function on a variety of screen sizes and resolutions. In order to display well on all monitors, a resolution of 1366 x 768 was used.



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The application was configured by the usability review team. The application was running on a test database on a LAN connection. Technically, the system performance including screen presentation and response time was representative to what actual users would experience in a field implementation.

### **Test Forms and Tools**

Prior to the commencement of the test, the participants were provided with the non-disclosure agreement and informed consent shown in Appendix 2 & 3 respectively. During the usability test, various documents and instruments were used, including:

1. Task descriptions
2. Post-test questionnaire

Also prior to the test, participants were sent the rating metrics so they would have them available during testing for reference. Rating metrics sent were:

1. Very Difficult
2. Difficult
3. Neither Difficult nor Easy
4. Easy
5. Very Easy

### **Participant Instructions**

At the beginning of each testing session 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 60 minutes. During that time you will use an instance of an electronic health record, ManagementPlus, Version 7.0. 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, 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 instruct you or provide help in how to use the application.



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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. Please be honest with your opinions. 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 ManagementPlus EHR, Version 7.0 and were given 30 minutes of instruction on using the EHR. Once the training was completed, the administrator gave the following instructions:

For each task, I will read the description to you and say “Begin.” At that point, please perform the task and say “Done” once you believe you have successfully completed the task. I would like to request you to not to talk aloud or verbalize while you are doing the tasks. I will ask for your impressions about the task once you are done.

Participants were then given 43 tasks to complete. Tasks are listed in Appendix 5.

### 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 the 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 ManagementPlus EHR, Version 7.0 by measuring participant success rates and errors.
2. Efficiency of ManagementPlus EHR, Version 7.0 by measuring the average task time and path deviations.
3. Satisfaction with ManagementPlus EHR, Version 7.0 by measuring ease-of-use ratings.

### Data Scoring

The following table details how tasks were scored, errors were evaluated and the

time data was analyzed:

Measures	Rationale and Scoring
Effectiveness: Task Success	<p>Task success was determined by assigning numeric weights for various levels of task success, as follows:</p> <ul style="list-style-type: none"> <li>• Success (without assistance) = 1.0</li> <li>• Partial success = 0.5</li> <li>• Failure = 0.0</li> </ul> <p>A task was counted as a “Success” if the participant was able to achieve the correct outcome within the time allotted on a per task basis and a ‘Partial success’ if the participant was able to achieve the correct outcome with minimal assistance.</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 were provided as a percentage.</p> <p>Task times were recorded for successes. Observed task times divided by the expected time for each task is a measure of optimal efficiency.</p>
Effectiveness: Task Failure	<p>If the participant abandoned the task, did not reach the correct answer, performed it incorrectly, or reached the end of the allotted time before successful completion, the task was counted as a failure. No task times for failed tasks or tasks that exceeded the target task time were used in calculations. Participants were not asked to attempt the task more than once.</p> <p>The total number of errors was calculated by averaging the number of errors counted for each task. Not all deviations were counted as errors. Task failures were also expressed as the mean number of failed tasks per participant.</p> <p>A qualitative account of the observed errors and error types was collected.</p>

Efficiency: Task Deviations	<p>The participant’s navigation path (i.e., steps) through the application was recorded.</p> <p>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>Path deviations are reported on a qualitative level for use in recommendations for improvement.</p>
Efficiency: Task Time	<p>Each task was timed from when the administrator said “Begin” until the participant said “Done.” If the participant failed to say “Done,” the time was stopped when the participant ceased performing the task. Only task times for tasks that were successfully completed and tasks that were completed at or under the target time were included in the average task time analysis. Average time per task and variance measures were calculated for each task for use in the results analysis.</p>
Satisfaction: Task Rating	<p>Participant’s subjective impression of the ease of use of the application was measured by administering both a simple question on completion of each scenario and a post-session questionnaire. After each scenario, the participant was asked to rate “Overall, these tasks were:” on a scale of 1 (Very Difficult) to 5 (Very Easy). These data were averaged across participants.</p>

Table 3: Data Scoring

## Result

### Data Analysis and Reporting

The results of the usability test were calculated according to the methods specified in the Usability Metrics section above.

The usability testing results for ManagementPlus EHR, Version 7.0 are detailed below. A numerical summary is shown in a tabular form in the Executive Summary section of this report. The results should be seen in light of the objectives and goals outlined in the Study Design section. The data yielded actionable results that, when

corrected, will yield a material, positive impact on user performance.

### Discussion of the Findings

The test findings are discussed below.

#### Effectiveness

##### 1. (a.1, a.2 and a.3) CPOE- Medications, Laboratory Order and Diagnostic Imaging Order

Participants were easily able to access and change the medication, laboratory and diagnostic imaging orders as well as record new ones. The success score was 100% for changing and displaying the changed record. However some of the participants faced slight difficulty while recording a new medication order.

##### 2. (a.5) Demographics

The success score for the record and display the changed fields under the Demographics task was 100% and 95.45% for changing the demographics. The participants faced difficulty in making entries in front of the specified fields. All participants were ultimately able to complete the tasks.

##### 3. (a.6) Problem List

The success score for displaying the active and the historical problem list task was 95.45%. Participants faced some difficulties while recording a new problem to the problem list as evidenced by the success score of 90.09%. Participants were easily able to change a problem in the problem list, with a success score of 100%

##### 4. (a.7) Medication List

The success score for changing a medication and displaying the active and the historical medication list task was 95.45% and 100% respectively. Participants faced some difficulties while recording a new medication to the medication list as evidenced by the success score of 90.09%.

##### 5. (a.8) Medication Allergy List

The success score for displaying the active & historical medication allergy list, and record a new medication allergy tasks was 100%. For the change a medication allergy task, the success score was 95.45%. Participants were easily able to access, record, and change the medication allergies as needed.

##### 6. (a.9) Clinical Decision Support

All participants found the CDS worked well. The success score for most of the tasks under CDS measure was reportedly 100%. However the success score for accessing the attributes for the triggered CDS intervention was 95.80%.

##### 7. (a.14) Implantable Device List



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The success score for each of the tasks was 100%. Participants were easily able to access, change, and record implantable devices.

#### 8. (b.2) Clinical Information Reconciliation and Incorporation

Effectiveness- The success score for both the tasks was observed to be 100%. All participants were ultimately able to review the patient's clinical information, reconcile the data, and complete the tasks.

#### 9. (a.4) Drug- Drug and Drug- Allergy Interaction Checks

All participants were able to successfully perform and process a drug interaction check, yielding a task success score for each of these tasks at 100%. The task success score for adjusting the severity level of an intervention was observed to be 100%

#### 10. (b.3) Electronic Prescribing

The success score for each of the tasks was 100%. Participants were able to perform the tasks successfully without any deviation and any error.

### Efficiency

#### 1. (a.1, a.2 and a.3) CPOE- Medications, Laboratory Order and Diagnostic Imaging Order

All participants completed the task successfully without any error; with either fewer steps or the same number of steps as expert users. Majority of the participants completed the task within the optimal time for each task. However few of them experienced path deviation while creating a new order.

#### 2. (a.5) Demographics

All participants completed the task successfully without any error; with either fewer steps or the same number of steps as expert users. Majority of the participants completed the task within the optimal time for each task. However few of them experienced path deviation while changing the necessary details under demographics.

#### 3. (a.6) Problem List

The participants faced difficulty while selecting specific diagnostic codes while recording the problem conditions and while displaying the active and historical problem list.

#### 4. (a.7) Medication List

Few participants experienced path deviations while making new entries to the medication list. Some of the participants exceeded the expected time range while changing the medication present in the medication list.

#### 5. (a.8) Medication Allergy List

All participants completed the task successfully without any error; with either fewer steps or the same number of steps as expert users. Majority of the participants completed the task within the optimal time for each task. However few of them experienced path deviation while changing the medication allergy.

#### 6. (a.9) Clinical Decision Support

All participants noticed the diagnostic and therapeutic reference information and were able to add & trigger the CDS interventions, within optimal time and steps or the same number of steps as expert users.

#### 7. (a.14) Implantable Device List

All participants were able to complete the tasks within the optimal time for each task, as suggested by expert timings.

#### 8. (b.2) Clinical Information Reconciliation and Incorporation

Some participants exceeded the target time while incorporating and reconciling the medication, medication allergy & problem list. However, all participants were ultimately able to complete these tasks successfully.

#### 9. (a.4) Drug- Drug and Drug- Allergy Interaction Checks

All participants completed the tasks with either fewer steps or the same number of steps as expert users. All participants completed the tasks within the optimal time for each task, as suggested by expert timings.

#### 10. (b.3) Electronic Prescribing

Participants completed the tasks with either fewer steps or the same number of steps as expert users. Participants completed the tasks within the optimal time for each task, as suggested by expert timings.

### Satisfaction

#### 1. (a.1, a.2 and a.3) CPOE- Medications, Laboratory Order and Diagnostic Imaging Order

Participants rated this at an average of 4.7 out of 5 for ease of use.

#### 2. (a.5) Demographics

Participants rated this at an average of 4.6 out of 5 for ease of use.

3. (a.6) Problem List

Participants rated this at an average of 4.7 out of 5 for ease of use.

4. (a.7) Medication List

Participants rated this at an average of 4.6 out of 5 for ease of use.

5. (a.8) Medication Allergy List

Participants rated this at an average of 4.7 out of 5 for ease of use.

6. (a.9) Clinical Decision Support

Participants rated this at an average of 4.5 out of 5 for ease of use.

7. (a.14) Implantable Device List

Participants rated this at an average of 4.5 out of 5 for ease of use.

8. (b.2) Clinical Information Reconciliation and Incorporation

Participants rated this at an average of 4.6 out of 5 for each of use.

9. (a.4) Drug- Drug and Drug- Allergy Interaction Checks

Participants rated this at an average of 4.6 out of 5 for each of use

10. (b.3) Electronic Prescribing

Participants rated this at an average of 4.7 out of 5 for each of use

**Major Findings**

Majority of the tasks performed by the participants during the testing process were observed to be successful, without any errors. Though some of the participants observed deviations in terms of expected path, while completing the tasks under clinical information reconciliation.

In some cases, participants exceeded the expected time range while performing the test scenarios under certain components like problem list, clinical decision support and implantable device list.

The implantable device list was recognized as the high risk module because it requires a manual entry of the UDI, which is a long alphanumeric number with special characters; which might result into errors. In order to access the attributes



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and details regarding the implantable device list; the module is dependent over a third party GUDID API.

For most of the part, users followed the instructions and were able to perform the functions as instructed and were able to easily locate fields to record patient data. The user interface, processes and features for the tasks in the table above have not changed significantly from the last year. However, participants noted that most expected tasks were intuitive, logical, straight-forward and required minimal clicks.

### Areas for Improvement

We found that the first area of improvement pertains to the Implantable device list, which includes manual entry of the unique device identifier which is time consuming. The second area of improvement belongs to Clinical information reconciliation; which evidenced the need for a good hands-on experience. This needs to be thoroughly reviewed with the help of trainings in order to improve the user experience.



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## APPENDICES

The following appendices include supplemental data for this usability test report.

Following is a list of appendices provided:

1. Participant demographics
2. Non-Disclosure Agreement
3. Informed Consent
4. Usability Instructions
5. Safety Enhanced Design Test Scenarios
6. Post-test Questionnaire

## Appendix 1: Participant Demographics

Below is a summary of participant demographics for this study.

### 1. Participant Gender:

Participant Gender	(N=11)	%
Female	6	54.54
Male	5	45.45

### 2. Participant Age:

Participant Age	(N=11)	%
20-29	6	54.54
30-39	3	27.27
40-49	2	18.18

### 3. Participant Education:

Participant Education	(N=11)	%
Bachelor's Degree	4	36.36
Master's Degree	3	27.27
Doctorate degree (e.g., MD, DNP, DMD, PhD)	1	9.09
Associate degree	1	9.09
High school graduate, diploma or the equivalent (for example: GED)	2	18.18

### 4. Participant Role:

Participant Role	(N=11)	%
Business Analyst	2	18.18
Customer Support Executive	2	18.18
Physician	1	9.09
Quality Analyst	1	9.09
Ophthalmic Technician	2	18.18

Practice Administrator	1	9.09
Senior Business Analyst	1	9.09
Lead Technician	1	9.09

5. Participant Professional Experience:

Participant Professional Experience	N=11	Months	Years
	Mean	132	11

6. Participant Computer Experience:

Participant Computer Experience	N=11	Months	Years
	Mean	158	13.16

7. Participant Product Experience:

Participant Product Experience	N=11	Months	Years
	Mean	61	5.08



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## Appendix 2: Non- Disclosure Agreement

### Non-Disclosure Agreement for Usability Study

THIS AGREEMENT is entered into as of \_\_\_\_\_, 2017, between \_\_\_\_\_ (“the Participant”) and ManagementPlus, LLC.

The Participant acknowledges his or her voluntary participation in today’s usability study may bring the Participant into possession of Confidential Information. The term "Confidential Information" means all technical and commercial information of a proprietary or confidential nature which is disclosed by ManagementPlus, or otherwise acquired by the Participant, in the course of today’s study.

By way of illustration, but not limitation, Confidential Information includes trade secrets, processes, formulae, data, know-how, products, designs, drawings, computer aided design files and other computer files, computer software, ideas, improvements, inventions, training methods and materials, marketing techniques, plans, strategies, budgets, financial information, or forecasts.

Any information the Participant acquires relating to this product during this study is confidential and proprietary to Test Company and is being disclosed solely for the purposes of the Participant’s participation in today’s usability study. By signing this form the Participant acknowledges that s/he will receive monetary compensation for feedback and will not disclose this confidential information obtained today to anyone else or any other organizations.

**Participant’s printed name:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_



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### Appendix 3: Participant Consent Form

#### Informed Consent

Management plus would like to thank you for participating in this study. The purpose of this study is to evaluate an electronic health records system. If you decide to participate, you will be asked to perform several tasks using the prototype and give your feedback. The study will last about approximately 60 minutes. At the conclusion of the test, you will be compensated for your time.

#### Agreement

I understand and agree that as a voluntary participant in the present study conducted by Management Plus, I am free to withdraw consent or discontinue participation at any time.

I understand and agree that the purpose of this study is to make the software applications more useful and usable in the future.

I understand and agree that the data collected from this study may be shared outside of Management Plus and Management Plus clients. I understand and agree that data confidentiality is assured, because only de- identified data – i.e., identification numbers not names – will be used in analysis and reporting of the results.

I agree to immediately raise any concerns or areas of discomfort with the study administrator. I understand that I can leave at any time.

#### Please check one of the following:

YES, I have read the above statement and agree to be a participant.

NO, I choose not to participate in this study.

**Participant’s printed name:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Email Address:** \_\_\_\_\_



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## Appendix 4: Usability Instructions

### Usability Instructions (MM/DD/YYYY)

Administrator	
Data Logger	
Date	
Time	
Participant Number	

### Orientation

We express our gratitude towards you for participating in this study. You will be helping us evaluate the workflows pertaining to the ONC’s EHR vendor certification requirements. Our session today will last approximately 60 minutes. During that you will be provided with an overview in relation to ManagementPlus and the modules involved under this testing.

The product you will be using today is ManagementPlus, which you are already familiar with. It is, however, a non-production version, so all patients are fake. As you go through the workflows, please keep in mind that it is ManagementPlus under review here, not you.

During this study, you will be asked to complete a few tasks using ManagementPlus and answer some questions. We are interested in obtaining feedback regarding the ease of use of this product, what in the product you find most useful, and feedback as to how it can be improved.

You will be asked to complete these tasks on your own, trying to do them as quickly as possible with the fewest possible errors and deviations.

Please save your detailed comments until the end of a task or the end of the session as a whole, when we can discuss freely. Please feel free to be honest with your opinions.

All of the information that you provide will be kept confidential and your name will not be associated with your comments at any time.

Do you have any questions or concerns?



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### Preliminary Questions

Okay, now we need to ask you a few questions about yourself. What is you're:

Education	
Occupation/Role	
Professional Experience	
Computer Experience	
Product Experience	

On a scale of 1 to 5, with 5 being “most familiar”, how would you rate your knowledge of the following:

Computerized Physician Order Entry	
Drug-Drug, Drug-Allergy Interactions checks	
Demographics	
Problem List	
Medication List	
Medication Allergy List	
Clinical Decision Support	
Implantable Device List	
Clinical Information Reconciliation and Incorporation	
E-prescribing	

## Appendix 5: Safety enhanced design test scenarios

The tasks are prioritized in accordance with the risks associated with user errors.

### 1. (a.9) Clinical Decision Support (User Interaction- Low and Risk- High)

#### Tasks

1. Add a CDS intervention and/or reference resource for each of the required elements,-
  - Problem list {Diabetes Mellitus Type 2 (disorder) with Hyperosmolarity; SNOMED code: 190329007, ICD 10 code: E11.00 }
  - Medication list (Augmentin XR 1000MG RxNorm Code: 861689)
  - Medication Allergy List (Codeine; RxNorm code: 2670)
  - At least one Demographic (Gender- Female)
  - Laboratory Test (Creatinine 24H renal clearance panel, LOINC® code: 34555-3)
  - Vital Signs (BP= <120 and <80)
  - And add a combination of at least 2 of the elements listed above (Demographics, Age= >20 years and Drug- Allergy Interaction checks, Enter Drug- Glucosamine Sulphate 1000mg RxNorm code- 359572)

#### Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

#### Optimal Path:

- Correct
- Deviations



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If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:



Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

2. Trigger the CDS interventions/resources added using the applicable data elements from each of the required elements.

Vital Signs - enter Blood Pressure 90/60 mm/Hg

{Please note that this would trigger a CDS based intervention alert}

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:



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**Rating:**

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

3. View the intervention/resource information using the Infobutton standard for data elements in the problem list, medication list, and demographics

**Success**

- Please rate this task using the following scale:
- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

**Optimal Path:**

- Correct
  - Deviations
- If any, no. of deviations observed \_\_\_\_\_

**Observed errors and Verbalizations:**

**Rating:**

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1



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- 2
- 3
- 4
- 5

4. 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

Success

- Please rate this task using the following scale:
- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
  - Deviations
- If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

5. Access the following attributes for one of the triggered CDS interventions/resources: bibliographic citation, developer, funding source, release/revision date

**Success**

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
  - Deviations
- If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

2. (a.6) Problem List

(User Interaction- High and Risk- Moderate)



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**Tasks**

{Preexisting problem-Non proliferative Diabetic retinopathy SNOMED: 390834004, ICD10 code: E08.321}

1. Record a problem to the problem list- Diabetes Mellitus Type 2 (disorder) with Hyperosmolarity; SNOMED: 190329007, ICD 10 code: E11.00

{Please note that this would trigger a CDS based intervention alert}

**Success**

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

**Optimal Path:**

- Correct
  - Deviations
- If any, no. of deviations observed \_\_\_\_\_

**Observed errors and Verbalizations:**

**Rating:**

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5



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- 2. Change a problem on the problem list- Resolve Non proliferative Diabetic retinopathy SNOMED: 390834004, ICD10 code: E08.321

**Success**

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

**Optimal Path:**

- Correct
  - Deviations
- If any, no. of deviations observed \_\_\_\_\_

**Observed errors and Verbalizations:**

**Rating:**

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

- 3. Display the active problem list- Diabetes Mellitus Type 2 (disorder) with Hyperosmolarity; SNOMED: 190329007, ICD 10 code: E11.00

**Success**



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Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
  - Deviations
- If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

4. Display the historical problem list  
Resolved Non proliferative Diabetic retinopathy SNOMED: 390834004,  
ICD10 code: E08.321 and Active SNOMED- 127013003 ICD10- E11.21  
Diabetic renal disease (disorder)

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult



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- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

3. (a.7) Medication List

(User Interaction- High and Risk- Moderate)

**Tasks**

(Preexisting medication-Lisinopril 20mg RxNorm Code- 314077)

1. Record a medication to the medication list- Augmentin XR 1000MG one capsule by mouth every 12 hours for 7 days; RxNorm code: 861689.

{Please note that this would trigger a CDS based intervention alert}

Success

Please rate this task using the following scale:



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- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

2. Change a medication on the medication list- Discontinue Lisinopril 20mg  
RxNorm code: 314077

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy



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Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

3. Display the active medication list- Augmentin XR 1000MG one capsule by mouth every 12 hours for 7 days; RxNorm code: 861689.

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	



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Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

4. Display the historical medication list – (Active) Augmentin XR 1000MG one capsule by mouth every 12 hours for 7 days; RxNorm code: 861689 and Discontinued Lisinopril 20mg RxNorm code: 314077

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_



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Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

4. (a.2) CPOE Laboratory

(User Interaction- Low and Risk- Low)

**Tasks**

1. Record a CPOE lab order- Creatinine 24H renal clearance panel, LOINC® code: 34555-3  
{Please note that this would trigger a CDS based intervention alert}

**Success**

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

**Optimal Path:**

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_



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Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

2. Change a CPOE lab order- Carboxyhaemoglobin/ Hemoglobin, LOINC® code: 2031-3

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:



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On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

3. Display changed CPOE Lab order- Carboxyhaemoglobin/ Hemoglobin, LOINC® code: 2031-3

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5



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5. (a.3) CPOE Imaging  
(User Interaction- High and Risk- Low)

**Tasks**

1. Record a CPOE image order- Corneal Topography, CPT code: 92025

**Success**

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

**Optimal Path:**

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

**Observed errors and Verbalizations:**

**Rating:**

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

2. Change the CPOE image order- External Photo, CPT code: 92285



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**Success**

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

**Optimal Path:**

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

**Observed errors and Verbalizations:**

**Rating:**

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

3. Display changed CPOE image order- External Photo, CPT code: 92285

**Success**

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy



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Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

6. (a.1) CPOE Medication

(User Interaction- High and Risk- Low)

**Tasks**

1. Record a CPOE medication order- Tab Simvastatin- 20mg OD FOR 1month

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy



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Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

2. Change a CPOE medication order- Tab Atorvastatin- 20mg OD FOR 1month

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:



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- Correct
  - Deviations
- If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

3. Display changed CPOE medication order- Tab Atorvastatin- 20mg OD FOR 1month

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
  - Deviations
- If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:



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**Rating:**

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

7. (a.5) Demographics

(User Interaction- High and Risk- Moderate)

A new patient comes in for an appointment, search if the patient is in the system. If there is no patient that matches the search, click new patient to register this patient into the system.

**Tasks**

1. Record demographics

- Record Date of Birth, 05/09/1987 {Please note that this would trigger a CDS based intervention alert}
- Record Sex, Female
- Record Race, American Indian (OMB- 1002-5)
- Record Ethnicity, Declined to specify
- Record Preferred Language, English
- Record Sexual Orientation, Bisexual
- Record Gender Identity, Male-to-Female (MTF)/Transgender

**Success**

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy



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Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

## 2. Change demographics

- Change Date of Birth, 02/10/1986
- Change Sex, Male
- Change Race, White (OMB- 2106-3)
- Change Ethnicity, Not Hispanic or Latino
- Change Preferred Language, French
- Change Sexual Orientation, Homosexual
- Change Gender Identity, Female-to-Male (FTM)/Transgender

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy



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Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

3. Display the patient’s changed preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	



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Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

8. (a.8) Medication Allergy List

(User Interaction- High and Risk- Low)

**Tasks**

(Preexisting medication allergy- Penicillin V)

1. Record a medication allergy- Codeine; RxNorm code: 2670; Reaction: Skin rash

{Please note that this would trigger a CDS based intervention alert}

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	



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Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

2. Change a medication allergy- Inactive Penicillin V; RxNorm code: 7984;  
Reaction: Dizziness

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct



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- Deviations  
If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

- 3. Display the active medication allergy list- Codeine; RxNorm code: 2670;  
Reaction: Skin rash

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
- Deviations  
If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

4. Display the historical medication allergy list- Active Codeine; RxNorm code: 2670; Reaction: Skin rash and Inactive Penicillin V; RxNorm code: 7984; Reaction: Dizziness

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1



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- 2
- 3
- 4
- 5

9. (a.14) Implantable Device List  
(User Interaction- Low and Risk- High)

**Tasks**

{Preexisting Condition-  
=/W4146EB0010T0475=,000025=A99971312345600=>014032=}013032&,100000  
0000000XYZ123 is already present}

1. Record UDI:

+B06600032501INS1/\$\$420020216LOT123456789012345/SXYZ4567890123456  
78/16D20130202C1

**Success**

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

**Rating:**

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

2. Change the status of the Unique Device Identifier (UDI)- Mark  
=/W4146EB0010T0475=,000025=A99971312345600=>014032=}013032&,100000  
0000000XYZ123 as Inactive

**Success**

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

**Optimal Path:**

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

**Observed errors and Verbalizations:**

**Rating:**

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1



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- 2
- 3
- 4
- 5

### 3. Access UDI, device description, identifiers and attributes

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5



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10. (b.2) Clinical Information Reconciliation and Incorporation  
(User Interaction- High and Risk- Low)

**Tasks**

(Please note that CDS based intervention alert for Problem List, Medication List and Medication allergy list has already been added)

1. 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.

{Please note that this would trigger a CDS based intervention alert}

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
  - Deviations
- If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2



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- 3
- 4
- 5

2. Generate a new CCDA with reconciled data

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

11. (a.4) Drug-drug, drug-allergy interaction checks for CPOE  
(User Interaction- High and Risk- Low)

**Tasks**



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{Preexisting Condition- Ampicillin and Shellfish are already added}

1. Using CPOE, trigger a drug-drug interaction by entering a new medication order

Amoxicillin 400 MG; RxNorm code: 262073; one capsule by mouth daily for 10 days

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
  - Deviations
- If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

- Using CPOE, trigger a drug-allergy interaction by entering a new medication order- Record Glucosamine sulfate 100mg capsule RxNorm code- 359572; 1 capsule two times a day; for 5 days

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
  - Deviations
- If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

- Adjust the severity level of a displayed drug-drug interaction

Success

Please rate this task using the following scale:

- Very Difficult



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- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

12. (b.3) e-Prescribing

(User Interaction- High and Risk- Low)

**Tasks**

{Preexisting Condition- Tylenol 325 MG; RxNorm code: 209387 is already added}

1. Create new prescription.

Amoxicillin 400 MG; RxNorm code: 262073; one capsule by mouth, once daily for 10 days.

Success



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Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
  - Deviations
- If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

2. Change prescription (dosage or duration) - Change the dosage for Glucosamine Sulphate 100mg capsule; from two times a day for 5 days to once a day for 15 days

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy



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Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

3. Cancel prescription- Amoxicillin 400 MG; RxNorm code: 262073; one capsule by mouth, once daily for 10 days.

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:



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- Correct
  - Deviations
- If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

4. Refill prescription- for Tylenol 325 MG; RxNorm code: 209387, add refill as “5”

**Success**

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
  - Deviations
- If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:



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**Rating:**

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

**5. Receive fill status notification**

**Success**

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

**Optimal Path:**

- Correct
- Deviations

If any, no. of deviations observed \_\_\_\_\_

**Observed errors and Verbalizations:**

**Rating:**

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4



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5

### 6. Request and receive medication history information

Success

Please rate this task using the following scale:

- Very Difficult
- Difficult
- Neither Difficult nor Easy
- Easy
- Very Easy

Expected Task Time	
Actual Task Time	

Optimal Path:

- Correct
  - Deviations
- If any, no. of deviations observed \_\_\_\_\_

Observed errors and Verbalizations:

Rating:

On a scale of 1 to 5, with 5 being “very easy to use”, how would you rate the ease of use for completing this task?

- 1
- 2
- 3
- 4
- 5

### Appendix 6: Post-test Questionnaire

Based on your overall experience with all the tasks, please answer the following questions:

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

Strongly Disagree

Strongly Agree

1	2	3	4	5

2. I found the system unnecessarily complex

Strongly Disagree

Strongly Agree

1	2	3	4	5

3. I thought that the system was easy to use

Strongly Disagree

Strongly Agree

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

Strongly Disagree

Strongly Agree

1	2	3	4	5

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

Strongly Disagree

Strongly Agree

1	2	3	4	5

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

Strongly Disagree

Strongly Agree

1	2	3	4	5

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

Strongly Disagree

Strongly Agree

1	2	3	4	5

8. I found the system very cumbersome to use

Strongly Disagree

Strongly Agree

--	--	--	--	--

